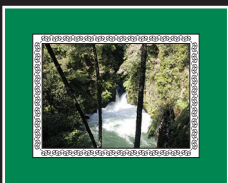
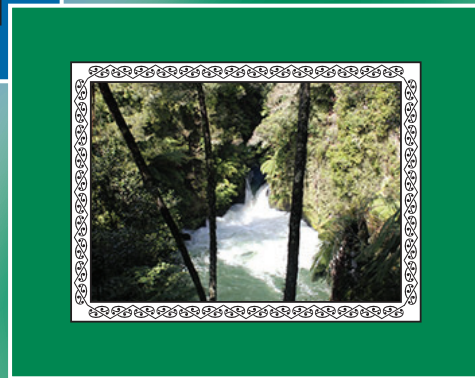
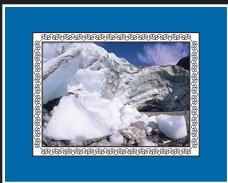
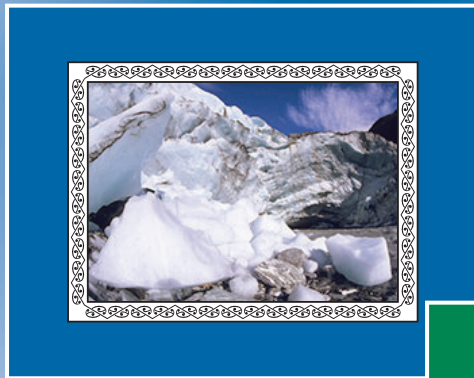
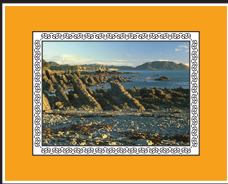


MATHS MATE Skill Builder

fourth edition



4.2

5.1

J. B. Wright



J. B. Wright

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The Educational Advantage Pty Ltd
 Building 5 / 29 Clarice Road
 Box Hill South VIC 3128 Australia
 Phone: 613 9899 9065
 Fax: 613 9899 9598
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TEACHER'S GUIDE

FORWARD

Why use Skill Builders?

Too often, through the teaching, learning and assessment process, teachers identify weaknesses and gaps in student learning but the constraints of the classroom severely limit remediation opportunities.

The Maths Mate Skill Builder series was prepared in response to requests from teachers and parents who want an easy but effective way to help students who identify skill deficiencies using the Maths Mate Programme, and are motivated to do something about them.

The Maths Mate record keeping sheets found at the start of each term in each Student Pad (and on each CD ~ Record Keeping Sheets, pages 1 to 4) enable students to find out what they know and what they still need to learn and practise.

The Skill Builders extensively target through instruction and practice, all skills within the related Maths Mate Programme except the problem solving questions. The Problem Solving Hints & Solutions (see CD ~ Problem Solving Hints & Solutions) can be used by teachers to develop students' problem solving skills. The Skill Builders also contain a Glossary of important facts and reference material that will provide instant help when students present with difficulties.

Background to the design of Maths Mate and Skill Builders

| | | | | |
|-------|---|---|---|---|
| MM4.2 | 1 | 2 | 3 | 4 |
| MM5.1 | 1 | 2 | 3 | 4 |

Any question on the Maths Mate sheets is part of a set of 4 similar questions in the term. For example, consider sheets 1, 2, 3 and 4 in year 8 term 1. Question 10 on each sheet is similar in design, content and degree of difficulty. This grouping of question style is also true of the next set of four sheets and so on. Thus the Maths Mate tests made available in the Teacher Resource Book and CD (see CD ~ Test Masters, pages 1 to 32 and Test Answers, pages 1 to 32) also reflect this grouping of question style and substance. Generally too, the Skill Builders can be linked to each set of 4 similar questions. These links are identified in the grid at the title of each skill. The grid shown here for example, would relate a skill to questions in the first 4 sheets of MM Level 4.2 term 1, the last 4 sheets of MM Level 4.2 term 2 and the first 4 sheets of MM Level 5.1 term 1. Once understood, these links will be helpful to students in their selection of Skill Builders and to you in your allocation of Skill Builders to students.

On each Maths Mate worksheet, questions 1 through to 33 get progressively harder. (Refer - How to use the Skill Builders, page iv)

Suggestions for the preparation and organisation of Skill Builders

Teachers can either direct students to their digital copies or print copies of particular pages for students. Rather than photocopying Skill Builders one at a time, you may find it helpful to set up a file in a central area that contains perhaps five copies of each Skill Builder. In this way you will save time and be prepared in advance. Students should be reminded that the Glossary is a valuable resource that can be added to. The Glossary too can be photocopied for students as a resource.

How you can help

We are confident that your students will be rewarded for the effort you have made in making these worksheets available to them. As with any programme, however, there is always room for improvement and we place great value in feedback from people like yourself. Please, if you have any suggestions at all, contact us.

HOW TO USE MATHS MATE SKILL BUILDERS

1. Determine which Maths Mate questions pose a difficulty

If a student gets one or more incorrect answers, represented by one or more successive unshaded boxes on their worksheet results sheet, then that question requires a Skill Builder.

For example, question 13 in Sheets 1, 2, 3 and 4 is not shaded, so Skill 13.1 from Skill Builder 13 needs to be handed to the student.

MATHS MATE Name: Paul Wright
 Level 4 of 2 Class: 8B
 Teacher: Miss Bourke

Worksheet Results

| Term 1 | Sheet 1 | Sheet 2 | Sheet 3 | Sheet 4 | Skill Builder | Sheet 1 | Sheet 2 | Sheet 3 | Sheet 4 | Skill Builder |
|--|---------|---------|---------|---------|---------------|---------|---------|---------|---------|---------------|
| 1. [- Whole Numbers to 10] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 2. [- Whole Numbers to 10] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 3. [- Whole Numbers to 10] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 4. [- Whole Numbers to 12] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 5. [Large Number +,-] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 6. [Large Number x,-] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 7. [Decimal +,-] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 8. [Decimal x,-] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 9. [Fraction +,-] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 10. [Fraction x,-] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 11. [Percentages] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 12. [Decimals / Fractions / Percentages] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 13. [Integers] | 10 | 10 | 10 | 10 | 13.1 | 10 | 10 | 10 | 10 | 13.1 |
| 14. [Rates / Ratios] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 15. [Indices / Square Roots] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 16. [Order of Operations] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 17. [Exploring Numbers] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 18. [Multiples / Factors / Primes] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 19. [Number Patterns] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 20. [Expressions] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 21. [Substitution] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 22. [Equations] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 23. [Coordinates] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 24. [Units of Measurements / Time] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 25. [Perimeter] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 26. [Area / Volume] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 27. [Shapes] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 28. [Location / Transformation] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 29. [Statistics] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 30. [Probability] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 31. [Problem Solving 1] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 32. [Problem Solving 2] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| 33. [Problem Solving 3] | 10 | 10 | 10 | 10 | 10.1 | 10 | 10 | 10 | 10 | 10.1 |
| Total Correct | 20 | 24 | 22 | 26 | | | | | | |

2. Find the relevant Skill Builder on the Maths Mate worksheet results sheet

Check across the question that is posing difficulties on the worksheet results sheet to find the list of skills within the Skill Builder that are most relevant to that question.

Obtain a copy of one or all of the skills listed for that question (pages 1 to 326). You can also double check with the grid at the right of each skill title, that the chosen skill is appropriate.

Remember, students should work through the skills in order. The skills where possible are arranged in increasing degree of difficulty.

Be aware that some skills may require the knowledge of previous skills, so when a student has several areas of weakness, they should work on the lowest numbered skill builders first. For example, a student struggling with Q9 and Q12 may need to build skills required for Q9 before they can improve Q12.

13. [Integers]

Skill 13.1: Comparing and ordering integers.

- Use a number line.
- Hint: Numbers decrease as you move to the left or down and increase as you move to the right or up.
- A negative number is always smaller than a positive number.

An altitude is lower when further down, below sea level (BSL) and higher when further up, above sea level (ASL).

Temperatures below zero are lower than temperatures above zero.

Q. Who won the 2010 Women's British Open Golf Tournament? (Hint: In golf the lowest score wins.)

A) +5 K. Webb
 B) -10 K. Hull
 C) -11 Y. Tseng

A. C Find the lowest score to determine the winner.

a) Which of Saturn's moons has the highest temperature?

A) -201°C Enceladus
 B) -200°C Mimas
 C) -187°C Tethys

b) Which temperature for oxygen is higher?

A) -183°C boiling point
 B) -218°C melting point

c) Who won the 2010 British Open Golf Tournament? (Hint: In golf the lowest score wins.)

A) -16 L. Oosthuizen
 B) +3 P. Senior
 C) -2 R. Allenby

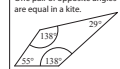
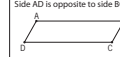


d) Which body of water is at the lowest altitude?

A) -28 m Caspian Sea
 B) -408 m Dead Sea
 C) -15 m Lake Eyre

3. Look up any unknown terms in the Skill Builder glossary

The glossary (pages 327 to 378) is more than just a list of definitions. It contains a wealth of relevant information that may help the students to better understand the question at hand. Weaker students may find that referring to a copy of the glossary, and even building on it, is a helpful strategy for improving their overall mathematical competency.

For example, a student might need to look up the word “operation” before attempting to complete Skill 13.1

| | | |
|----------------------------|--|---|
| once | • On one occasion. | Just this time! |
| operation | • A mathematical process performed according to certain <i>rules</i> . | There are four basic operations in arithmetic: addition $3 + 12$ subtraction $3 - 1$ multiplication 1×5 division $6 \div 3$ There are many complex operations like: sine 30° , $\sqrt{9}$ and $\log_{10} 100.5^4$. |
| opposite angles | • Angles across from each other in a shape. | One pair of opposite angles are equal in a kite.  |
| opposite sides | • Sides across from each other in a shape. | Side \overline{AB} is opposite to side \overline{CD} Side \overline{AD} is opposite to side \overline{BC}  |
| opposites | • Two <i>numbers</i> with the same <i>absolute value</i> but different <i>signs</i> . | The opposite of $+4$ is -4 . |
| order | • Placing a group in a special arrangement. | The aliens are arranged in order of height.  |
| order of operations | • The order of doing <i>operations</i> is: 1) <i>Simplify</i> inside all <i>brackets</i> . 2) <i>Evaluate powers</i> and <i>square roots</i> . 3) Calculate \times and \div from left to right. 4) Calculate $+$ and $-$ from left to right. | Calculate $4 + 3 \times (6 - 2)$ by 1) $4 + 3 \times (6 - 2)$ 2) $4 + 3 \times 4$ 3) $4 + 9 \times 4$ 4) $4 + 36$ = 40 |
| ordered pair | • See <i>coordinates</i> . | |
| ordinal numbers | • A <i>whole number</i> that shows position. | 1st, 2nd, 3rd, 4th, 5th, ... are ordinal numbers. |
| orientation | • Position relative to <i>direction</i> . | The tornado is coming from the west.  |

page 352 www.mathsmate.co.nz © Maths Mate 4.2/5.1 Glossary

4. Complete the relevant Skill Builder

Work through the examples given for that skill, and complete the exercises.

There are many techniques or methods that can be used to teach the same basic skills, even something as simple as adding 7 and 9. It is good for a student to be given a range of alternatives appropriate for each skill but space restrictions make this impossible. These sheets often suggest an approach that may be different to a student's past experience. If a student feels more comfortable with his current technique, that is fine. In most cases it is the end result that counts.

It is possible to take a very weak student back to a Skill Builder from a lower level if this is necessary. It is also possible to use a higher level book for students to have further practice if required.

5. Correct the relevant Skill Builders from the Skill Builder answer sheets (from page 387)

6. Circle the completed skill numbers on the Maths Mate worksheet results sheet



| | | | | | | | | | | | | |
|------------------------------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|
| 17. [Exploring Number] | 17.1 | 17.2 | 17.3 | 17.4 | 17.5 | 17.6 | 17.7 | 17.8 | 17.9 | 17.10 | 17.11 | 17.12 |
| 18. [Multiples / Factors / Primes] | 18.1 | 18.2 | 18.3 | 18.4 | 18.5 | 18.6 | 18.7 | 18.8 | 18.9 | 18.10 | 18.11 | 18.12 |
| 19. [Number Patterns] | 19.1 | 19.2 | 19.3 | 19.4 | 19.5 | 19.6 | 19.7 | 19.8 | 19.9 | 19.10 | 19.11 | 19.12 |
| 20. [Expressions] | 20.1 | 20.2 | 20.3 | 20.4 | 20.5 | 20.6 | 20.7 | 20.8 | 20.9 | 20.10 | 20.11 | 20.12 |
| 21. [Substitution] | 21.1 | 21.2 | 21.3 | 21.4 | 21.5 | 21.6 | 21.7 | 21.8 | 21.9 | 21.10 | 21.11 | 21.12 |
| 22. [Equations] | 22.1 | 22.2 | 22.3 | 22.4 | 22.5 | 22.6 | 22.7 | 22.8 | 22.9 | 22.10 | 22.11 | 22.12 |
| 23. [Coordinates] | 23.1 | 23.2 | 23.3 | 23.4 | 23.5 | 23.6 | 23.7 | 23.8 | 23.9 | 23.10 | 23.11 | 23.12 |
| 24. [Units of Measurement / Time] | 24.1 | 24.2 | 24.3 | 24.4 | 24.5 | 24.6 | 24.7 | 24.8 | 24.9 | 24.10 | 24.11 | 24.12 |
| 25. [Perimeter] | 25.1 | 25.2 | 25.3 | 25.4 | 25.5 | 25.6 | 25.7 | 25.8 | 25.9 | 25.10 | 25.11 | 25.12 |

7. Go back and repeat previous Maths Mate questions

After completing a Skill Builder, students should be encouraged to go back and attempt again those particular questions on the recently completed Maths Mate worksheets.

Dear Parents

As part of their Mathematics programme this year, all students have been given a weekly Maths Mate worksheet.

The programme is now under way. The diagnostic nature of the worksheets helps students monitor their own progress. After they correct their worksheet and complete the record keeping sheet, over time, your child will be able to identify areas of strength and weakness in their mathematical learning.

If your child is having difficulty with a question for consecutive weeks or believes that their understanding is not at the level they would like, then Skill Builder sheets will be made available to develop each of the skills in the Maths Mate programme. Each Skill Builder focuses on and explores one question from the Maths Mate worksheets.

As each question in the Maths Mate is generally more difficult than the last, finishing with the problem solving questions, then it would be advised that, if students are concerned with more than one question, they tackle lower numbered questions first.

The Skill Builders may also help to motivate students to make another attempt at mastering skills that they have found too difficult in the past, given that it will become clear to them that they will be confronted by the same type of question on a regular basis.

While we will be monitoring your child's progress and supporting their skill development in the school environment, it would be appreciated if you would complete the tear off slip at the bottom of this page so that we can be sure that you are aware of our expectations regarding both the Maths Mate worksheets and the availability of Skill Builder worksheets. We ask also that you continue to sign the completed worksheets each week so that we can ensure each student is working independently and regularly but with your support.

We thank you in anticipation of your involvement and remind you that you are encouraged to call and discuss your child's progress at any time.

Yours sincerely

Class Teacher

Principal

Maths Mate Programme - Skill Builder Return Slip

Student's Name: Class:

As a parent / guardian I have signed this form to indicate that I am aware of the support Maths Mate Skill Builders can give my child in their mathematical development.

Parent's Signature: Date:

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| MM | SB | [Maths Mate - Mathematical strand] | |
|-----------|-----------|---|-----------|
| Question | Skill No. | Skill Builder - Skill description | |
| 1. | | [+ Whole Numbers to 10] | 1 |
| | 1.1 | Adding whole numbers from 1 to 10. | |
| | 1.2 | Adding whole numbers from 1 to 10 to negative numbers. | |
| 2. | | [- Whole Numbers to 10] | 3 |
| | 2.1 | Subtracting whole numbers from 1 to 10. | |
| | 2.2 | Subtracting whole numbers from 1 to 10 from negative numbers. | |
| 3. | | [× Whole Numbers to 12] | 5 |
| | 3.1 | Multiplying whole numbers from 1 to 12. | |
| | 3.2 | Multiplying whole numbers from 1 to 12 by negative numbers. | |
| 4. | | [÷ Whole Numbers to 12] | 7 |
| | 4.1 | Dividing whole numbers from 1 to 12. | |
| | 4.2 | Dividing whole numbers from 1 to 12 into negative numbers. | |
| 5. | | [Large Number +, -] | 9 |
| | 5.1 | Adding large numbers without carry over. | |
| | 5.2 | Subtracting large numbers without carry over. | |
| | 5.3 | Adding two large numbers with carry over. | |
| | 5.4 | Subtracting large numbers with carry over. | |
| | 5.5 | Adding and/or subtracting multiple large numbers with carry over. | |
| 6. | | [Large Number ×, ÷] | 15 |
| | 6.1 | Multiplying a large number by a power of 10. | |
| | 6.2 | Dividing a large number by a power of 10. | |
| | 6.3 | Multiplying a large number by a single digit. | |
| | 6.4 | Dividing a large number by a single digit. | |
| | 6.5 | Multiplying a large number by a multiple of 10. | |
| | 6.6 | Dividing a large number by a multiple of 10. | |
| | 6.7 | Multiplying a large number by a two-digit number. | |
| | 6.8 | Dividing a large number by a two-digit number. | |
| | 6.9 | Multiplying a whole number by a large multiple of 10. | |
| | 6.10 | Dividing a whole number - answer as a terminating decimal. | |
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| | 7.1 | Adding decimal numbers. | |
| | 7.2 | Subtracting decimal numbers. | |
| | 7.3 | Subtracting a decimal number from a whole number. | |

| | | |
|------------|-------|--|
| 8. | | [Decimal \times, \div] 33 |
| | 8.1 | Multiplying a decimal number by a single digit number. |
| | 8.2 | Dividing a decimal number by a single digit number. |
| | 8.3 | Multiplying a decimal number by a power of 10. |
| | 8.4 | Dividing a decimal number by a power of 10. |
| | 8.5 | Multiplying a decimal number by another decimal number. |
| | 8.6 | Dividing a decimal number by another decimal number. |
| | 8.7 | Dividing a whole number by a decimal number. |
| 9. | | [Fraction $+, -$] 41 |
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| | 9.2 | Subtracting fractions with the same denominator. |
| | 9.3 | Adding mixed numbers with the same denominator. |
| | 9.4 | Subtracting mixed numbers with the same denominator. |
| | 9.5 | Subtracting a fraction or a mixed number from a whole number. |
| | 9.6 | Adding fractions with different denominators - one denominator divides evenly into the other denominator. |
| | 9.7 | Adding fractions with different denominators - the denominators have no common factors other than 1 (e.g. 5 and 6). |
| | 9.8 | Subtracting fractions with different denominators - one denominator divides evenly into the other denominator. |
| | 9.9 | Subtracting fractions with different denominators - the denominators have no common factors other than 1 (e.g. 5 and 6). |
| 10. | | [Fraction \times, \div] 55 |
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| | 10.2 | Finding a fraction of a quantity. |
| | 10.3 | Dividing a whole number by a fraction. |
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| | 11.3 | Finding a percentage of multiples of 100. |
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| | 12.7 | Writing a percentage as a decimal number. |
| | 12.8 | Writing a decimal number as a fraction in simplest form. |
| | 12.9 | Writing a fraction as a terminating decimal. |
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| | 13.4 | Finding the difference between a positive and a negative integer. |
| | 13.5 | Modelling integer addition on a number line. |
| | 13.6 | Solving word problems involving two or more integers. |
| | 13.7 | Adding integers. |
| | 13.8 | Subtracting integers. |
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| | | |
|------------|---|------------|
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| 14.4 | Simplifying ratios by comparing three numbers. | |
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| 16.5 | Using 'order of operations' mixing powers, (), \times , \div , $+$ and/or $-$ | |
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|------------|--|------------|
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| 30.8 | Calculating the probability of complementary events. | |
| 30.9 | Calculating the probability of mutually exclusive events. | |
| 30.10 | Finding the possible outcomes of an event by applying the counting principle. | |

1. [+ Whole Numbers to 10]

Skill 1.1 Adding whole numbers from 1 to 10.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

EITHER

Regroup into easier numbers

- Break a number up so that you can work with groups of 10

$$\begin{aligned} \text{Example: } 5 + 8 & \\ &= 5 + 5 + 3 \\ &= 10 + 3 \\ &= 13 \end{aligned}$$

OR

Count on

- Start with the largest number and count on the smaller amount.

$$\begin{aligned} \text{Example:} \\ 8 + 5 &\Rightarrow 9, 10, 11, 12, 13 \end{aligned}$$

OR

Use an addition table

- Move down the column and across the row to find the intersection.

| + | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----|----|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |

Example:

$$8 + 5 = 5 + 8 = 13$$

Hint: Addition tables are symmetrical.

Q.

| | | | | | | | | | | |
|-----|---|---|---|---|---|---|---|----|---|---|
| | 5 | 2 | 7 | 3 | 8 | 6 | 1 | 10 | 9 | 4 |
| + 8 | | | | | | | | | | |

Add 8 to each of the numbers in the top row.

A.

| | | | | | | | | | | |
|-----|----|----|----|----|----|----|---|----|----|----|
| | 5 | 2 | 7 | 3 | 8 | 6 | 1 | 10 | 9 | 4 |
| + 8 | 13 | 10 | 15 | 11 | 16 | 14 | 9 | 18 | 17 | 12 |

a)

| | | | | | | | | | | |
|------|----|----|----|---|----|---|---|---|----|----|
| | 5 | 7 | 10 | 9 | 16 | 8 | 3 | 4 | 12 | 11 |
| + 10 | 15 | 17 | 20 | | | | | | | |

b)

| | | | | | | | | | | |
|-----|---|----|---|---|----|---|---|---|---|----|
| | 3 | 12 | 6 | 8 | 10 | 7 | 4 | 9 | 5 | 11 |
| + 3 | | | | | | | | | | |

c)

| | | | | | | | | | | |
|-----|----|----|----|----|---|----|----|---|----|----|
| | 23 | 16 | 12 | 18 | 9 | 11 | 20 | 7 | 15 | 24 |
| + 6 | | | | | | | | | | |

d)

| | | | | | | | | | | |
|-----|----|---|----|---|----|----|----|----|----|----|
| | 32 | 8 | 35 | 7 | 19 | 13 | 11 | 44 | 16 | 10 |
| + 5 | | | | | | | | | | |

e)

| | | | | | | | | | | |
|-----|----|----|----|----|----|----|----|----|---|----|
| | 14 | 45 | 20 | 86 | 19 | 47 | 15 | 32 | 8 | 23 |
| + 7 | | | | | | | | | | |

Skill 1.2 Adding whole numbers from 1 to 10 to negative numbers.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Use a number line.

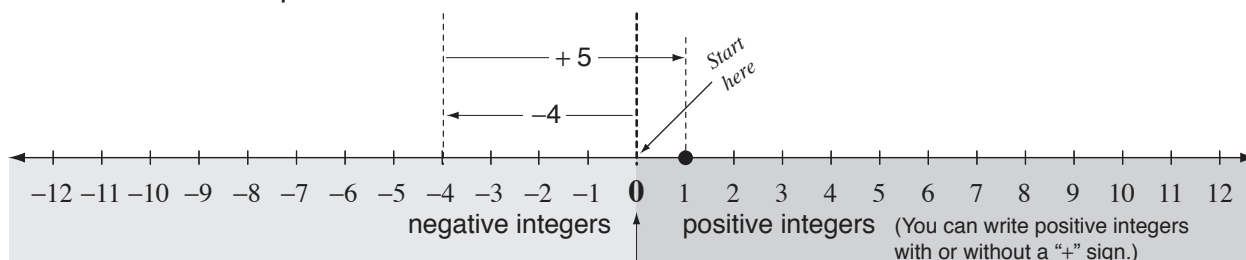
Example: $-4 + 5$ is read as: negative 4 plus 5

Start at 0

Move 4 units to the left (negative direction).

Move 5 units to the right (positive direction).

You stop at 1



| | | | | | | | | | | | |
|----|-----|----|----|----|-----|---|----|---|-----|----|---|
| Q. | | -4 | -6 | 12 | -10 | 9 | -3 | 5 | -11 | -7 | 8 |
| | + 5 | | | | | | | | | | |

Add 5 to each of the numbers on the top row.

| | | | | | | | | | | | |
|----|-----|----|----|----|-----|----|----|----|-----|----|----|
| A. | | -4 | -6 | 12 | -10 | 9 | -3 | 5 | -11 | -7 | 8 |
| | + 5 | 1 | -1 | 17 | -5 | 14 | 2 | 10 | -6 | -2 | 13 |

| | | | | | | | | | | | |
|----|-----|---|----|----|----|---|----|----|----|---|-----|
| a) | | 3 | -9 | 11 | -6 | 7 | 12 | -4 | 15 | 8 | -10 |
| | + 2 | 5 | | | | | | | | | |

| | | | | | | | | | | | |
|----|-----|---|----|----|----|---|----|---|---|----|-----|
| b) | | 6 | -7 | -3 | 10 | 9 | -5 | 8 | 4 | 11 | -12 |
| | + 4 | | | | | | | | | | |

| | | | | | | | | | | | |
|----|-----|----|----|---|----|----|-----|---|-----|---|-----|
| c) | | 11 | -2 | 5 | -8 | 10 | -14 | 7 | -19 | 3 | -26 |
| | + 8 | | | | | | | | | | |

| | | | | | | | | | | | |
|----|-----|---|-----|----|----|----|----|-----|----|----|-----|
| d) | | 9 | -13 | 27 | -1 | 46 | 38 | -15 | 24 | 12 | -30 |
| | + 6 | | | | | | | | | | |

| | | | | | | | | | | | |
|----|-----|----|----|----|----|-----|----|-----|-----|---|-----|
| e) | | 35 | -8 | 34 | 19 | -42 | 26 | -13 | -20 | 7 | -11 |
| | + 9 | | | | | | | | | | |

| | | | | | | | | | | | |
|----|-----|----|-----|-----|----|----|---|-----|----|----|-----|
| f) | | 12 | -44 | -18 | 23 | 86 | 9 | -11 | -5 | 10 | -27 |
| | + 7 | | | | | | | | | | |

2. [- Whole Numbers to 10]

Skill 2.1 Subtracting whole numbers from 1 to 10.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

EITHER

Break down to easier numbers

- Break a number down so that you can work with groups of 10

$$\begin{aligned} \text{Example: } 16 - 9 & \\ &= 15 - 8 \\ &= 14 - 7 \\ &= 13 - 6 \\ &= 12 - 5 \\ &= 11 - 4 \\ &= 10 - 3 \\ &= 7 \end{aligned}$$

Make 16 into 10 by taking 6 from both 16 and 9.

OR

Build up to easier numbers

- Build a number up so that you can work with groups of 10.

$$\begin{aligned} \text{Example: } 16 - 9 & \\ \text{Add 1 to 9 to make 10} & \\ \text{and another 6 to get to 16.} & \\ 1 + 6 = 7 & \end{aligned}$$

OR

Use an addition table

- Move down the column and across the row to find the intersection.

| + | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----|----|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |

Example: $16 - 9 = ?$
 Reword the subtraction by turning it into an addition.
 What number when added to 9 will give 16?
 From the addition table,
 $9 + 7 = 16$
 So $16 - 9 = 7$

Q.

| | | | | | | | | | | |
|-----|----|----|----|----|----|----|----|----|----|----|
| | 16 | 14 | 17 | 10 | 18 | 13 | 11 | 19 | 15 | 12 |
| - 9 | | | | | | | | | | |

Subtract 9 from each of the numbers in the top row.

A.

| | | | | | | | | | | |
|-----|----|----|----|----|----|----|----|----|----|----|
| | 16 | 14 | 17 | 10 | 18 | 13 | 11 | 19 | 15 | 12 |
| - 9 | 7 | 5 | 8 | 1 | 9 | 4 | 2 | 10 | 6 | 3 |

a)

| | | | | | | | | | | |
|-----|---|---|----|---|----|----|---|---|---|---|
| | 5 | 4 | 10 | 7 | 12 | 11 | 8 | 9 | 3 | 6 |
| - 2 | 3 | | | | | | | | | |

b)

| | | | | | | | | | | |
|-----|----|----|----|----|----|----|----|----|----|---|
| | 14 | 17 | 10 | 15 | 12 | 18 | 13 | 16 | 11 | 9 |
| - 8 | | | | | | | | | | |

c)

| | | | | | | | | | | |
|-----|----|----|---|----|----|---|----|----|----|----|
| | 14 | 16 | 9 | 23 | 21 | 7 | 15 | 12 | 30 | 28 |
| - 4 | | | | | | | | | | |

d)

| | | | | | | | | | | |
|-----|----|----|----|----|----|----|----|----|----|----|
| | 20 | 14 | 23 | 16 | 32 | 25 | 17 | 18 | 11 | 49 |
| - 7 | | | | | | | | | | |

Skill 2.2 Subtracting whole numbers from 1 to 10 from negative numbers

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Use a number line.

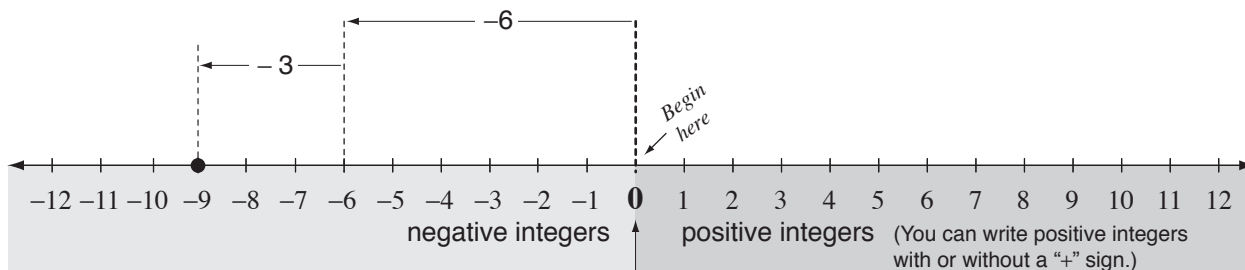
Example: $-6 - 3$ is read as: negative 6 subtract 3 OR negative 6 minus 3

Start at 0

Move 6 units to the left (negative direction).

Move 3 units to the left again (negative direction).

You stop at negative 9



| | | | | | | | | | | | |
|----|----|----|---|---|----|----|---|---|----|---|----|
| Q. | | -6 | 3 | 9 | -7 | 10 | 1 | 5 | -4 | 2 | -8 |
| | -3 | | | | | | | | | | |

Subtract 3 from each of the numbers on the top row.

| | | | | | | | | | | | |
|----|----|----|---|---|-----|----|----|---|----|----|-----|
| A. | | -6 | 3 | 9 | -7 | 10 | 1 | 5 | -4 | 2 | -8 |
| | -3 | -9 | 0 | 6 | -10 | 7 | -2 | 2 | -7 | -1 | -11 |

| | | | | | | | | | | | |
|----|----|----|---|----|----|-----|---|---|----|---|-----|
| a) | | 10 | 6 | -8 | 15 | -11 | 7 | 4 | -9 | 2 | -13 |
| | -5 | 5 | | | | | | | | | |

| | | | | | | | | | | | |
|----|----|----|---|----|----|---|----|---|---|---|-----|
| b) | | -6 | 7 | -3 | 10 | 9 | -5 | 8 | 4 | 1 | -12 |
| | -2 | | | | | | | | | | |

| | | | | | | | | | | | |
|----|----|----|----|----|---|-----|---|---|----|----|---|
| c) | | 10 | -5 | -7 | 1 | -12 | 9 | 3 | 14 | -6 | 8 |
| | -4 | | | | | | | | | | |

| | | | | | | | | | | | |
|----|----|----|----|----|----|---|-----|----|----|----|----|
| d) | | 12 | -8 | 19 | -5 | 1 | -10 | -6 | 13 | 17 | -4 |
| | -8 | | | | | | | | | | |

| | | | | | | | | | | | |
|----|----|----|----|----|----|-----|----|---|-----|---|-----|
| e) | | 35 | 24 | -8 | 19 | -42 | 26 | 3 | -20 | 7 | -11 |
| | -6 | | | | | | | | | | |

| | | | | | | | | | | | |
|----|----|----|----|-----|----|-----|-----|---|----|---|----|
| f) | | 15 | 57 | -18 | 11 | -49 | -20 | 4 | 33 | 6 | 72 |
| | -9 | | | | | | | | | | |

3. [× Whole Numbers to 12]

Skill 3.1 Multiplying whole numbers from 1 to 12.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Find one of the numbers to be multiplied across the top row.
- Find the other number to be multiplied down the left hand side column.
- Follow the line of each number until they intersect at their product.

Example: The product of 3 and 9 is 27

$$3 \times 9 = 27$$

$$\text{Since } 3 \times 9 = 9 \times 3 = 27$$

multiplication tables are symmetrical.

Hint: This means you only need to learn half of your times tables.

MULTIPLICATION TABLE

| × | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 2 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 3 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 |
| 4 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 |
| 5 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| 6 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| 7 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 |
| 8 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 |
| 9 | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 | 99 | 108 |
| 10 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| 11 | 11 | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99 | 110 | 121 | 132 |
| 12 | 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 |

Q.

| | | | | | | | | | | |
|-----|---|----|---|---|---|---|----|---|---|----|
| | 3 | 12 | 9 | 7 | 4 | 5 | 10 | 8 | 6 | 11 |
| × 9 | | | | | | | | | | |

Multiply each of the numbers in the top row by 9.

A.

| | | | | | | | | | | |
|-----|----|-----|----|----|----|----|----|----|----|----|
| | 3 | 12 | 9 | 7 | 4 | 5 | 10 | 8 | 6 | 11 |
| × 9 | 27 | 108 | 81 | 63 | 36 | 45 | 90 | 72 | 54 | 99 |

a)

| | | | | | | | | | | |
|-----|----|---|----|----|---|---|---|---|---|---|
| | 4 | 8 | 11 | 10 | 5 | 6 | 1 | 7 | 9 | 2 |
| × 4 | 16 | | | | | | | | | |

b)

| | | | | | | | | | | |
|-----|---|---|----|---|---|---|----|---|---|---|
| | 1 | 5 | 10 | 7 | 4 | 9 | 12 | 8 | 3 | 6 |
| × 2 | | | | | | | | | | |

c)

| | | | | | | | | | | |
|------|---|----|---|---|---|---|----|---|---|---|
| | 8 | 10 | 2 | 7 | 9 | 3 | 11 | 5 | 6 | 4 |
| × 10 | | | | | | | | | | |

d)

| | | | | | | | | | | |
|-----|---|---|---|---|---|---|----|---|----|---|
| | 2 | 4 | 8 | 5 | 7 | 6 | 12 | 9 | 11 | 3 |
| × 8 | | | | | | | | | | |

e)

| | | | | | | | | | | |
|------|----|---|---|---|---|---|---|---|----|---|
| | 10 | 4 | 3 | 6 | 2 | 5 | 7 | 8 | 12 | 9 |
| × 12 | | | | | | | | | | |

Skill 3.2 Multiplying whole numbers from 1 to 12 by negative numbers.

MM4.2 1 1 22 33 44
MM5.1 1 1 22 33 44

- Find one of the numbers to be multiplied across the top row.
- Find the other number to be multiplied down the left hand side column.
- Follow the line of each number until they intersect at their product.
- Then apply the multiplication rules.

MULTIPLICATION TABLE

| × | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 2 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 3 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 |
| 4 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 |
| 5 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| 6 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| 7 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 |
| 8 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 |
| 9 | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 | 99 | 108 |
| 10 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| 11 | 11 | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99 | 110 | 121 | 132 |
| 12 | 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 |

Multiplication Rules

different signs: positive \times negative = negative
negative \times positive = negative

Example:

The product of negative 3 and 6 is negative 18
 $-3 \times 6 = -18$

Since $-3 \times 6 = 6 \times -3 = -18$

multiplication tables are symmetrical.

Q.

| | | | | | | | | | | |
|------------|----|---|---|-----|---|----|---|-----|----|----|
| | -3 | 7 | 9 | -11 | 5 | -4 | 2 | -10 | -8 | 12 |
| $\times 6$ | | | | | | | | | | |

Multiply each of the numbers in the top row by 6.

A.

| | | | | | | | | | | |
|------------|-----|----|----|-----|----|-----|----|-----|-----|----|
| | -3 | 7 | 9 | -11 | 5 | -4 | 2 | -10 | -8 | 12 |
| $\times 6$ | -18 | 42 | 54 | -66 | 30 | -24 | 12 | -60 | -48 | 72 |

Use the rule:
A negative number multiplied by a positive number results in a negative number.

a)

| | | | | | | | | | | |
|------------|---|-----|---|----|-----|---|---|----|----|---|
| | 3 | -5 | 8 | -7 | -11 | 6 | 2 | -4 | 12 | 9 |
| $\times 3$ | 9 | -15 | | | | | | | | |

b)

| | | | | | | | | | | |
|------------|----|----|----|---|---|----|---|---|---|-----|
| | 7 | -4 | -2 | 3 | 8 | -5 | 9 | 1 | 6 | -10 |
| $\times 5$ | 35 | | | | | | | | | |

c)

| | | | | | | | | | | |
|-------------|----|---|----|----|----|---|----|---|----|---|
| | -6 | 2 | 11 | -5 | 10 | 8 | -4 | 9 | -7 | 1 |
| $\times 11$ | | | | | | | | | | |

d)

| | | | | | | | | | | |
|------------|----|---|----|----|---|----|----|---|----|---|
| | -7 | 3 | -1 | -2 | 9 | -6 | 10 | 5 | -8 | 4 |
| $\times 4$ | | | | | | | | | | |

e)

| | | | | | | | | | | |
|------------|---|----|---|----|---|---|-----|----|----|---|
| | 2 | -7 | 9 | -5 | 3 | 6 | -12 | 10 | -4 | 8 |
| $\times 7$ | | | | | | | | | | |

f)

| | | | | | | | | | | |
|------------|-----|---|---|----|----|----|---|----|----|----|
| | -12 | 3 | 8 | -4 | -7 | -9 | 5 | 11 | 10 | -6 |
| $\times 9$ | | | | | | | | | | |

4. [\div Whole Numbers to 12]

Skill 4.1 Dividing whole numbers from 1 to 12.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Reword the division by turning it into a multiplication.
- Use a multiplication table.
- Convert the multiplication back to a division.

Example: How many 6's go into 42?

$$42 \div 6 = ?$$

Reworded: What number multiplied by 6 equals 42?

$$6 \times ? = 42$$

From the multiplication table, $6 \times 7 = 42$

$$\text{So } 42 \div 6 = 7$$

MULTIPLICATION TABLE

| \times | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|----------|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 2 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 3 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 |
| 4 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 |
| 5 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| 6 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| 7 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 |
| 8 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 |
| 9 | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 | 99 | 108 |
| 10 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| 11 | 11 | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99 | 110 | 121 | 132 |
| 12 | 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 |

Q.

| | | | | | | | | | | |
|----------|----|----|----|----|----|----|----|----|----|----|
| | 42 | 60 | 18 | 36 | 30 | 54 | 72 | 24 | 12 | 48 |
| $\div 6$ | | | | | | | | | | |

 Divide each of the numbers in the top row by 6.

A.

| | | | | | | | | | | |
|----------|----|----|----|----|----|----|----|----|----|----|
| | 42 | 60 | 18 | 36 | 30 | 54 | 72 | 24 | 12 | 48 |
| $\div 6$ | 7 | 10 | 3 | 6 | 5 | 9 | 12 | 4 | 2 | 8 |

a)

| | | | | | | | | | | |
|----------|----|----|---|----|----|----|---|----|----|----|
| | 16 | 28 | 8 | 40 | 24 | 20 | 4 | 32 | 36 | 44 |
| $\div 4$ | 4 | | | | | | | | | |

b)

| | | | | | | | | | | |
|-----------|----|----|----|-----|----|----|----|-----|----|----|
| | 99 | 66 | 33 | 121 | 44 | 88 | 77 | 110 | 11 | 22 |
| $\div 11$ | | | | | | | | | | |

c)

| | | | | | | | | | | |
|-----------|----|----|-----|----|-----|----|----|----|----|----|
| | 40 | 90 | 120 | 30 | 100 | 10 | 70 | 50 | 80 | 60 |
| $\div 10$ | | | | | | | | | | |

d)

| | | | | | | | | | | |
|----------|----|----|----|----|----|---|----|----|----|----|
| | 56 | 14 | 28 | 70 | 63 | 7 | 21 | 84 | 42 | 77 |
| $\div 7$ | | | | | | | | | | |

e)

| | | | | | | | | | | |
|-----------|-----|----|----|----|-----|----|----|----|----|----|
| | 120 | 48 | 36 | 24 | 144 | 60 | 12 | 96 | 84 | 72 |
| $\div 12$ | | | | | | | | | | |

Skill 4.2 Dividing whole numbers from 1 to 12 into negative numbers.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Reword the division by turning it into a multiplication.
- Use a multiplication table.
- Convert the multiplication back to a division.
- Then apply the division rules.

Division Rules

different signs: positive \div negative = negative
negative \div positive = negative

Example: How many 5's go into negative 30?
 $-30 \div 5 = ?$

Reworded: What number multiplied by 5 gives
negative -30 ?

$$5 \times ? = -30$$

From the multiplication table, $5 \times -6 = -30$

$$\text{So } -30 \div 5 = -6$$

MULTIPLICATION TABLE

| \times | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|----------|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 2 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 3 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 |
| 4 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 |
| 5 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| 6 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| 7 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 |
| 8 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 |
| 9 | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 | 99 | 108 |
| 10 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| 11 | 11 | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99 | 110 | 121 | 132 |
| 12 | 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 |

Q.

| | | | | | | | | | | |
|----------|-----|-----|-----|----|----|----|----|-----|-----|----|
| | -30 | -55 | -25 | 15 | 35 | 40 | 50 | -45 | -20 | 60 |
| $\div 5$ | | | | | | | | | | |

Divide each of the numbers in the top row by 5.

A.

| | | | | | | | | | | |
|----------|-----|-----|-----|----|----|----|----|-----|-----|----|
| | -30 | -55 | -25 | 15 | 35 | 40 | 50 | -45 | -20 | 60 |
| $\div 5$ | -6 | -11 | -5 | 3 | 7 | 8 | 10 | -9 | -4 | 12 |

Use the rule:
A negative number divided by a positive number results in a negative number.

a)

| | | | | | | | | | | |
|----------|----|----|----|----|----|-----|----|-----|---|-----|
| | 12 | 21 | -6 | 30 | 15 | -18 | 36 | -33 | 3 | -24 |
| $\div 3$ | 4 | | | | | | | | | |

b)

| | | | | | | | | | | |
|----------|---|-----|----|----|-----|----|-----|----|----|-----|
| | 5 | -30 | 10 | 45 | -35 | 40 | -25 | 60 | 15 | -20 |
| $\div 5$ | | | | | | | | | | |

c)

| | | | | | | | | | | |
|-----------|-----|----|-----|-----|----|----|-----|----|-----|----|
| | -44 | 88 | 121 | -55 | 22 | 77 | -33 | 11 | -66 | 99 |
| $\div 11$ | | | | | | | | | | |

d)

| | | | | | | | | | | |
|----------|----|----|----|-----|----|----|----|-----|----|-----|
| | 56 | 72 | -8 | -40 | 32 | 16 | 64 | -24 | 48 | -80 |
| $\div 8$ | | | | | | | | | | |

e)

| | | | | | | | | | | |
|----------|----|-----|----|-----|----|----|-----|----|----|-----|
| | 66 | -48 | 36 | -24 | 18 | 60 | -12 | 30 | 54 | -42 |
| $\div 6$ | | | | | | | | | | |

f)

| | | | | | | | | | | |
|----------|-----|-----|----|-----|----|----|-----|----|-----|----|
| | 108 | -90 | -9 | -45 | 63 | 36 | -72 | 99 | -18 | 27 |
| $\div 9$ | | | | | | | | | | |

5. [Large Number +,-]

Skill 5.1 Adding large numbers without carry over.

MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Always keep your working columns in line, aligning units with units, tens with tens, etc.
- Add from right to left.

Q. $1276 + 4520 =$

A. $1276 + 4520 = 5796$

Units: $6 + 0 = 6 \Rightarrow 6$ units

Tens: $7 + 2 = 9 \Rightarrow 9$ tens

Hundreds: $2 + 5 = 7 \Rightarrow 7$ hundreds

Thousands: $1 + 4 = 5 \Rightarrow 5$ thousands

$$\begin{array}{r} 1\ 2\ 7\ 6 \\ +\ 4\ 5\ 2\ 0 \\ \hline 5\ 7\ 9\ 6 \end{array}$$

thousands
hundreds
tens
units

a) $5420 + 362 =$

$$\begin{array}{r} 5\ 4\ 2\ 0 \\ +\ 3\ 6\ 2 \\ \hline 5\ 7\ 8\ 2 \end{array}$$

b) $1674 + 125 =$

$$\begin{array}{r} 1\ 6\ 7\ 4 \\ +\ 1\ 2\ 5 \\ \hline \end{array}$$

c) $2081 + 406 =$

$$\begin{array}{r} 2\ 0\ 8\ 1 \\ +\ 4\ 0\ 6 \\ \hline \end{array}$$

d) $2316 + 350 =$

$$\begin{array}{r} 2\ 3\ 1\ 6 \\ +\ 3\ 5\ 0 \\ \hline \end{array}$$

e) $1854 + 124 =$

$$\begin{array}{r} 1\ 8\ 5\ 4 \\ +\ 1\ 2\ 4 \\ \hline \end{array}$$

f) $3224 + 360 =$

$$\begin{array}{r} 3\ 2\ 2\ 4 \\ +\ 3\ 6\ 0 \\ \hline \end{array}$$

g) $2246 + 7401 =$

$$\begin{array}{r} 2\ 2\ 4\ 6 \\ +\ 7\ 4\ 0\ 1 \\ \hline \end{array}$$

h) $3517 + 2262 =$

$$\begin{array}{r} 3\ 5\ 1\ 7 \\ +\ 2\ 2\ 6\ 2 \\ \hline \end{array}$$

i) $1843 + 3026 =$

$$\begin{array}{r} 1\ 8\ 4\ 3 \\ +\ 3\ 0\ 2\ 6 \\ \hline \end{array}$$

j) $7024 + 1721 =$

$$\begin{array}{r} 7\ 0\ 2\ 4 \\ +\ 1\ 7\ 2\ 1 \\ \hline \end{array}$$

k) $3251 + 3641 =$

$$\begin{array}{r} 3\ 2\ 5\ 1 \\ +\ 3\ 6\ 4\ 1 \\ \hline \end{array}$$

l) $4835 + 2163 =$

$$\begin{array}{r} 4\ 8\ 3\ 5 \\ +\ 2\ 1\ 6\ 3 \\ \hline \end{array}$$

Skill 5.2 Subtracting large numbers without carry over.

MM4.2 1 1 22 33 44
MM5.1 11 22 33 44

- Always keep your working columns in line, aligning units with units, tens with tens, etc.
- Subtract from right to left.

Q. $2718 - 1403 =$

A. $2718 - 1403 = 1315$

Units: $8 - 3 = 5 \Rightarrow 5$ units

Tens: $1 - 0 = 1 \Rightarrow 1$ ten

Hundreds: $7 - 4 = 3 \Rightarrow 3$ hundreds

Thousands: $2 - 1 = 1 \Rightarrow 1$ thousand

$$\begin{array}{r} 2718 \\ - 1403 \\ \hline 1315 \end{array}$$

thousands
hundreds
tens
units

a) $5899 - 473 =$

5426

$$\begin{array}{r} 5899 \\ - 473 \\ \hline 5426 \end{array}$$

b) $1473 - 302 =$

$$\begin{array}{r} 1473 \\ - 302 \\ \hline \end{array}$$

c) $1384 - 261 =$

$$\begin{array}{r} 1384 \\ - 261 \\ \hline \end{array}$$

d) $8641 - 240 =$

$$\begin{array}{r} 8641 \\ - 240 \\ \hline \end{array}$$

e) $2756 - 304 =$

$$\begin{array}{r} 2756 \\ - 304 \\ \hline \end{array}$$

f) $8792 - 3420 =$

$$\begin{array}{r} 8792 \\ - 3420 \\ \hline \end{array}$$

g) $6207 - 3201 =$

$$\begin{array}{r} 6207 \\ - 3201 \\ \hline \end{array}$$

h) $7493 - 2151 =$

$$\begin{array}{r} 7493 \\ - 2151 \\ \hline \end{array}$$

i) $9867 - 6456 =$

$$\begin{array}{r} 9867 \\ - 6456 \\ \hline \end{array}$$

j) $7085 - 4013 =$

$$\begin{array}{r} 7085 \\ - 4013 \\ \hline \end{array}$$

k) $8782 - 6241 =$

$$\begin{array}{r} 8782 \\ - 6241 \\ \hline \end{array}$$

l) $5694 - 3564 =$

$$\begin{array}{r} 5694 \\ - 3564 \\ \hline \end{array}$$

Skill 5.3 Adding two large numbers with carry over.

MM4.2 1 1 2 3 3 4 4
MM5.1 1 1 2 3 3 4 4

- Always keep your working columns in line, aligning units with units, tens with tens, etc.
- Add from right to left.

Q. $4627 + 1398 =$ **A.** $4627 + 1398 = 6025$

Units: $7 + 8 = 15$
 $15 \text{ units} = 1 \text{ ten and } 5 \text{ units} \Rightarrow 5 \text{ units}$
 Carry the 1 ten to the tens column.

Tens: $2 + 9 + \text{carry } 1 = 12$
 $12 \text{ tens} = 1 \text{ hundred and } 2 \text{ tens} \Rightarrow 2 \text{ tens}$
 Carry the 1 hundred to the next column.

Hundreds: $6 + 3 + \text{carry } 1 = 10$
 $10 \text{ hundreds} = 1 \text{ thousand and } 0 \text{ hundred} \Rightarrow 0 \text{ hundred}$
 Carry the 1 thousand to the next column.

Thousands: $4 + 1 + \text{carry } 1 = 6$
 $\Rightarrow 6 \text{ thousands}$

a) $2873 + 651 =$ **3524** **b)** $7546 + 372 =$ **c)** $261 + 1384 =$

$$\begin{array}{r} \overset{1}{2} \overset{1}{8} 7 3 \\ + \quad 6 5 1 \\ \hline 3 5 2 4 \end{array}$$

$$\begin{array}{r} 7 5 4 6 \\ + \quad 3 7 2 \\ \hline \end{array}$$

$$\begin{array}{r} \quad 2 6 1 \\ + 1 3 8 4 \\ \hline \end{array}$$

d) $5783 + 2791 =$ **e)** $3367 + 2945 =$ **f)** $1592 + 4318 =$

$$\begin{array}{r} 5 7 8 3 \\ + 2 7 9 1 \\ \hline \end{array}$$

$$\begin{array}{r} 3 3 6 7 \\ + 2 9 4 5 \\ \hline \end{array}$$

$$\begin{array}{r} 1 5 9 2 \\ + 4 3 1 8 \\ \hline \end{array}$$

g) $6256 + 2938 =$ **h)** $2098 + 3147 =$ **i)** $5437 + 2659 =$

$$\begin{array}{r} 6 2 5 6 \\ + \quad \quad \quad \\ \hline \end{array}$$

$$\begin{array}{r} 2 0 9 8 \\ + \quad \quad \quad \\ \hline \end{array}$$

$$\begin{array}{r} \quad \quad \quad \\ + \quad \quad \quad \\ \hline \end{array}$$

j) $46723 + 3581 =$ **k)** $31054 + 6294 =$ **l)** $58943 + 2387 =$

$$\begin{array}{r} 4 6 7 2 3 \\ + \quad 3 5 8 1 \\ \hline \end{array}$$

$$\begin{array}{r} 3 1 0 5 4 \\ + \quad \quad \quad \\ \hline \end{array}$$

$$\begin{array}{r} 5 8 9 4 3 \\ + \quad \quad \quad \\ \hline \end{array}$$

Skill 5.4 Subtracting large numbers with carry over (1).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Always keep your working columns in line, aligning units with units, tens with tens, etc.
- Subtract from right to left.
- Whenever a number cannot be subtracted from another number to give a positive result then use:

EITHER

Decomposition method - Borrow from a higher place value and give to a lower place value.

Example: $3541 - 194 = 3347$

Units: $1 - 4 = ?$

Borrow 1 ten from the tens column (reduce the 4 tens to 3 tens) and give it as 10 units to the units column to make 11 units.

$11 - 4 = 7$ units

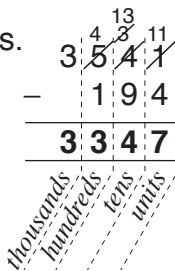
Tens: $3 - 9 = ?$

Borrow 1 hundred from the hundreds column (reduce the 5 hundreds to 4 hundreds) and give it as 10 tens to the tens column to make 13 tens.

$13 - 9 = 4$ tens

Hundreds: $4 - 1 = 3$ hundreds

Thousands: $3 - 0 = 3$ thousands



OR

Equal addition method - Each time a number is added to the top it must also be added to the bottom but in different columns.

Example: $3541 - 194 = 3347$

Units: $1 - 4 = ?$

Add 10 units to the 1 and add 10 units (1 ten) to the 9 (bottom number in the tens column)

$11 - 4 = 7$ units

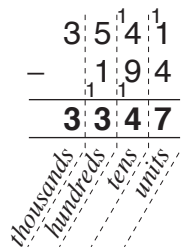
Tens: $4 - (9 + 1) = ?$

Add 10 tens to the 4 and add 10 tens (1 hundred) to the 1 (bottom number in the hundreds column)

$14 - 10 = 4$ tens

Hundreds: $5 - (1 + 1) = 3$ hundreds

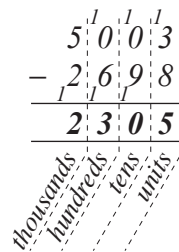
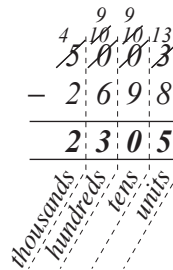
Thousands: $3 - 0 = 3$ thousands



Q. $5003 - 2698 =$

A. $5003 - 2698 = 2305$

Decomposition OR Equal addition

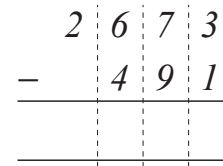
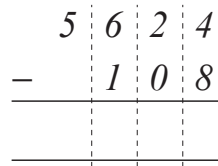
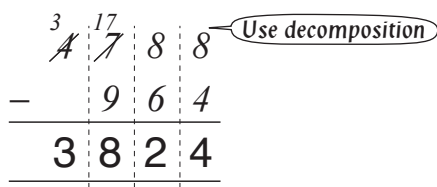


a) $4788 - 964 =$

3824

b) $5624 - 108 =$

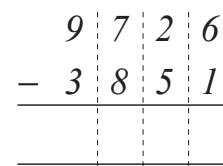
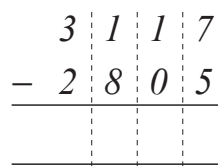
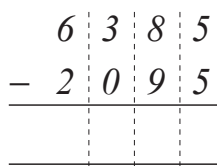
c) $2673 - 491 =$



d) $6385 - 2095 =$

e) $3117 - 2805 =$

f) $9726 - 3851 =$



Skill 5.4 Subtracting large numbers with carry over (2).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

g) $6319 - 254 =$

$$\begin{array}{r} 6 \ 3 \ 1 \ 9 \\ - \quad 2 \ 5 \ 4 \\ \hline \\ \hline \end{array}$$

h) $8536 - 914 =$

$$\begin{array}{r} 8 \ 5 \ 3 \ 6 \\ - \quad 9 \ 1 \ 4 \\ \hline \\ \hline \end{array}$$

i) $4467 - 318 =$

$$\begin{array}{r} 4 \ 4 \ 6 \ 7 \\ - \quad 3 \ 1 \ 8 \\ \hline \\ \hline \end{array}$$

j) $9307 - 2453 =$

$$\begin{array}{r} 9 \ 3 \ 0 \ 7 \\ - \quad 2 \ 4 \ 5 \ 3 \\ \hline \\ \hline \end{array}$$

k) $4083 - 1957 =$

$$\begin{array}{r} 4 \ 0 \ 8 \ 3 \\ - \quad 1 \ 9 \ 5 \ 7 \\ \hline \\ \hline \end{array}$$

l) $7062 - 2948 =$

$$\begin{array}{r} 7 \ 0 \ 6 \ 2 \\ - \quad 2 \ 9 \ 4 \ 8 \\ \hline \\ \hline \end{array}$$

m) $4208 - 657 =$

$$\begin{array}{r} 4 \ 2 \ 0 \ 8 \\ - \quad 6 \ 5 \ 7 \\ \hline \\ \hline \end{array}$$

n) $2009 - 121 =$

$$\begin{array}{r} 2 \ 0 \ 0 \ 9 \\ - \quad 1 \ 2 \ 1 \\ \hline \\ \hline \end{array}$$

o) $3564 - 285 =$

$$\begin{array}{r} 3 \ 5 \ 6 \ 4 \\ - \quad 2 \ 8 \ 5 \\ \hline \\ \hline \end{array}$$

p) $8357 - 489 =$

$$\begin{array}{r} 8 \ 3 \ 5 \ 7 \\ - \quad 4 \ 8 \ 9 \\ \hline \\ \hline \end{array}$$

q) $7231 - 645 =$

$$\begin{array}{r} 7 \ 2 \ 3 \ 1 \\ - \quad 6 \ 4 \ 5 \\ \hline \\ \hline \end{array}$$

r) $6534 - 3977 =$

$$\begin{array}{r} 6 \ 5 \ 3 \ 4 \\ - \quad 3 \ 9 \ 7 \ 7 \\ \hline \\ \hline \end{array}$$

s) $45328 - 8634 =$

$$\begin{array}{r} 4 \ 5 \ 3 \ 2 \ 8 \\ - \quad 8 \ 6 \ 3 \ 4 \\ \hline \\ \hline \end{array}$$

t) $31764 - 5936 =$

$$\begin{array}{r} 3 \ 1 \ 7 \ 6 \ 4 \\ - \quad 5 \ 9 \ 3 \ 6 \\ \hline \\ \hline \end{array}$$

u) $72004 - 4527 =$

$$\begin{array}{r} 7 \ 2 \ 0 \ 0 \ 4 \\ - \quad 4 \ 5 \ 2 \ 7 \\ \hline \\ \hline \end{array}$$

v) $63148 - 7980 =$

$$\begin{array}{r} 6 \ 3 \ 1 \ 4 \ 8 \\ - \quad 7 \ 9 \ 8 \ 0 \\ \hline \\ \hline \end{array}$$

w) $52305 - 4615 =$

$$\begin{array}{r} 5 \ 2 \ 3 \ 0 \ 5 \\ - \quad 4 \ 6 \ 1 \ 5 \\ \hline \\ \hline \end{array}$$

x) $28007 - 3495 =$

$$\begin{array}{r} 2 \ 8 \ 0 \ 0 \ 7 \\ - \quad 3 \ 4 \ 9 \ 5 \\ \hline \\ \hline \end{array}$$

Skill 5.5 Adding and/or subtracting multiple large numbers with carry over.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Work from left to right.

Q. $563 + 4027 - 945 =$

A. $563 + 4027 - 945 = 3645$

Complete the addition first
 $563 + 4027 = 4590$
 Then subtract 945 from 4590
 $4590 - 945 = 3645$

$$\begin{array}{r}
 \begin{array}{|c|c|c|c|}
 \hline
 5 & 6 & 3 & \\
 \hline
 \end{array} \\
 + \begin{array}{|c|c|c|c|}
 \hline
 4 & 0 & 2 & 7 \\
 \hline
 \end{array} \\
 \hline
 \begin{array}{|c|c|c|c|}
 \hline
 4 & 5 & 9 & 0 \\
 \hline
 \end{array} \\
 \\
 \begin{array}{|c|c|c|c|}
 \hline
 4 & 5 & 9 & 0 \\
 \hline
 \end{array} \\
 - \begin{array}{|c|c|c|c|}
 \hline
 9 & 4 & 5 & \\
 \hline
 \end{array} \\
 \hline
 \begin{array}{|c|c|c|c|}
 \hline
 3 & 6 & 4 & 5 \\
 \hline
 \end{array} \\
 \begin{array}{l}
 \text{thousands} \\
 \text{hundreds} \\
 \text{tens} \\
 \text{units}
 \end{array}
 \end{array}$$

a) $1256 + 3875 + 496 =$

5627

b) $883 + 437 + 170 =$

$$\begin{array}{r}
 \begin{array}{|c|c|c|c|}
 \hline
 1 & 2 & 5 & 6 \\
 \hline
 \end{array} \\
 \begin{array}{|c|c|c|c|}
 \hline
 3 & 8 & 7 & 5 \\
 \hline
 \end{array} \\
 + \begin{array}{|c|c|c|c|}
 \hline
 4 & 9 & 6 & \\
 \hline
 \end{array} \\
 \hline
 \begin{array}{|c|c|c|c|}
 \hline
 5 & 6 & 2 & 7 \\
 \hline
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{|c|c|c|}
 \hline
 8 & 8 & 3 \\
 \hline
 \end{array} \\
 + \\
 \hline
 \\
 \hline
 \end{array}$$

c) $945 + 34 + 286 + 121 =$

d) $598 + 1763 - 555 =$

$$\begin{array}{r}
 \begin{array}{|c|c|c|}
 \hline
 9 & 4 & 5 \\
 \hline
 \end{array} \\
 + \\
 \hline
 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{|c|c|c|}
 \hline
 5 & 9 & 8 \\
 \hline
 \end{array} \\
 + \\
 \hline
 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 \begin{array}{|c|c|c|}
 \hline
 5 & 5 & 5 \\
 \hline
 \end{array} \\
 - \\
 \hline
 \\
 \hline
 \end{array}$$

e) $764 + 8359 - 847 =$

f) $1435 + 2957 - 444 =$

$$\begin{array}{r}
 \begin{array}{|c|c|c|}
 \hline
 7 & 6 & 4 \\
 \hline
 \end{array} \\
 + \\
 \hline
 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 - \\
 \hline
 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 + \\
 \hline
 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 - \\
 \hline
 \\
 \hline
 \end{array}$$

g) $4000 + 10000 - 11374 =$

h) $17000 + 2000 - 13857 =$

$$\begin{array}{r}
 \begin{array}{|c|c|c|c|}
 \hline
 4 & 0 & 0 & 0 \\
 \hline
 \end{array} \\
 + \\
 \hline
 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 - \\
 \hline
 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 + \\
 \hline
 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 - \\
 \hline
 \\
 \hline
 \end{array}$$

6. [Large Number \times, \div]

Skill 6.1 Multiplying a large number by a power of 10.

MM4.2 1 2 2 3 3 4 4
MM5.1 1 2 2 3 3 4 4

When the multiplication is displayed in a **horizontal line**:

- Add the same number of zeros at the end of the given number as there are zeros in the power of 10.

When the multiplication is displayed in a **vertical algorithm**:

- Move each digit of the given number as many places to the left as there are zeros in the power of 10.
- Add zeros as place holders in the vacated places.

Q. $376 \times 1000 =$

A. $376 \times 1000 = 376000$ *Add 3 zeros*

a) $318 \times 10 =$

3180

b) $2040 \times 10 =$

c) $9080 \times 10 =$

d) $238 \times 100 =$

e) $7015 \times 100 =$

f) $4619 \times 100 =$

g) $179 \times 1000 =$

h) $412 \times 1000 =$

i) $905 \times 1000 =$

j) $506 \times 1000 =$

k) $803 \times 1000 =$

l) $248 \times 1000 =$

Skill 6.2 Dividing a large number by a power of 10.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Remove as many zeros from the end of the given number as there are zeros in the power of 10.

Hint: If the division is written as a fraction, simply cross off respective zeros from the top and bottom of the fraction.

Q. $850\,000 \div 1000 =$

A. $850\cancel{000} \div 1\cancel{000} =$
 $= 850$

OR $850\,000 \div 1000$

$$= \frac{850\,000 \div 1000}{1000 \div 1000}$$

$$= \frac{850\cancel{000}}{1\cancel{000}}$$

$$= 850$$

Any division can be written as a fraction.

Simplify by dividing both the numerator and denominator by 1000.

Cross off the respective zeros.

a) $460 \div 10 =$

$$= \frac{460 \div 10}{10 \div 10}$$

$$= \frac{46\cancel{0}}{1\cancel{0}} = \boxed{46}$$

b) $280 \div 10 =$

$$= \frac{280 \div 10}{10 \div 10}$$

$$= \frac{28\cancel{0}}{1\cancel{0}} = \boxed{}$$

c) $5020 \div 10 =$

$$=$$

$$= \frac{502\cancel{0}}{1\cancel{0}} = \boxed{}$$

d) $8900 \div 100 =$

$$= \frac{8900 \div 100}{100 \div 100}$$

$$= \frac{89\cancel{00}}{1\cancel{00}} = \boxed{}$$

e) $1500 \div 100 =$

$$=$$

$$= \frac{15\cancel{00}}{1\cancel{00}} = \boxed{}$$

f) $37000 \div 100 =$

$$=$$

$$= \frac{370\cancel{00}}{1\cancel{00}} = \boxed{}$$

g) $23000 \div 100 =$

$$=$$

$$= \frac{230\cancel{00}}{1\cancel{00}} = \boxed{}$$

h) $480000 \div 100 =$

$$=$$

$$= \frac{4800\cancel{00}}{1\cancel{00}} = \boxed{}$$

i) $200500 \div 100 =$

$$=$$

$$= \frac{2005\cancel{00}}{1\cancel{00}} = \boxed{}$$

j) $570000 \div 1000 =$

$$=$$

$$= \frac{570\cancel{000}}{1\cancel{000}} = \boxed{}$$

k) $706000 \div 1000 =$

$$=$$

$$= \frac{706\cancel{000}}{1\cancel{000}} = \boxed{}$$

l) $309000 \div 1000 =$

$$=$$

$$= \frac{309\cancel{000}}{1\cancel{000}} = \boxed{}$$

Skill 6.3 Multiplying a large number by a single digit.

MM4.2 11 2 33 44
MM5.1 11 2 33 44

- Multiply the number by the single digit working from right to left.
- If there is a 'carry over': First multiply.
Then add on the carry over.

Q. $4019 \times 7 =$

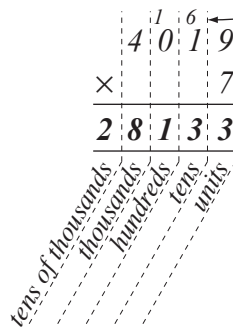
A. $4019 \times 7 = 28133$

Units: $7 \times 9 = 63$
63 units = 6 tens and 3 units \Rightarrow 3 units
Carry the 6 tens to the next column.

Tens: $7 \times 1 = 7, 7 + 6 = 13$
13 tens = 1 hundred and 3 tens \Rightarrow 3 tens
Carry the 1 hundred to the next column.

Hundreds: $7 \times 0 = 0$
 $0 + 1 = 1 \Rightarrow$ 1 hundred

Thousands: $7 \times 4 = 28 \Rightarrow$ 28 thousand



a) $65 \times 6 =$

390

b) $34 \times 9 =$

c) $59 \times 7 =$

$$\begin{array}{r} \overset{3}{6} 5 \\ \times \quad 6 \\ \hline 390 \end{array}$$

Units first!

$$\begin{array}{r} 34 \\ \times \quad 9 \\ \hline \end{array}$$

$$\begin{array}{r} 59 \\ \times \quad 7 \\ \hline \end{array}$$

d) $517 \times 3 =$

e) $265 \times 4 =$

f) $440 \times 8 =$

$$\begin{array}{r} \overset{2}{5} 17 \\ \times \quad 3 \\ \hline \quad 1 \end{array}$$

Units first!

$$\begin{array}{r} 265 \\ \times \quad 4 \\ \hline \end{array}$$

$$\begin{array}{r} 440 \\ \times \quad 8 \\ \hline \end{array}$$

g) $374 \times 7 =$

h) $1043 \times 6 =$

i) $2015 \times 5 =$

$$\begin{array}{r} \overset{2}{3} 74 \\ \times \quad 7 \\ \hline \end{array}$$

$$\begin{array}{r} 1043 \\ \times \quad 6 \\ \hline \end{array}$$

$$\begin{array}{r} 2015 \\ \times \quad 5 \\ \hline \end{array}$$

j) $3627 \times 2 =$

k) $5214 \times 3 =$

l) $4382 \times 4 =$

$$\begin{array}{r} 3627 \\ \times \quad 2 \\ \hline \end{array}$$

$$\begin{array}{r} 5214 \\ \times \quad 3 \\ \hline \end{array}$$

$$\begin{array}{r} 4382 \\ \times \quad 4 \\ \hline \end{array}$$

Skill 6.4 Dividing a large number by a single digit.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Divide from left to right across the digits one at a time.
- If any result is less than 1: Cross off the number being divided into.
'Carry over' this amount to the next column.
Add on the carry.
Then try dividing again.

Q. $7168 \div 8 =$

A. $7168 \div 8 = 896$

$$\begin{array}{r} 896 \\ 8 \overline{) 7168} \\ \underline{72} \\ 16 \\ \underline{16} \\ 0 \\ \underline{0} \\ 0 \end{array}$$

Divide 8 into 7.

8 does not divide into 7, so 'carry over' the 7 groups of 1000 and make 71 groups of 100.

8 divides into 71 eight times with 7 remainder. Write an 8 above the 1 and carry the remaining 7 groups of 100 to the tens column to make 76 tens.

Divide 8 into 76.

8 divides into 76 nine times and 4 remainder. Write a 9 above the 6 and carry the remaining 4 groups of tens to the units column to make 48 units.

Divide 8 into 48.

8 divides into 48 six times and 0 remainder.

Write a 6 above the 8.

Read as: 7168 divided by 8

OR How many times can 8 be taken from 7168?

OR How many 8's go into 7168?

a) $468 \div 3 =$

156

$$\begin{array}{r} 156 \\ 3 \overline{) 468} \\ \underline{3} \\ 16 \\ \underline{15} \\ 18 \\ \underline{18} \\ 0 \end{array}$$

b) $356 \div 4 =$

$$\begin{array}{r} 89 \\ 4 \overline{) 356} \\ \underline{32} \\ 36 \\ \underline{36} \\ 0 \end{array}$$

c) $475 \div 5 =$

$$\begin{array}{r} 95 \\ 5 \overline{) 475} \\ \underline{45} \\ 25 \\ \underline{25} \\ 0 \end{array}$$

d) $546 \div 6 =$

$$\begin{array}{r} 91 \\ 6 \overline{) 546} \\ \underline{54} \\ 6 \\ \underline{6} \\ 0 \end{array}$$

e) $296 \div 8 =$

$$\begin{array}{r} 37 \\ 8 \overline{) 296} \\ \underline{24} \\ 56 \\ \underline{56} \\ 0 \end{array}$$

f) $387 \div 9 =$

$$\begin{array}{r} 43 \\ 9 \overline{) 387} \\ \underline{36} \\ 27 \\ \underline{27} \\ 0 \end{array}$$

g) $2214 \div 3 =$

$$\begin{array}{r} 738 \\ 3 \overline{) 2214} \\ \underline{21} \\ 14 \\ \underline{12} \\ 24 \\ \underline{24} \\ 0 \end{array}$$

h) $2046 \div 6 =$

$$\begin{array}{r} 341 \\ 6 \overline{) 2046} \\ \underline{18} \\ 24 \\ \underline{24} \\ 6 \\ \underline{6} \\ 0 \end{array}$$

i) $4085 \div 5 =$

$$\begin{array}{r} 817 \\ 5 \overline{) 4085} \\ \underline{40} \\ 85 \\ \underline{85} \\ 0 \end{array}$$

j) $2364 \div 4 =$

$$\begin{array}{r} 591 \\ 4 \overline{) 2364} \\ \underline{20} \\ 36 \\ \underline{36} \\ 4 \\ \underline{4} \\ 0 \end{array}$$

k) $4347 \div 7 =$

$$\begin{array}{r} 621 \\ 7 \overline{) 4347} \\ \underline{42} \\ 14 \\ \underline{14} \\ 7 \\ \underline{7} \\ 0 \end{array}$$

l) $2392 \div 8 =$

$$\begin{array}{r} 299 \\ 8 \overline{) 2392} \\ \underline{16} \\ 79 \\ \underline{72} \\ 72 \\ \underline{72} \\ 0 \end{array}$$

m) $3608 \div 4 =$

$$\begin{array}{r} 902 \\ 4 \overline{) 3608} \\ \underline{32} \\ 40 \\ \underline{40} \\ 8 \\ \underline{8} \\ 0 \end{array}$$

n) $3725 \div 5 =$

$$\begin{array}{r} 745 \\ 5 \overline{) 3725} \\ \underline{35} \\ 22 \\ \underline{20} \\ 25 \\ \underline{25} \\ 0 \end{array}$$

o) $2268 \div 9 =$

$$\begin{array}{r} 252 \\ 9 \overline{) 2268} \\ \underline{18} \\ 46 \\ \underline{45} \\ 18 \\ \underline{18} \\ 0 \end{array}$$

Skill 6.5 Multiplying a large number by a multiple of 10.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Consider the zeros as making groups of 10's or 100's and place them at the end.
- Then multiply by the remaining digit as though it was a unit.

Q. $554 \times 300 =$

A. $554 \times 300 = 166200$

Consider 300 as 3 groups of 100.

Multiply 554 by 3:
 $554 \times 3 = 1662$

To show we want groups of 100,
place two zeros after 1662.

$$\begin{array}{r} \overset{1}{5} \ \overset{1}{5} \ \overset{1}{4} \\ \times \quad \quad 3 \ 0 \ 0 \\ \hline 1 \ 6 \ 6 \ 2 \ 0 \ 0 \end{array}$$

a) $98 \times 70 =$

6860

b) $75 \times 60 =$

c) $619 \times 20 =$

$$\begin{array}{r} \overset{5}{9} \ \overset{8}{8} \\ \times \quad \quad 7 \ 0 \\ \hline 6 \ 8 \ 6 \ 0 \end{array}$$

$$\begin{array}{r} \overset{3}{7} \ \overset{5}{5} \\ \times \quad \quad 6 \ 0 \\ \hline \quad \quad 0 \ 0 \end{array}$$

$$\begin{array}{r} \overset{6}{6} \ \overset{1}{1} \ \overset{9}{9} \\ \times \quad \quad 2 \ 0 \\ \hline \quad \quad 0 \end{array}$$

d) $346 \times 50 =$

e) $477 \times 40 =$

f) $537 \times 30 =$

$$\begin{array}{r} \overset{3}{3} \ \overset{4}{4} \ \overset{6}{6} \\ \times \quad \quad 5 \ 0 \\ \hline \quad \quad \quad \end{array}$$

$$\begin{array}{r} \overset{4}{4} \ \overset{7}{7} \ \overset{7}{7} \\ \times \quad \quad 4 \ 0 \\ \hline \quad \quad \quad \end{array}$$

$$\begin{array}{r} \overset{5}{5} \ \overset{3}{3} \ \overset{7}{7} \\ \times \quad \quad 3 \ 0 \\ \hline \quad \quad \quad \end{array}$$

g) $327 \times 400 =$

h) $148 \times 600 =$

i) $563 \times 200 =$

$$\begin{array}{r} \overset{1}{3} \ \overset{5}{2} \ \overset{7}{7} \\ \times \quad \quad 4 \ 0 \ 0 \\ \hline 1 \ 3 \ 0 \ 8 \ 0 \ 0 \end{array}$$

$$\begin{array}{r} \overset{1}{1} \ \overset{4}{4} \ \overset{8}{8} \\ \times \quad \quad 6 \ 0 \ 0 \\ \hline \quad \quad \quad \end{array}$$

$$\begin{array}{r} \overset{5}{5} \ \overset{6}{6} \ \overset{3}{3} \\ \times \quad \quad 2 \ 0 \ 0 \\ \hline \quad \quad \quad \end{array}$$

j) $206 \times 500 =$

k) $412 \times 700 =$

l) $3478 \times 200 =$

$$\begin{array}{r} \overset{2}{2} \ \overset{0}{0} \ \overset{6}{6} \\ \times \quad \quad 5 \ 0 \ 0 \\ \hline \quad \quad \quad \end{array}$$

$$\begin{array}{r} \overset{4}{4} \ \overset{1}{1} \ \overset{2}{2} \\ \times \quad \quad 7 \ 0 \ 0 \\ \hline \quad \quad \quad \end{array}$$

$$\begin{array}{r} \overset{3}{3} \ \overset{4}{4} \ \overset{7}{7} \ \overset{8}{8} \\ \times \quad \quad 2 \ 0 \ 0 \\ \hline \quad \quad \quad \end{array}$$

m) $2500 \times 60 =$

n) $1200 \times 70 =$

o) $1500 \times 80 =$

$$\begin{array}{r} \overset{2}{2} \ \overset{5}{5} \ \overset{0}{0} \ \overset{0}{0} \\ \times \quad \quad 6 \ 0 \\ \hline \quad \quad \quad \end{array}$$

$$\begin{array}{r} \overset{1}{1} \ \overset{2}{2} \ \overset{0}{0} \ \overset{0}{0} \\ \times \quad \quad 7 \ 0 \\ \hline \quad \quad \quad \end{array}$$

$$\begin{array}{r} \overset{1}{1} \ \overset{5}{5} \ \overset{0}{0} \ \overset{0}{0} \\ \times \quad \quad 8 \ 0 \\ \hline \quad \quad \quad \end{array}$$

Skill 6.6 Dividing a large number by a multiple of 10.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Remove as many zeros from the end of the given number as there are zeros in the multiple of 10.
- Divide by the remaining digit working from left to right.

Q. $2280 \div 60 =$

A. $2280 \div 60 =$

$$= \frac{228\cancel{0} \div 10}{6\cancel{0} \div 10}$$

$$= 38$$

$$\begin{array}{r} 38 \\ 6 \overline{) 2280} \\ \underline{18} \\ 48 \\ \underline{48} \\ 0 \end{array}$$

Divide both numbers by 10, by crossing off the zeros.

Complete the division $228 \div 6$
6 divides into 22 three times and 4 remainder.
Write a 3 above the 2 and carry the remaining 4 groups of tens to the units column to make 48 units.

6 divides into 48 eight times and 0 remainder.
Write an 8 above the 8.

a) $5600 \div 20 =$

$$= \frac{560\cancel{0} \div 10}{2\cancel{0} \div 10} = \boxed{280}$$

$$\begin{array}{r} 280 \\ 2 \overline{) 5600} \\ \underline{10} \\ 16 \\ \underline{12} \\ 40 \\ \underline{40} \\ 0 \end{array}$$

b) $4800 \div 30 =$

$$= \boxed{}$$

$$\begin{array}{r} \\ 3 \overline{) 4800} \\ \underline{3} \\ 18 \\ \underline{15} \\ 30 \\ \underline{30} \\ 0 \end{array}$$

c) $8160 \div 40 =$

$$= \boxed{}$$

$$\begin{array}{r} \\ 4 \overline{) 8160} \\ \underline{8} \\ 16 \\ \underline{16} \\ 0 \end{array}$$

d) $7350 \div 50 =$

$$= \boxed{}$$

$$\begin{array}{r} \\ 5 \overline{) 7350} \\ \underline{5} \\ 23 \\ \underline{20} \\ 35 \\ \underline{35} \\ 0 \end{array}$$

e) $9660 \div 60 =$

$$= \boxed{}$$

$$\begin{array}{r} \\ 6 \overline{) 9660} \\ \underline{6} \\ 36 \\ \underline{36} \\ 0 \end{array}$$

f) $5240 \div 40 =$

$$= \boxed{}$$

$$\begin{array}{r} \\ \overline{) 5240} \\ \\ \\ \end{array}$$

g) $18000 \div 400 =$

$$= \boxed{}$$

$$\begin{array}{r} \\ 4 \overline{) 18000} \\ \underline{12} \\ 60 \\ \underline{60} \\ 0 \end{array}$$

h) $22000 \div 500 =$

$$= \boxed{}$$

$$\begin{array}{r} \\ 5 \overline{) 22000} \\ \\ \\ \end{array}$$

i) $31000 \div 200 =$

$$= \boxed{}$$

$$\begin{array}{r} \\ \overline{) 31000} \\ \\ \\ \end{array}$$

j) $40500 \div 300 =$

$$= \boxed{}$$

$$\begin{array}{r} \\ 3 \overline{) 40500} \\ \underline{3} \\ 10 \\ \underline{9} \\ 15 \\ \underline{15} \\ 0 \end{array}$$

k) $20400 \div 600 =$

$$= \boxed{}$$

$$\begin{array}{r} \\ 6 \overline{) 20400} \\ \underline{12} \\ 84 \\ \underline{84} \\ 0 \end{array}$$

l) $98700 \div 700 =$

$$= \boxed{}$$

$$\begin{array}{r} \\ \overline{) 98700} \\ \\ \\ \end{array}$$

Skill 6.7 Multiplying a large number by a two-digit number (1).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Multiply by the unit digit first, working from right to left.
Reminder: Put a zero in the units place before you start multiplying by the tens.
- Then multiply by the ten digit, working from right to left.
- Add the results last.

Q. $1426 \times 37 =$

A. $1426 \times 37 = 52762$

Multiply 1426 by 7.

Then multiply 1426 by 30.

Remember: Put a 0 in the units place.

Add these results.

The question can be thought of as:

$$\begin{array}{r}
 \begin{array}{r}
 \overset{2}{1} \overset{1}{4} \overset{4}{2} \overset{1}{6} \\
 \times \quad \quad \quad 37 \\
 \hline
 9982 \\
 + 42780 \\
 \hline
 52762
 \end{array} \\
 \begin{array}{l}
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---}
 \end{array}
 \end{array}$$

$1426 \times 7 = 9982$
 $1426 \times 30 = 42780$

$$\begin{array}{r}
 \begin{array}{r}
 \overset{2}{1} \overset{1}{4} \overset{4}{2} \overset{1}{6} \\
 \times \quad \quad \quad 7 \\
 \hline
 9982
 \end{array}
 \text{ plus }
 \begin{array}{r}
 \overset{1}{1} \overset{1}{4} \overset{1}{2} \overset{1}{6} \\
 \times \quad \quad \quad 30 \\
 \hline
 42780
 \end{array}
 = 52762
 \end{array}$$

a) $57 \times 82 =$

4674

b) $64 \times 93 =$

c) $35 \times 46 =$

$$\begin{array}{r}
 \begin{array}{r}
 \overset{1}{5} \overset{5}{7} \\
 \times \quad \quad 82 \\
 \hline
 114 \\
 + 4560 \\
 \hline
 4674
 \end{array} \\
 \begin{array}{l}
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---}
 \end{array}
 \end{array}$$

0 as place holder

$$\begin{array}{r}
 \begin{array}{r}
 \overset{1}{6} \overset{4}{4} \\
 \times \quad \quad 93 \\
 \hline
 92 \\
 \hline

 \end{array} \\
 \begin{array}{l}
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{r}
 \overset{3}{3} \overset{5}{5} \\
 \times \quad \quad 46 \\
 \hline
 \\
 \hline

 \end{array} \\
 \begin{array}{l}
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---}
 \end{array}
 \end{array}$$

d) $715 \times 17 =$

e) $809 \times 23 =$

f) $648 \times 34 =$

$$\begin{array}{r}
 \begin{array}{r}
 \overset{1}{7} \overset{3}{1} \overset{5}{5} \\
 \times \quad \quad 17 \\
 \hline
 5005 \\
 + 7150 \\
 \hline

 \end{array} \\
 \begin{array}{l}
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{r}
 \overset{8}{8} \overset{0}{0} \overset{9}{9} \\
 \times \quad \quad 23 \\
 \hline
 27 \\
 \hline

 \end{array} \\
 \begin{array}{l}
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{r}
 \overset{6}{6} \overset{4}{4} \overset{8}{8} \\
 \times \quad \quad 34 \\
 \hline
 \\
 \hline

 \end{array} \\
 \begin{array}{l}
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---}
 \end{array}
 \end{array}$$

g) $416 \times 42 =$

h) $353 \times 56 =$

i) $207 \times 64 =$

$$\begin{array}{r}
 \begin{array}{r}
 \overset{4}{4} \overset{1}{1} \overset{6}{6} \\
 \times \quad \quad 42 \\
 \hline
 \\
 \hline

 \end{array} \\
 \begin{array}{l}
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{r}
 \overset{3}{3} \overset{5}{5} \overset{3}{3} \\
 \times \quad \quad 56 \\
 \hline
 \\
 \hline

 \end{array} \\
 \begin{array}{l}
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{r}
 \overset{2}{2} \overset{0}{0} \overset{7}{7} \\
 \times \quad \quad 64 \\
 \hline
 \\
 \hline

 \end{array} \\
 \begin{array}{l}
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---} \\
 \text{---}
 \end{array}
 \end{array}$$

Skill 6.7 Multiplying a large number by a two-digit number (2).

MM4.2 1 1 2 2 3 4
MM5.1 1 1 2 2 3 3 4 4

j) $804 \times 75 =$

$$\begin{array}{r} 804 \\ \times 75 \\ \hline \\ \hline \\ \hline \end{array}$$

k) $532 \times 28 =$

$$\begin{array}{r} 532 \\ \times 28 \\ \hline \\ \hline \\ \hline \end{array}$$

l) $926 \times 45 =$

$$\begin{array}{r} 926 \\ \times 45 \\ \hline \\ \hline \\ \hline \end{array}$$

m) $1602 \times 19 =$

$$\begin{array}{r} 1602 \\ \times 19 \\ \hline \\ \hline \\ \hline \end{array}$$

n) $4086 \times 24 =$

$$\begin{array}{r} 4086 \\ \times 24 \\ \hline \\ \hline \\ \hline \end{array}$$

o) $1903 \times 36 =$

$$\begin{array}{r} 1903 \\ \times 36 \\ \hline \\ \hline \\ \hline \end{array}$$

p) $3015 \times 45 =$

$$\begin{array}{r} 3015 \\ \times 45 \\ \hline \\ \hline \\ \hline \end{array}$$

q) $2038 \times 87 =$

$$\begin{array}{r} 2038 \\ \times 87 \\ \hline \\ \hline \\ \hline \end{array}$$

r) $5217 \times 23 =$

$$\begin{array}{r} 5217 \\ \times 23 \\ \hline \\ \hline \\ \hline \end{array}$$

s) $2009 \times 73 =$

$$\begin{array}{r} 2009 \\ \times 73 \\ \hline \\ \hline \\ \hline \end{array}$$

t) $3014 \times 46 =$

$$\begin{array}{r} 3014 \\ \times 46 \\ \hline \\ \hline \\ \hline \end{array}$$

u) $4268 \times 29 =$

$$\begin{array}{r} 4268 \\ \times 29 \\ \hline \\ \hline \\ \hline \end{array}$$

Skill 6.8 Dividing a large number by a two-digit number (1).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Work from left to right.
- Break down the division into smaller divisions by dividing into only as many digits as you need to get an answer greater than 1.
- It may be difficult, so guess the number of divisions, and multiply your guess to check.
- Subtract your answer from the original number to get the remainder, which must be less than the number you are dividing by.
- Continue in this way by bringing down the next digit to make the next number to divide into.
- Repeat until the result of the subtraction is zero.

Q. $9690 \div 15 =$

A. $9690 \div 15 = 646$

$$\begin{array}{r}
 \overline{) 9690} \\
 \underline{90} \\
 69 \\
 \underline{60} \\
 90 \\
 \underline{90} \\
 0
 \end{array}$$

Start at the left.

9 is too small to divide 15 into, so consider 96.

Divide $96 \div 15 = ?$

6 is a good guess.

Check by multiplying $6 \times 15 = 90$

Subtract $96 - 90 = 6$

Write 6 above the 6.

Bring down the 9.

Divide $69 \div 15 = ?$ (Guess 4)

Check by multiplying $4 \times 15 = 60$

Subtract $69 - 60 = 9$

Write 4 above the 9.

Bring down the 0.

Divide $90 \div 15 = 6$ (No remainder)

Write 6 above the 0.

$$\begin{array}{r}
 \overline{) 9690} \\
 \underline{90} \\
 69 \\
 \underline{60} \\
 90 \\
 \underline{90} \\
 0
 \end{array}$$

OR Work as a short division.

a) $725 \div 25 =$

29

$$\begin{array}{r}
 \overline{) 725} \\
 \underline{50} \\
 225 \\
 \underline{225} \\
 0
 \end{array}$$

b) $912 \div 16 =$

$$\begin{array}{r}
 \overline{) 912} \\
 \underline{80} \\
 112 \\
 \underline{112} \\
 0
 \end{array}$$

c) $948 \div 12 =$

$$\begin{array}{r}
 \overline{) 948} \\
 \underline{84} \\
 108 \\
 \underline{108} \\
 0
 \end{array}$$

d) $2607 \div 11 =$

$$\begin{array}{r}
 \overline{) 2607} \\
 \underline{22} \\
 40 \\
 \underline{33} \\
 77 \\
 \underline{77} \\
 0
 \end{array}$$

e) $3682 \div 14 =$

$$\begin{array}{r}
 \overline{) 3682} \\
 \underline{28} \\
 88 \\
 \underline{84} \\
 42 \\
 \underline{42} \\
 0
 \end{array}$$

f) $4368 \div 12 =$

$$\begin{array}{r}
 \overline{) 4368} \\
 \underline{36} \\
 78 \\
 \underline{72} \\
 68 \\
 \underline{60} \\
 88 \\
 \underline{84} \\
 48 \\
 \underline{48} \\
 0
 \end{array}$$

Skill 6.8 Dividing a large number by a two-digit number (2).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

g) $5550 \div 15 =$ **h)** $8085 \div 11 =$ **i)** $7680 \div 12 =$

$$\begin{array}{r} 15 \overline{) 5550} \\ - \\ \\ - \\ \\ - \\ \\ - \end{array}$$

$$\begin{array}{r} 11 \overline{) 8085} \\ - \\ \\ - \\ \\ - \\ \\ - \end{array}$$

$$\begin{array}{r} 12 \overline{) 7680} \\ - \\ \\ - \\ \\ - \\ \\ - \end{array}$$

j) $7252 \div 14 =$ **k)** $4224 \div 22 =$ **l)** $5350 \div 25 =$

$$\begin{array}{r} 14 \overline{) 7252} \\ - \\ \\ - \\ \\ - \\ \\ - \end{array}$$

$$\begin{array}{r} 22 \overline{) 4224} \\ - \\ \\ - \\ \\ - \\ \\ - \end{array}$$

$$\begin{array}{r} 25 \overline{) 5350} \\ - \\ \\ - \\ \\ - \\ \\ - \end{array}$$

m) $3570 \div 15 =$ **n)** $9030 \div 21 =$ **o)** $3335 \div 23 =$

$$\begin{array}{r} 15 \overline{) 3570} \\ - \\ \\ - \\ \\ - \\ \\ - \end{array}$$

$$\begin{array}{r} 21 \overline{) 9030} \\ - \\ \\ - \\ \\ - \\ \\ - \end{array}$$

$$\begin{array}{r} 23 \overline{) 3335} \\ - \\ \\ - \\ \\ - \\ \\ - \end{array}$$

p) $36864 \div 12 =$ **q)** $25795 \div 11 =$ **r)** $20650 \div 25 =$

$$\begin{array}{r} 12 \overline{) 36864} \\ - \\ \\ - \\ \\ - \\ \\ - \end{array}$$

$$\begin{array}{r} 11 \overline{) 25795} \\ - \\ \\ - \\ \\ - \\ \\ - \end{array}$$

$$\begin{array}{r} 25 \overline{) 20650} \\ - \\ \\ - \\ \\ - \\ \\ - \end{array}$$

Skill 6.9 Multiplying a whole number by a large multiple of 10.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Consider the zeros as making groups of 10’s or 100’s and place them at the end.
- Multiply by the unit digit first, working from right to left.
- Then multiply by the ten digit, working from right to left.
- Add the results last.

Q. $703 \times 2500 =$

A. $703 \times 2500 = 1\,757\,500$

Consider 2500 as 25 groups of 100.

$$\begin{array}{r} 703 \\ \times 2500 \\ \hline 351500 \\ + 140600 \\ \hline 1757500 \end{array}$$

Work with the 25 first.

Multiply 703 by 5.

Then multiply 703 by 20.

Add these results.

To show we want groups of 100, place two zeros after 17575.

a) $324 \times 120 = \boxed{38880}$

$$\begin{array}{r} 324 \\ \times 120 \\ \hline 648 \\ + 3240 \\ \hline 38880 \end{array}$$

b) $716 \times 150 = \boxed{}$

$$\begin{array}{r} 716 \\ \times 150 \\ \hline \\ \hline \\ \hline \\ \hline \end{array}$$

c) $172 \times 160 = \boxed{}$

$$\begin{array}{r} 172 \\ \times 160 \\ \hline \\ \hline \\ \hline \\ \hline \end{array}$$

d) $634 \times 240 = \boxed{}$

$$\begin{array}{r} 634 \\ \times 240 \\ \hline \\ \hline \\ \hline \\ \hline \end{array}$$

e) $352 \times 280 = \boxed{}$

$$\begin{array}{r} 352 \\ \times 280 \\ \hline \\ \hline \\ \hline \\ \hline \end{array}$$

f) $785 \times 310 = \boxed{}$

$$\begin{array}{r} 785 \\ \times 310 \\ \hline \\ \hline \\ \hline \\ \hline \end{array}$$

g) $208 \times 1400 = \boxed{}$

$$\begin{array}{r} 208 \\ \times 1400 \\ \hline \\ \hline \\ \hline \\ \hline \end{array}$$

h) $509 \times 2300 = \boxed{}$

$$\begin{array}{r} 509 \\ \times 2300 \\ \hline \\ \hline \\ \hline \\ \hline \end{array}$$

i) $807 \times 3200 = \boxed{}$

$$\begin{array}{r} 807 \\ \times 3200 \\ \hline \\ \hline \\ \hline \\ \hline \end{array}$$

Skill 6.10 Dividing a whole number - answer as a terminating decimal.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Line up the decimal point in your answer.
 - Place a decimal point and more zeros at the end of the whole number to be divided.
 - Divide into the whole number and continue until you get an exact division with no remainder.
- Hint: When no decimal point is shown it is always placed on the far right of the number.*

Q. $3458 \div 8 =$

A. $3458 \div 8 = 432.25$

$$\begin{array}{r} 432.25 \\ 8 \overline{) 3458.200} \end{array}$$

Start at the left.

Divide 8 into 3458.00

Continue until you get an exact number with no remainder.

a) $1487 \div 2 =$

b) $6014 \div 4 =$

c) $2564 \div 5 =$

$$\begin{array}{r} 743.5 \\ 2 \overline{) 1487.0} \end{array}$$

$$\begin{array}{r} 1503.5 \\ 4 \overline{) 6014.0} \end{array}$$

$$\begin{array}{r} 512.8 \\ 5 \overline{) 2564.0} \end{array}$$

d) $5945 \div 4 =$

e) $3564 \div 8 =$

f) $3057 \div 2 =$

$$\begin{array}{r} 1486.25 \\ 4 \overline{) 5945.00} \end{array}$$

$$\begin{array}{r} 445.5 \\ 8 \overline{) 3564.0} \end{array}$$

$$\begin{array}{r} 1528.5 \\ 2 \overline{) 3057.0} \end{array}$$

g) $1806 \div 5 =$

h) $2732 \div 8 =$

i) $7263 \div 5 =$

$$\begin{array}{r} 361.2 \\ 5 \overline{) 1806.0} \end{array}$$

$$\begin{array}{r} 341.5 \\ 8 \overline{) 2732.0} \end{array}$$

$$\begin{array}{r} 1452.6 \\ 5 \overline{) 7263.0} \end{array}$$

j) $4026 \div 4 =$

k) $7385 \div 2 =$

l) $5862 \div 8 =$

$$\begin{array}{r} 1006.5 \\ 4 \overline{) 4026.0} \end{array}$$

$$\begin{array}{r} 3692.5 \\ 2 \overline{) 7385.0} \end{array}$$

$$\begin{array}{r} 732.75 \\ 8 \overline{) 5862.0} \end{array}$$

m) $9305 \div 2 =$

n) $2189 \div 4 =$

o) $9287 \div 5 =$

$$\begin{array}{r} 4652.5 \\ 2 \overline{) 9305.0} \end{array}$$

$$\begin{array}{r} 547.25 \\ 4 \overline{) 2189.00} \end{array}$$

$$\begin{array}{r} 1857.4 \\ 5 \overline{) 9287.0} \end{array}$$

7. [Decimal +,-]

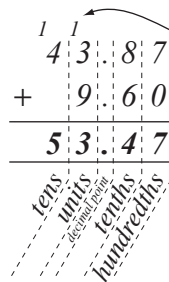
Skill 7.1 Adding decimal numbers (1).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Always keep your working columns in line, aligning the decimal points, the decimal places, units with units, tens with tens, etc.
- Add from right to left.

Q. $43.87 + 9.6 =$

A. $43.87 + 9.6 = 53.47$ **Hundredths:** $7 + 0 = 7 \Rightarrow 7$ hundredths

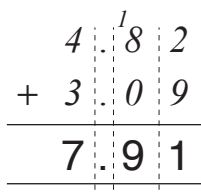


Tenths: $8 + 6 = 14 \Rightarrow 4$ tenths
Carry over 10 tenths as 1 unit

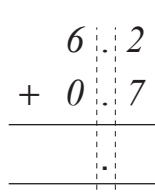
Units: $3 + 9 + \text{carry } 1 = 13 \Rightarrow 3$ units
Carry over 10 units as 1 ten

Tens: $4 + 0 + \text{carry } 1 = 5 \Rightarrow 5$ tens

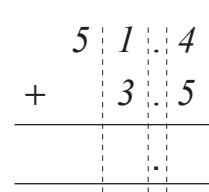
a) $4.82 + 3.09 =$



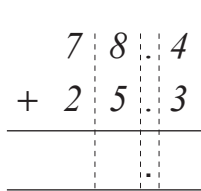
b) $6.2 + 0.7 =$



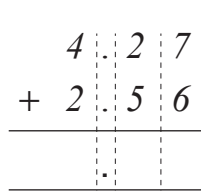
c) $51.4 + 3.5 =$



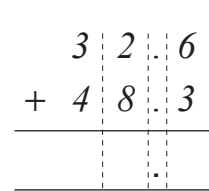
d) $78.4 + 25.3 =$



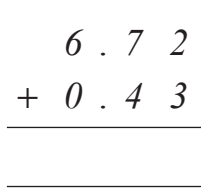
e) $4.27 + 2.56 =$



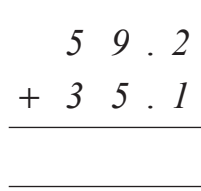
f) $32.6 + 48.3 =$



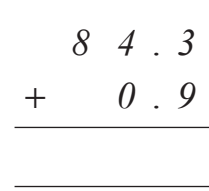
g) $6.72 + 0.43 =$



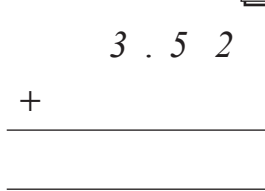
h) $59.2 + 35.1 =$



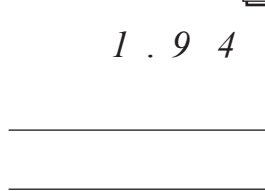
i) $84.3 + 0.9 =$



j) $3.52 + 40.08 =$



k) $1.94 + 27.6 =$



l) $51.4 + 3.58 =$



Skill 7.1 Adding decimal numbers (2).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

m) $9.86 + 0.09 =$

$$\begin{array}{r} 9 \ . \ 8 \ 6 \\ + 0 \ . \ 0 \ 9 \\ \hline \\ \hline \end{array}$$

n) $7.54 + 6.3 =$

$$\begin{array}{r} 7 \ . \ 5 \ 4 \\ + 6 \ . \ 3 \\ \hline \\ \hline \end{array}$$

o) $65.7 + 8 =$

$$\begin{array}{r} 6 \ 5 \ . \ 7 \\ + \quad 8 \ . \ 0 \\ \hline \\ \hline \end{array}$$

p) $42.08 + 17.95 =$

$$\begin{array}{r} 4 \ 2 \ . \ 0 \ 8 \\ + \\ \hline \\ \hline \end{array}$$

q) $45.69 + 38.37 =$

$$\begin{array}{r} 4 \ 5 \ . \ 6 \ 9 \\ + \\ \hline \\ \hline \end{array}$$

r) $64.8 + 9.72 =$

$$\begin{array}{r} \\ + \\ \hline \\ \hline \end{array}$$

s) $31.54 + 29.8 =$

$$\begin{array}{r} \\ + \\ \hline \\ \hline \end{array}$$

t) $5.47 + 26.7 =$

$$\begin{array}{r} \\ + \\ \hline \\ \hline \end{array}$$

u) $9 + 26.82 =$

$$\begin{array}{r} \\ + \\ \hline \\ \hline \end{array}$$

v) $0.5 + 49.7 + 6.41 =$

$$\begin{array}{r} \quad 0 \ . \ 5 \\ 4 \ 9 \ . \ 7 \\ + \quad 6 \ . \ 4 \ 1 \\ \hline \\ \hline \end{array}$$

w) $38.2 + 0.95 + 7 =$

$$\begin{array}{r} 3 \ 8 \ . \ 2 \\ \quad 0 \ . \ 9 \ 5 \\ + \quad 7 \ . \\ \hline \\ \hline \end{array}$$

x) $51.46 + 8 + 4.9 =$

$$\begin{array}{r} 5 \ 1 \ . \ 4 \ 6 \\ + \\ \hline \\ \hline \end{array}$$

y) $0.8 + 25.6 + 7.59 =$

$$\begin{array}{r} 0 \ . \ 8 \\ + \\ \hline \\ \hline \end{array}$$

z) $23.5 + 6.974 + 0.69 =$

$$\begin{array}{r} \\ + \\ \hline \\ \hline \end{array}$$

A) $0.258 + 7.9 + 24.56 =$

$$\begin{array}{r} \\ + \\ \hline \\ \hline \end{array}$$

- Always keep your working columns in line, aligning the decimal points, the decimal places, units with units, tens with tens, etc.
- Subtract from right to left.
- Whenever a number cannot be subtracted from another number to give a positive result then use either the decomposition or equal addition method. (see skill 5.4, page 12)

Q. $45.23 - 27.84 =$

A. $45.23 - 27.84 = 17.39$

$$\begin{array}{r}
 \overset{1}{4} \overset{1}{5} \overset{1}{.} \overset{1}{2} \overset{1}{3} \\
 - \overset{1}{2} \overset{1}{7} \overset{1}{.} \overset{1}{8} \overset{1}{4} \\
 \hline
 \overset{1}{1} \overset{1}{7} \overset{1}{.} \overset{1}{3} \overset{1}{9}
 \end{array}$$

tens *units* *decimal point* *tenths* *hundredths*

Using the **Equal Addition** method

Hundredths: $3 - 4 = ?$

Add 10 hundredths to the 3 and 10 hundredths (1 tenth) to the 8 (bottom number in the tenths column)

$$13 - 4 = 9 \text{ hundredths}$$

Tenths: $2 - (8 + 1) = ?$

Add 10 tenths to the 2 and 10 tenths (1 unit) to the 7 (bottom number in the units column)

$$12 - 9 = 3 \text{ tenths}$$

Units: $5 - (7 + 1) = ?$

Add 10 units to the 5 and 10 units (1 ten) to the 2 (bottom number in the tens column)

$$15 - 8 = 7 \text{ units}$$

Tens: $4 - (2 + 1) = 1 \text{ ten}$

a) $6.37 - 2.76 =$

3.61

b) $4.8 - 0.3 =$

c) $62.9 - 1.5 =$

$$\begin{array}{r}
 \overset{5}{6} \overset{13}{.} \overset{13}{3} \overset{13}{7} \\
 - \overset{13}{2} \overset{13}{.} \overset{13}{7} \overset{13}{6} \\
 \hline
 \overset{13}{3} \overset{13}{.} \overset{13}{6} \overset{13}{1}
 \end{array}$$

Use decomposition

$$\begin{array}{r}
 4 \ . \ 8 \\
 - 0 \ . \ 3 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 6 \ 2 \ . \ 9 \\
 - \quad 1 \ . \ 5 \\
 \hline
 \end{array}$$

d) $87.3 - 64.5 =$

e) $6.57 - 1.93 =$

f) $57.6 - 38.2 =$

$$\begin{array}{r}
 8 \ 7 \ . \ 3 \\
 - 6 \ 4 \ . \ 5 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 6 \ . \ 5 \ 7 \\
 - 1 \ . \ 9 \ 3 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 5 \ 7 \ . \ 6 \\
 - 3 \ 8 \ . \ 2 \\
 \hline
 \end{array}$$

g) $8.46 - 3.95 =$

h) $74.5 - 35.8 =$

i) $34.7 - 28.7 =$

$$\begin{array}{r}
 8 \ . \ 4 \ 6 \\
 - 3 \ . \ 9 \ 5 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 7 \ 4 \ . \ 5 \\
 - 3 \ 5 \ . \ 8 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 3 \ 4 \ . \ 7 \\
 - 2 \ 8 \ . \ 7 \\
 \hline
 \end{array}$$

Skill 7.2 Subtracting decimal numbers (2).

MM4.2 1 2 3 4
MM5.1 1 2 3 4 4

j) $27.4 - 9.6 =$

$$\begin{array}{r} 27.4 \\ - 9.6 \\ \hline \\ \hline \end{array}$$

k) $8.24 - 0.75 =$

$$\begin{array}{r} 8.24 \\ - 0.75 \\ \hline \\ \hline \end{array}$$

l) $43.8 - 8.9 =$

$$\begin{array}{r} 43.8 \\ - 8.9 \\ \hline \\ \hline \end{array}$$

m) $63.45 - 6.52 =$

$$\begin{array}{r} 63.45 \\ - 6.52 \\ \hline \\ \hline \end{array}$$

n) $28.31 - 9.4 =$

$$\begin{array}{r} 28.31 \\ - 9.4 \\ \hline \\ \hline \end{array}$$

o) $25.4 - 8.63 =$

$$\begin{array}{r} 25.4 \\ - 8.63 \\ \hline \\ \hline \end{array}$$

p) $55.63 - 26.8 =$

$$\begin{array}{r} 55.63 \\ - 26.8 \\ \hline \\ \hline \end{array}$$

q) $37.4 - 6.91 =$

$$\begin{array}{r} 37.4 \\ - 6.91 \\ \hline \\ \hline \end{array}$$

r) $46.2 - 8.37 =$

$$\begin{array}{r} 46.2 \\ - 8.37 \\ \hline \\ \hline \end{array}$$

s) $45.23 - 27.84 =$

$$\begin{array}{r} 45.23 \\ - 27.84 \\ \hline \\ \hline \end{array}$$

t) $34.21 - 18.45 =$

$$\begin{array}{r} 34.21 \\ - 18.45 \\ \hline \\ \hline \end{array}$$

u) $65.62 - 19.84 =$

$$\begin{array}{r} 65.62 \\ - 19.84 \\ \hline \\ \hline \end{array}$$

v) $90.03 - 4.08 =$

$$\begin{array}{r} 90.03 \\ - 4.08 \\ \hline \\ \hline \end{array}$$

w) $80.5 - 4.63 =$

$$\begin{array}{r} 80.5 \\ - 4.63 \\ \hline \\ \hline \end{array}$$

x) $25.46 - 7.59 =$

$$\begin{array}{r} 25.46 \\ - 7.59 \\ \hline \\ \hline \end{array}$$

y) $35.46 - 27.48 =$

$$\begin{array}{r} 35.46 \\ - 27.48 \\ \hline \\ \hline \end{array}$$

z) $66.23 - 19.54 =$

$$\begin{array}{r} 66.23 \\ - 19.54 \\ \hline \\ \hline \end{array}$$

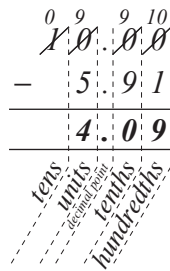
A) $57.2 - 9.84 =$

$$\begin{array}{r} 57.2 \\ - 9.84 \\ \hline \\ \hline \end{array}$$

- Write a decimal point at the end of the whole number.
- Add as many zeros after the decimal point as there are decimal places in the decimal number.
- Work vertically, lining up the decimal points.
- Subtract from right to left.
- Whenever a digit cannot be subtracted from another digit to give a positive result then use either the decomposition or equal addition method. (see skill 5.4, page 12)

Q. $10 - 5.91 =$

A. $10 - 5.91 =$
 $= 10.00 - 5.91$
 $= 4.09$



Using the **Decomposition** method:

Work from right to left until you reach a number you can borrow from, in this case the 1 ten. Restructure the 1 ten to 9 units, 9 tenths and 10 hundredths.

Hundredths: $10 - 1 = 9$ hundredths

Tenths: $9 - 9 = 0$ tenths

Units: $9 - 5 = 4$ units

Tens: $0 - 0 = 0$ tens

a) $3 - 1.27 =$

1.73

b) $8 - 3.7 =$

c) $4 - 2.75 =$

$$\begin{array}{r} 3 \ . \ 0 \ 0 \\ - 1 \ . \ 2 \ 7 \\ \hline 1 \ . \ 7 \ 3 \end{array}$$
 Use equal addition

$$\begin{array}{r} 8 \ . \ 0 \\ - 3 \ . \ 7 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \ . \ . \\ - 2 \ . \ 7 \ 5 \\ \hline \end{array}$$

d) $4 - 1.61 =$

e) $7 - 3.38 =$

f) $8 - 3.25 =$

$$\begin{array}{r} 4 \ . \ . \\ - 1 \ . \ 6 \ 1 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \ . \ . \\ - 3 \ . \ 3 \ 8 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \ . \ . \\ - \ . \ . \\ \hline \end{array}$$

g) $13 - 2.54 =$

h) $19 - 3.87 =$

i) $22 - 7.43 =$

$$\begin{array}{r} 1 \ 3 \ . \ . \\ - \ . \ . \\ \hline \end{array}$$

$$\begin{array}{r} \ . \ . \\ - \ . \ . \\ \hline \end{array}$$

$$\begin{array}{r} \ . \ . \\ - \ . \ . \\ \hline \end{array}$$

j) $7 - 0.357 =$

k) $9 - 0.619 =$

l) $6 - 0.802 =$

$$\begin{array}{r} 7 \ . \ 0 \ 0 \ 0 \\ - 0 \ . \ 3 \ 5 \ 7 \\ \hline 6 \ . \ 6 \ 4 \ 3 \end{array}$$
 Use decomposition

$$\begin{array}{r} 9 \ . \ . \\ - \ . \ . \\ \hline \end{array}$$

$$\begin{array}{r} \ . \ . \\ - \ . \ . \\ \hline \end{array}$$

8. [Decimal \times, \div]

Skill 8.1 Multiplying a decimal number by a single digit number (1).

MM4.2 1 2 3 4 4
MM5.1 1 2 3 4 4

- Multiply from right to left, disregarding the decimal point.
- Count the number of places to the right of the decimal point in the question.
- Position the decimal point the same number of places from the right in the answer.

Q. $0.62 \times 4 =$

A. $0.62 \times 4 = 2.48$

$$\begin{array}{r} 0.62 \\ \times 4 \\ \hline 2.48 \end{array}$$

$4 \times 2 = 8$

write 8

$4 \times 6 = 24$

carry 2, write 4

$4 \times 0 + \text{carry } 2 = 2$

write 2

2 decimal places in question so
move decimal point 2 places from right in the answer

a) $0.9 \times 3 =$

2.7

$$\begin{array}{r} 0.9 \\ \times 3 \\ \hline 2.7 \end{array}$$

b) $0.8 \times 2 =$

$$\begin{array}{r} 0.8 \\ \times 2 \\ \hline \end{array}$$

c) $0.7 \times 5 =$

$$\begin{array}{r} 0.7 \\ \times 5 \\ \hline \end{array}$$

d) $0.4 \times 6 =$

$$\begin{array}{r} 0.4 \\ \times 6 \\ \hline \end{array}$$

e) $0.3 \times 7 =$

$$\begin{array}{r} 0.3 \\ \times 7 \\ \hline \end{array}$$

f) $0.6 \times 9 =$

$$\begin{array}{r} 0.6 \\ \times 9 \\ \hline \end{array}$$

g) $5.1 \times 3 =$

$$\begin{array}{r} 5.1 \\ \times 3 \\ \hline \end{array}$$

h) $4.3 \times 6 =$

$$\begin{array}{r} 4.3 \\ \times 6 \\ \hline \end{array}$$

i) $2.7 \times 4 =$

$$\begin{array}{r} 2.7 \\ \times 4 \\ \hline \end{array}$$

j) $3.8 \times 2 =$

$$\begin{array}{r} 3.8 \\ \times 2 \\ \hline \end{array}$$

k) $1.9 \times 5 =$

$$\begin{array}{r} 1.9 \\ \times 5 \\ \hline \end{array}$$

l) $7.3 \times 8 =$

$$\begin{array}{r} 7.3 \\ \times 8 \\ \hline \end{array}$$

Skill 8.1 Multiplying a decimal number by a single digit number (2).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

m) $0.24 \times 5 =$ **n)** $0.71 \times 6 =$ **o)** $1.56 \times 8 =$

$$\begin{array}{r} 0.24 \\ \times \quad 5 \\ \hline 1.20 \end{array}$$

$$\begin{array}{r} 0.71 \\ \times \quad 6 \\ \hline \end{array}$$

$$\begin{array}{r} 1.56 \\ \times \quad 8 \\ \hline \end{array}$$

p) $2.09 \times 4 =$ **q)** $3.26 \times 3 =$ **r)** $4.82 \times 2 =$

$$\begin{array}{r} 2.09 \\ \times \quad 4 \\ \hline \end{array}$$

$$\begin{array}{r} 3.26 \\ \times \quad 3 \\ \hline \end{array}$$

$$\begin{array}{r} 4.82 \\ \times \quad 2 \\ \hline \end{array}$$

s) $14.02 \times 6 =$ **t)** $4 \times 20.15 =$ **u)** $18.02 \times 3 =$

$$\begin{array}{r} 14.02 \\ \times \quad 6 \\ \hline \end{array}$$

$$\begin{array}{r} 20.15 \\ \times \quad 4 \\ \hline \end{array}$$

$$\begin{array}{r} 18.02 \\ \times \quad 3 \\ \hline \end{array}$$

v) $8 \times 10.91 =$ **w)** $2.008 \times 7 =$ **x)** $6 \times 0.521 =$

$$\begin{array}{r} 10.91 \\ \times \quad 8 \\ \hline \end{array}$$

$$\begin{array}{r} 2.008 \\ \times \quad 7 \\ \hline \end{array}$$

$$\begin{array}{r} 0.521 \\ \times \quad 6 \\ \hline \end{array}$$

y) $5 \times 3.105 =$ **z)** $5.312 \times 4 =$ **A)** $3 \times 2.041 =$

$$\begin{array}{r} 3.105 \\ \times \quad 5 \\ \hline \end{array}$$

$$\begin{array}{r} 5.312 \\ \times \quad 4 \\ \hline \end{array}$$

$$\begin{array}{r} 2.041 \\ \times \quad 3 \\ \hline \end{array}$$

Skill 8.2 Dividing a decimal number by a single digit number.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Line up the decimal point in your answer with the decimal point in the question.
- Divide from left to right.
- Break down the division into smaller divisions.
- If any result is less than 1: Cross off the number being divided into. 'Carry over' this amount to the next column. Add on the carry. Then try dividing again.

Q. $1.26 \div 9 =$

A. $1.26 \div 9 = 0.14$

$1 \div 9 = ?$ (less than 0) carry 1, write 0
Line up the decimal point.

$12 \div 9 = 1$

carry 3, write 1

$36 \div 9 = 4$

write 4

$$\begin{array}{r} 0.14 \\ 9 \overline{) 1.26} \end{array}$$

a) $4.2 \div 6 =$

0.7

b) $2.4 \div 8 =$

c) $1.5 \div 3 =$

÷ from left

$$\begin{array}{r} 0.7 \\ 6 \overline{) 4.2} \end{array}$$

Line up decimal points

$$\begin{array}{r} \\ 8 \overline{) 2.4} \end{array}$$

$$\begin{array}{r} \\ 3 \overline{) 1.5} \end{array}$$

d) $6.5 \div 5 =$

e) $7.2 \div 4 =$

f) $9.8 \div 7 =$

$$\begin{array}{r} \\ 5 \overline{) 6.5} \end{array}$$

$$\begin{array}{r} \\ 4 \overline{) 7.2} \end{array}$$

$$\begin{array}{r} \\ 7 \overline{) 9.8} \end{array}$$

g) $12.6 \div 9 =$

h) $1.11 \div 3 =$

i) $14.5 \div 5 =$

$$\begin{array}{r} \\ 9 \overline{) 12.6} \end{array}$$

$$\begin{array}{r} \\ 3 \overline{) 1.11} \end{array}$$

$$\begin{array}{r} \\ 5 \overline{) 14.5} \end{array}$$

j) $2.66 \div 7 =$

k) $0.96 \div 6 =$

l) $2.72 \div 8 =$

$$\begin{array}{r} \\ 7 \overline{) } \end{array}$$

$$\begin{array}{r} \\ 6 \overline{) } \end{array}$$

$$\begin{array}{r} \\ 8 \overline{) } \end{array}$$

m) $10.4 \div 4 =$

n) $1.47 \div 3 =$

o) $23.4 \div 9 =$

$$\begin{array}{r} \\ \phantom{) } \end{array}$$

$$\begin{array}{r} \\ \phantom{) } \end{array}$$

$$\begin{array}{r} \\ \phantom{) } \end{array}$$

EITHER

- Count the number of zeros in the power of 10.
- Move the decimal point to the right the same number of places.
- Remove all the zeros before and after the decimal number if needed.

Example: $015.600 = 15.6$

- Add zeros as place holders if needed.
- Example: $2.4 \times 100 = 2.4000 \times 100 = 240.00 = 240$

OR

- Write the number followed by the zeros, disregarding the decimal point.
- Count the number of decimal places in the question.
- Position the decimal point the same number of places from the right in the answer.

| | | | |
|--------------------------------|--|----|--|
| Q. $2.57 \times 1000 =$ | A. $2.57 \times 1000 =$ $= 2.5700 \times 1000$ $= 2570$ | OR | 2.57 ← 2 decimal places $\times 1000$ <hr/> 2570.00 ← 2 decimal places in the answer $2570.00 = 2570$ |
|--------------------------------|--|----|--|

| | | |
|---|--|--|
| a) $4.6 \times 10 =$ 46 | b) $0.8 \times 10 =$ | c) $5.3 \times 10 =$ |
| $\begin{array}{r} 4.6 \\ \times 10 \\ \hline 46.0 \end{array}$ | $\begin{array}{r} 0.8 \\ \times 10 \\ \hline 8.0 \end{array}$ | $\begin{array}{r} 5.3 \\ \times 10 \\ \hline \end{array}$ |

| | | |
|---|---|---|
| d) $0.17 \times 10 =$ | e) $3.29 \times 10 =$ | f) $8.04 \times 10 =$ |
| $\begin{array}{r} 0.17 \\ \times 10 \\ \hline 1.70 \end{array}$ | $\begin{array}{r} 3.29 \\ \times 10 \\ \hline 32.9 \end{array}$ | $\begin{array}{r} 8.04 \\ \times 10 \\ \hline \end{array}$ |

| | | |
|---|---|---|
| g) $6.5 \times 100 =$ | h) $0.177 \times 100 =$ | i) $0.038 \times 100 =$ |
| $\begin{array}{r} 6.5 \\ \times 100 \\ \hline 650.0 \end{array}$ | $\begin{array}{r} 0.177 \\ \times 100 \\ \hline 17.700 \end{array}$ | $\begin{array}{r} 0.038 \\ \times 100 \\ \hline 3.800 \end{array}$ |

| | | |
|---|---|---|
| j) $13.2 \times 1000 =$ | k) $7.54 \times 1000 =$ | l) $9.06 \times 1000 =$ |
| $\begin{array}{r} 13.2 \\ \times 1000 \\ \hline \end{array}$ | $\begin{array}{r} 7.54 \\ \times 1000 \\ \hline \end{array}$ | $\begin{array}{r} 9.06 \\ \times 1000 \\ \hline \end{array}$ |

| | | |
|---|---|---|
| m) $83.5 \times 1000 =$ | n) $1.02 \times 1000 =$ | o) $7.69 \times 1000 =$ |
| $\begin{array}{r} 83.5 \\ \times 1000 \\ \hline \end{array}$ | $\begin{array}{r} 1.02 \\ \times 1000 \\ \hline \end{array}$ | $\begin{array}{r} 7.69 \\ \times 1000 \\ \hline \end{array}$ |

Skill 8.4 Dividing a decimal number by a power of 10.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Count the number of zeros in the power of 10.
- Move the decimal point to the left the same number of places.
- Remove all the zeros before and after the decimal number if needed.

Example: $\emptyset 15.6 \emptyset \emptyset = 15.6$

- Add zeros as place holders if needed.

Example: $4.9 \div 100 = \emptyset \emptyset 0 4.9 \div 100 = \emptyset 0.049 = 0.049$

| | | |
|---|--|--|
| <p>Q. $314.5 \div 1000 =$</p> | <p>A. $314.5 \div 1000 =$ $= \emptyset \emptyset \emptyset 314.5 \div 1000$ $= 0.3145$</p> | <p>← 3 zeros in 1000 ← 3 places to the left</p> |
|---|--|--|

| | | |
|--|---|---|
| <p>a) $26.7 \div 10 =$ $= \widehat{26.7} \div 10 = \boxed{2.67}$</p> | <p>b) $30.8 \div 10 =$ $= \dots \dots \dots = \boxed{}$</p> | <p>c) $94.3 \div 10 =$ $= \dots \dots \dots = \boxed{}$</p> |
|--|---|---|

| | | |
|---|---|---|
| <p>d) $6.58 \div 10 =$ $= \widehat{06.58} \div 10 = \boxed{}$</p> | <p>e) $0.49 \div 10 =$ $= \dots \dots \dots = \boxed{}$</p> | <p>f) $1.73 \div 10 =$ $= \dots \dots \dots = \boxed{}$</p> |
|---|---|---|

| | | |
|---|--|--|
| <p>g) $27.5 \div 100 =$ $= \widehat{027.5} \div 100 = \boxed{}$</p> | <p>h) $18.6 \div 100 =$ $= \dots \dots \dots = \boxed{}$</p> | <p>i) $90.7 \div 100 =$ $= \dots \dots \dots = \boxed{}$</p> |
|---|--|--|

| | | |
|--|---|---|
| <p>j) $1.3 \div 100 =$ $= \widehat{001.3} \div 100 = \boxed{}$</p> | <p>k) $7.4 \div 100 =$ $= \dots \dots \dots = \boxed{}$</p> | <p>l) $5.2 \div 100 =$ $= \dots \dots \dots = \boxed{}$</p> |
|--|---|---|

| | | |
|--|---|---|
| <p>m) $408.9 \div 100 =$ $= \widehat{408.9} \div 100 = \boxed{}$</p> | <p>n) $623.7 \div 100 =$ $= \dots \dots \dots = \boxed{}$</p> | <p>o) $240.5 \div 100 =$ $= \dots \dots \dots = \boxed{}$</p> |
|--|---|---|

| | | |
|---|--|--|
| <p>p) $927.2 \div 1000 =$ $= \widehat{0927.2} \div 1000 = \boxed{}$</p> | <p>q) $103.5 \div 1000 =$ $= \dots \dots \dots = \boxed{}$</p> | <p>r) $448.7 \div 1000 =$ $= \dots \dots \dots = \boxed{}$</p> |
|---|--|--|

Skill 8.5 Multiplying a decimal number by another decimal number.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Multiply from right to left, disregarding the decimal point.
- Count the number of places to the right of the decimal point in the question.
- Position the decimal point the same number of decimal places from the right in the answer.
- Use zeros as place holders, if necessary.
Example: $0.02 \times 0.3 = 0.006$
- If the result is less than 1, write a zero in the units place.
Example: By convention 0.37 not .37

Q. $2.5 \times 0.8 =$

A. $2.5 \times 0.8 = 2$

$8 \times 5 = 40$

carry 4, write 0

$8 \times 2 + \text{carry } 4 = 20$

write 20

$$\begin{array}{r} 2.5 \\ \times 0.8 \\ \hline 2.00 \end{array}$$

2 decimal places in question so
move decimal point 2 places from right in the answer

a) $0.8 \times 0.9 =$

0.72

$$\begin{array}{r} 0.8 \\ \times 0.9 \\ \hline 0.72 \end{array}$$

b) $0.3 \times 0.4 =$

$$\begin{array}{r} 0.3 \\ \times 0.4 \\ \hline \end{array}$$

c) $0.5 \times 0.8 =$

$$\begin{array}{r} 0.5 \\ \times 0.8 \\ \hline \end{array}$$

d) $0.7 \times 0.6 =$

$$\begin{array}{r} 0.7 \\ \times 0.6 \\ \hline \end{array}$$

e) $0.9 \times 0.4 =$

$$\begin{array}{r} 0.9 \\ \times 0.4 \\ \hline \end{array}$$

f) $1.2 \times 0.6 =$

$$\begin{array}{r} 1.2 \\ \times 0.6 \\ \hline \end{array}$$

g) $1.4 \times 0.7 =$

$$\begin{array}{r} 1.4 \\ \times 0.7 \\ \hline \end{array}$$

h) $2.3 \times 0.9 =$

$$\begin{array}{r} 2.3 \\ \times 0.9 \\ \hline \end{array}$$

i) $1.6 \times 0.3 =$

$$\begin{array}{r} 1.6 \\ \times 0.3 \\ \hline \end{array}$$

j) $0.5 \times 0.06 =$

0.03

$$\begin{array}{r} 0.5 \\ \times 0.06 \\ \hline 0.030 \end{array}$$

remove unnecessary zero

< 1 so write zero in units place

k) $0.16 \times 0.3 =$

$$\begin{array}{r} 0.16 \\ \times 0.3 \\ \hline \end{array}$$

l) $1.07 \times 0.9 =$

$$\begin{array}{r} 1.07 \\ \times 0.9 \\ \hline \end{array}$$

Skill 8.6 Dividing a decimal number by another decimal number.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Move the decimal point to the right in the divisor, as many places as you need to make it a whole number.
- Then move the decimal point the same number of places to the right in the dividend.

Example: $0.5\widehat{6} \div 0.8\widehat{1} = 5.6 \div 8 = 0.7$

- Add zeros as place holders, if necessary.

Example: $4.9 \div 0.07 = 4.9\widehat{0} \div 0.07\widehat{1} = 490 \div 7 = 70$

- Line up the decimal point in your answer with the decimal point in the question.
- Divide from left to right. (see skill 8.2, page 35)

Q. $0.63 \div 0.7 =$

A. $0.6\widehat{3} \div 0.7\widehat{1} =$
 $= 6.3 \div 7$
 $= 0.9$

$$\begin{array}{r} 0.9 \\ 7 \overline{) 6.3} \end{array}$$

$6 \div 7 = ?$ (less than 0) carry 6, write 0
 Line up the decimal point.
 $63 \div 7 = 9$ write 9

a) $3.6 \div 0.6 =$

1 place right makes a whole number
 $= 36 \div 6 = \boxed{6}$

$$\begin{array}{r} 6 \\ 3 \overline{) 36} \end{array}$$

b) $1.4 \div 0.7 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ 7 \overline{) } \end{array}$$

c) $4.5 \div 0.9 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

d) $7.6 \div 0.2 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

e) $6.9 \div 0.3 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

f) $0.76 \div 0.4 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ 4 \overline{) } \end{array}$$

g) $0.08 \div 0.4 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

h) $0.49 \div 0.7 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

i) $6.42 \div 0.6 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

j) $9.5 \div 0.05 =$

$= 950 \div 5 = \boxed{}$

$$\begin{array}{r} \\ 5 \overline{) 950} \end{array}$$

k) $2.7 \div 0.09 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

l) $7.2 \div 0.08 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

m) $6.4 \div 0.04 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

n) $4.5 \div 0.05 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

o) $9.6 \div 0.06 =$

$= \dots = \boxed{}$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

Skill 8.7 Dividing a whole number by a decimal number.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Move the decimal point to the right in the divisor, as many places as you need to make a whole number.
- Then move the decimal point the same number of places to the right in the dividend.
- Add zeros as place holders.

Example: $16 \div 0.4 = 16.\widehat{0} \div 0.\widehat{4} = 160 \div 4 = 40$

- Divide the whole numbers.

Q. $9 \div 0.6 =$

A. $9.\widehat{0} \div 0.\widehat{6} =$ *1 place right makes a whole number*
add zero as place holder $= 90 \div 6$
 $= 15$

$$\begin{array}{r} 15 \\ 6 \overline{) 90} \end{array}$$

$$\begin{array}{l} 9 \div 6 = 1 \\ 30 \div 6 = 5 \end{array}$$

carry 3, write 1
write 5

a) $5 \div 0.5 =$

$$= 5.\widehat{0} \div 0.\widehat{5}$$

$$= 50 \div 5 = \boxed{10}$$

$$\begin{array}{r} 10 \\ 5 \overline{) 50} \end{array}$$

b) $6 \div 0.3 =$

$$= \dots = \boxed{}$$

$$\begin{array}{r} \\ 3 \overline{) } \end{array}$$

c) $6 \div 0.4 =$

$$= \dots = \boxed{}$$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

d) $8 \div 0.1 =$

$$= \dots = \boxed{}$$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

e) $5 \div 0.2 =$

$$= \dots = \boxed{}$$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

f) $4 \div 0.5 =$

$$= \dots = \boxed{}$$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

g) $9 \div 0.2 =$

$$= \dots = \boxed{}$$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

h) $3 \div 0.06 =$

$$= \dots = \boxed{}$$

$$\begin{array}{r} \\ 6 \overline{) } \end{array}$$

i) $7 \div 0.04 =$

$$= \dots = \boxed{}$$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

j) $4 \div 0.02 =$

$$= \dots = \boxed{}$$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

k) $9 \div 0.05 =$

$$= \dots = \boxed{}$$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

l) $6 \div 0.04 =$

$$= \dots = \boxed{}$$

$$\begin{array}{r} \\ \overline{) } \end{array}$$

9. [Fraction +,-]

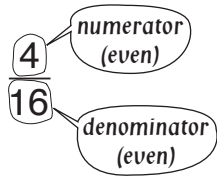
Skill 9.1 Adding fractions with the same denominator (1).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Add the numerators (top numbers of the fractions).
- Do not change the denominators.
- Simplify the resulting fraction and/or change it to a mixed number if necessary.

To simplify a fraction

Hint: If the numbers are both even then you can start with dividing by 2.



- Divide both the numerator and the denominator by the same number.

$$\frac{4 \div 2}{16 \div 2} = \frac{2 \div 2}{8 \div 2} = \frac{1}{4}$$

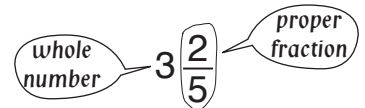
To change an improper fraction to a mixed number



- Divide the numerator by the denominator.
 $\frac{7}{3} = 7 \div 3 = 2 \text{ remainder } 1$
- Write the result as the whole number and the remainder over the denominator.
 $\frac{7}{3} = 7 \div 3 = 2\frac{1}{3}$

To change a mixed number to an improper fraction

MIXED NUMBER

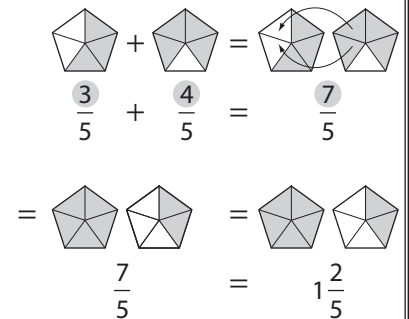


- Multiply the whole number by the denominator and then add the result to the numerator.
 $3\frac{2}{5} \rightarrow 3 \times 5 + 2 = 17$
- Rewrite the total over the denominator.

$$3\frac{2}{5} = \frac{17}{5}$$

Q. $\frac{3}{5} + \frac{4}{5} =$

A. $\frac{3}{5} + \frac{4}{5}$ *Add the numerators (top numbers) only*
 $= \frac{3+4}{5}$
 $= \frac{7}{5}$ *7 ÷ 5 = 1 remainder 2*
 $= 1\frac{2}{5}$



a) $\frac{5}{12} + \frac{4}{12} =$ *Add the numerators (top numbers) only*
 $= \frac{5+4}{12} = \frac{9}{12 \div 3} = \boxed{\frac{3}{4}}$

b) $\frac{2}{5} + \frac{2}{5} =$
 $= \dots = \boxed{\dots}$

c) $\frac{3}{11} + \frac{5}{11} =$
 $= \dots = \boxed{\dots}$

d) $\frac{2}{7} + \frac{4}{7} =$
 $= \dots = \boxed{\dots}$

e) $\frac{2}{13} + \frac{8}{13} =$
 $= \dots = \boxed{\dots}$

f) $\frac{4}{9} + \frac{1}{9} =$
 $= \dots = \boxed{\dots}$

Skill 9.1 Adding fractions with the same denominator (2).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

g) $\frac{4}{5} + \frac{4}{5} =$
 $= \frac{4+4}{5} = \frac{8}{5}$

Change to mixed number

$= 8 \div 5$

$= 1\frac{3}{5}$

h) $\frac{5}{7} + \frac{4}{7} =$

$=$

$=$

$=$

i) $\frac{7}{9} + \frac{7}{9} =$

$=$

$=$

$=$

j) $\frac{7}{11} + \frac{9}{11} =$

$=$

$=$

k) $\frac{10}{3} + \frac{1}{3} =$

$=$

$=$

l) $\frac{9}{13} + \frac{11}{13} =$

$=$

$=$

m) $\frac{5}{8} + \frac{7}{8} =$

$= \frac{5+7}{8} = \frac{12}{8}$

Simplify

$= \frac{3}{2} = 3 \div 2$

$=$

Change to mixed number

n) $\frac{3}{4} + \frac{3}{4} =$

$=$

$=$

o) $\frac{5}{6} + \frac{5}{6} =$

$=$

$=$

p) $\frac{1}{8} + \frac{5}{8} =$

$= \frac{1+5}{8} = \frac{6}{8}$

$=$

q) $\frac{1}{15} + \frac{2}{15} =$

$=$

$=$

r) $\frac{1}{6} + \frac{1}{6} =$

$=$

$=$

s) $\frac{3}{10} + \frac{2}{10} =$

$=$

t) $\frac{5}{12} + \frac{3}{12} =$

$=$

$=$

u) $\frac{7}{10} + \frac{1}{10} =$

$=$

$=$

v) $\frac{1}{8} + \frac{3}{8} =$

$=$

w) $\frac{5}{12} + \frac{5}{12} =$

$=$

$=$

x) $\frac{2}{15} + \frac{10}{15} =$

$=$

$=$

Skill 9.2 Subtracting fractions with the same denominator.

MM4.2 11 22 33 44
MM5.1 1 22 33 44

- Subtract the numerators (top numbers of the fractions).
- Do not change the denominators.
- Simplify the resulting fraction and/or change it to a mixed number if necessary.
(see skill 9.1, page 41)

Q. $\frac{5}{8} - \frac{1}{8} =$

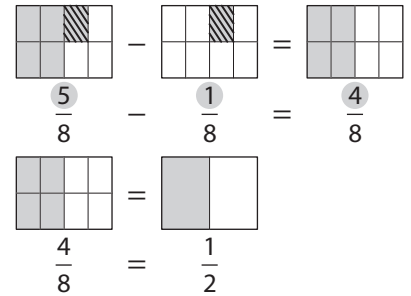
A. $\frac{5}{8} - \frac{1}{8}$ *Subtract the numerators (top numbers) only*

$$= \frac{5-1}{8}$$

Simplify

$$= \frac{4 \div 4}{8 \div 4}$$

$$= \frac{1}{2}$$



a) $\frac{7}{11} - \frac{2}{11}$ *Subtract the numerators (top numbers) only*

$$= \frac{7-2}{11} = \frac{5}{11}$$

b) $\frac{8}{9} - \frac{1}{9} =$

$$= \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

c) $\frac{11}{13} - \frac{9}{13} =$

$$= \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

d) $\frac{11}{5} - \frac{2}{5}$ *Change to mixed number*

$$= \frac{11-2}{5} = \frac{9}{5}$$

$$= 9 \div 5 = 1\frac{4}{5}$$

e) $\frac{8}{3} - \frac{1}{3} =$

$$= \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

f) $\frac{20}{7} - \frac{2}{7} =$

$$= \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

g) $\frac{7}{12} - \frac{5}{12}$ *Simplify*

$$= \frac{2 \div 2}{12 \div 2} = \frac{\quad}{\quad}$$

h) $\frac{13}{15} - \frac{8}{15} =$

$$= \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

i) $\frac{5}{6} - \frac{1}{6} =$

$$= \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

j) $\frac{9}{14} - \frac{5}{14} =$

$$= \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

k) $\frac{11}{16} - \frac{5}{16} =$

$$= \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

l) $\frac{9}{10} - \frac{1}{10} =$

$$= \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

m) $\frac{11}{18} - \frac{7}{18} =$

$$= \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

n) $\frac{9}{20} - \frac{3}{20} =$

$$= \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

o) $\frac{19}{24} - \frac{7}{24} =$

$$= \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

Skill 9.3 Adding mixed numbers with the same denominator (1).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Add the whole numbers first.
- Add the fractions. (see skill 9.1, page 41)
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 9.1, page 41)
- Write the result as a mixed number.

Q. $1\frac{5}{10} + 1\frac{3}{10} =$

A. $1 + 1 + \frac{5}{10} + \frac{3}{10}$

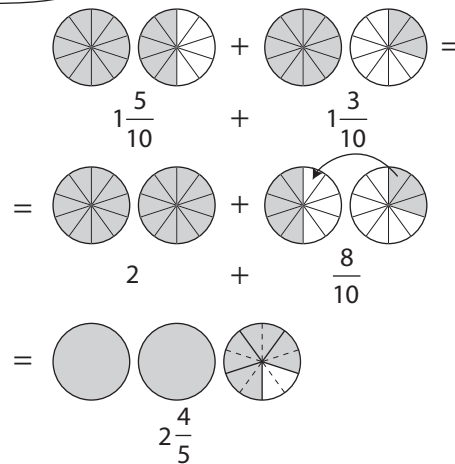
Add the numerators (top numbers) only

$= 2 + \frac{8}{10}$

Simplify

$= 2 + \frac{4}{5}$

$= 2\frac{4}{5}$



a) $2\frac{2}{5} + 1\frac{2}{5} =$

$= 3 + \frac{4}{5} = \boxed{}$

b) $1\frac{1}{7} + 3\frac{5}{7} =$

$= = \boxed{}$

c) $3\frac{1}{9} + \frac{4}{9} =$

$= = \boxed{}$

d) $3\frac{5}{11} + \frac{4}{11} =$

$= = \boxed{}$

e) $1\frac{2}{9} + 2\frac{5}{9} =$

$= = \boxed{}$

f) $2\frac{3}{7} + \frac{3}{7} =$

$= = \boxed{}$

g) $4\frac{1}{8} + \frac{3}{8} =$

$= 4 + \frac{4}{8}$

Simplify

$= 4 + \frac{1}{2} = \boxed{4\frac{1}{2}}$

h) $2\frac{3}{10} + \frac{3}{10} =$

$= = \boxed{}$

i) $1\frac{2}{9} + 2\frac{1}{9} =$

$= = \boxed{}$

j) $1\frac{1}{12} + 2\frac{7}{12} =$

$= $
 $= = \boxed{}$

k) $2\frac{1}{10} + \frac{4}{10} =$

$= $
 $= = \boxed{}$

l) $2\frac{1}{15} + 3\frac{4}{15} =$

$= $
 $= = \boxed{}$

Skill 9.3 Adding mixed numbers with the same denominator (2).

m) $1\frac{4}{5} + 2\frac{2}{5} =$
 $= 3 + \frac{6}{5}$ *Change to mixed number*
 $= 3 + 1\frac{1}{5} = \boxed{4\frac{1}{5}}$

n) $1\frac{2}{3} + 4\frac{2}{3} =$
 $=$
 $=$ $\boxed{}$

o) $3\frac{5}{7} + 2\frac{6}{7} =$
 $=$
 $=$ $\boxed{}$

p) $2\frac{5}{9} + \frac{5}{9} =$
 $=$
 $=$ $\boxed{}$

q) $3\frac{4}{11} + \frac{10}{11} =$
 $=$
 $=$ $\boxed{}$

r) $3\frac{8}{9} + \frac{8}{9} =$
 $=$
 $=$ $\boxed{}$

s) $3\frac{11}{15} + 2\frac{7}{15} =$
 $= 5 + \frac{18}{15}$ *Simplify*
 $= 5 + \frac{6}{5}$ *Change to mixed number*
 $= 5 + 1\frac{1}{5} = \boxed{6\frac{1}{5}}$

t) $4\frac{3}{8} + \frac{7}{8} =$
 $=$
 $=$ $\boxed{}$

u) $2\frac{3}{4} + 3\frac{3}{4} =$
 $=$
 $=$ $\boxed{}$

v) $1\frac{1}{2} + 4\frac{1}{2} =$
 $=$
 $=$ $\boxed{}$

w) $2\frac{5}{12} + \frac{11}{12} =$
 $=$
 $=$ $\boxed{}$

x) $4\frac{3}{10} + \frac{9}{10} =$
 $=$
 $=$ $\boxed{}$

y) $3\frac{2}{3} + 4\frac{1}{3} =$
 $=$
 $=$ $\boxed{}$

z) $5\frac{2}{6} + 3\frac{5}{6} =$
 $=$
 $=$ $\boxed{}$

A) $2\frac{7}{13} + \frac{9}{13} =$
 $=$
 $=$ $\boxed{}$

Skill 9.4 Subtracting mixed numbers with the same denominator (1).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

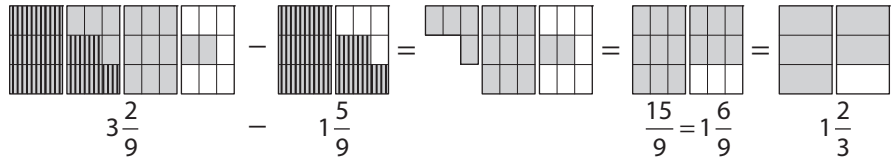
- Change mixed numbers to improper fractions before subtracting. (see skill 9.1, page 41)
- Subtract the fractions. (see skill 9.2, page 43)
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 9.1, page 41)

Q. $3\frac{2}{9} - 1\frac{5}{9} =$

A. $3\frac{2}{9} - 1\frac{5}{9}$ *Change to improper fractions*
 $= \frac{29}{9} - \frac{14}{9}$ *Subtract the numerators (top numbers) only*
 $= \frac{15}{9}$ *Change to mixed number*
 $= 1\frac{6 \div 3}{9 \div 3}$ *Simplify*
 $= 1\frac{2}{3}$

$$3\frac{2}{9} = \frac{3 \times 9 + 2}{9} = \frac{29}{9}$$

$$1\frac{5}{9} = \frac{1 \times 9 + 5}{9} = \frac{14}{9}$$



a) $3\frac{1}{5} - 1\frac{4}{5} =$

$$= \frac{16}{5} - \frac{9}{5}$$

Subtract the numerators (top numbers) only

$$= \frac{7}{5} = \boxed{1\frac{2}{5}}$$

b) $3\frac{2}{7} - 1\frac{4}{7} =$

$$=$$

$$= \boxed{}$$

c) $4\frac{1}{3} - 1\frac{2}{3} =$

$$=$$

$$= \boxed{}$$

d) $3\frac{4}{7} - 1\frac{6}{7} =$

$$=$$

$$= \boxed{}$$

e) $4\frac{1}{9} - 1\frac{5}{9} =$

$$=$$

$$= \boxed{}$$

f) $2\frac{3}{11} - 1\frac{8}{11} =$

$$=$$

$$= \boxed{}$$

g) $2\frac{3}{10} - \frac{7}{10} =$

$$= \frac{23}{10} - \frac{7}{10}$$

$$= \frac{16}{10}$$

Change to mixed number

$$= 1\frac{6 \div 2}{10 \div 2} = \boxed{}$$

h) $3\frac{1}{6} - \frac{5}{6} =$

$$=$$

$$= \boxed{}$$

i) $4\frac{5}{12} - 1\frac{7}{12} =$

$$=$$

$$= \boxed{}$$

Skill 9.4 Subtracting mixed numbers with the same denominator (2).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Subtract the whole numbers first.
- Subtract the fractions. (see skill 9.2, page 43)
- Simplify the resulting fraction if necessary. (see skill 9.1, page 41)

Hint: For subtractions you may need to convert 1 to an equivalent fraction.

Example:

$$\textcircled{\text{1 whole circle}} \quad 1 = \frac{3}{3} = \frac{5}{5} \quad \text{--- numerator = denominator ---}$$

Q. $4\frac{1}{8} - 2\frac{5}{8} =$

A. $4\frac{1}{8} - 2\frac{5}{8}$

$$= 2 + \frac{1}{8} - \frac{5}{8}$$

$$= 1 + 1 + \frac{1}{8} - \frac{5}{8}$$

$$= 1 + \frac{8}{8} + \frac{1}{8} - \frac{5}{8}$$

$$= 1 + \frac{9}{8} - \frac{5}{8}$$

$$= 1 + \frac{4}{8} = 1 + \frac{1}{2} = 1\frac{1}{2}$$

$$4 - 2 = 2 \text{ and } \frac{1}{8} - \frac{5}{8} = ?$$

$\frac{5}{8}$ can not be subtracted from $\frac{1}{8}$ and give a positive answer, so borrow a 1 from the 2.

$$1 = \frac{8}{8} \text{ (see hint)}$$

$$\frac{8}{8} + \frac{1}{8} = \frac{8+1}{8} = \frac{9}{8}$$

$$\frac{9}{8} - \frac{5}{8} = \frac{9-5}{8} = \frac{4}{8}$$

Simplify.

j) $4\frac{7}{9} - 1\frac{2}{9} =$

$$= 3 + \frac{7}{9} - \frac{2}{9}$$

Subtract the numerators (top numbers) only

$$= 3 + \frac{5}{9} = \boxed{}$$

k) $2\frac{7}{8} - 1\frac{5}{8} =$

$$= \boxed{}$$

l) $3\frac{8}{9} - 2\frac{1}{9} =$

$$= \boxed{}$$

m) $4\frac{1}{4} - 1\frac{3}{4} =$

$$= 3 + \frac{1}{4} - \frac{3}{4}$$

$$= 2 + 1 + \frac{1}{4} - \frac{3}{4}$$

$$= 2 + \frac{4}{4} + \frac{1}{4} - \frac{3}{4}$$

$$= 2 + \frac{2}{4} = 2 + \frac{1}{2}$$

$$= 2 + \frac{1}{2} = \boxed{}$$

n) $3\frac{1}{12} - 1\frac{5}{12} =$

$$= \boxed{}$$

$$= \boxed{}$$

$$= \boxed{}$$

$$= \boxed{}$$

$$= \boxed{}$$

o) $4\frac{2}{15} - 2\frac{7}{15} =$

$$= \boxed{}$$

$$= \boxed{}$$

$$= \boxed{}$$

$$= \boxed{}$$

$$= \boxed{}$$

Skill 9.5 Subtracting a fraction or a mixed number from a whole number (1) MM4.2 11 2 2 33 44
AM5.1 11 2 2 33 44

- Write the whole number as an improper fraction with the same denominator as the mixed number.
- Change the mixed number to an improper fraction before subtracting. (see skill 9.1, page 41)
- Subtract the fractions. (see skill 9.2, page 43)
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 9.1, page 41)

Q. $3 - 1\frac{1}{4} =$

A. $3 - 1\frac{1}{4}$ Change to improper fractions

3 can be written as: $\frac{3}{1} = \frac{12}{4}$

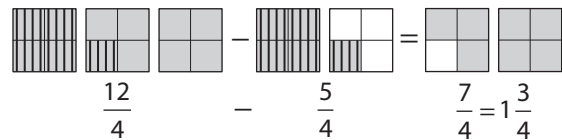
and $1\frac{1}{4} = \frac{1 \times 4 + 1}{4} = \frac{5}{4}$

$= \frac{3}{1} - \frac{5}{4}$

$= \frac{12}{4} - \frac{5}{4}$ Subtract the numerators (top numbers) only

$= \frac{7}{4}$ Change to mixed number

$= 1\frac{3}{4}$



a) $2 - \frac{2}{9} =$

$= \frac{2}{1} - \frac{2}{9}$ 2 can be written as $\frac{2}{1}$ or $\frac{18}{9}$

$= \frac{18}{9} - \frac{2}{9}$ Subtract the numerators (top numbers) only

$= \frac{16}{9} = \boxed{1\frac{7}{9}}$

b) $4 - \frac{7}{10} =$

$=$
.....
 $=$
.....
 $=$ \quad

c) $3 - \frac{1}{6} =$

$=$
.....
 $=$
.....
 $=$ \quad

d) $5 - 2\frac{4}{7} =$

$= \frac{5}{1} - \frac{18}{7}$
.....
 $= \frac{35}{7} - \frac{18}{7}$
.....
 $= \frac{17}{7} = \boxed{\quad}$

e) $4 - 2\frac{4}{5} =$

$=$
.....
 $=$
.....
 $=$ \quad

f) $3 - 1\frac{6}{11} =$

$=$
.....
 $=$
.....
 $=$ \quad

g) $4 - 1\frac{7}{8} =$

$=$
.....
 $=$
.....
 $=$ \quad

h) $3 - 2\frac{1}{8} =$

$=$
.....
 $=$
.....
 $=$ \quad

i) $5 - 3\frac{5}{12} =$

$=$
.....
 $=$
.....
 $=$ \quad

Skill 9.5 Subtracting a fraction or a mixed number from a whole number (2) MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Subtract the whole numbers first.
- Borrow 1 from the whole number and write it as a fraction with the same denominator.
- Subtract the fractions. (see skill 9.2, page 43)

Q. $4 - 1\frac{5}{7} =$

A. $4 - 1\frac{5}{7} =$
 $= 3 - \frac{5}{7}$
 $= 2 + 1 - \frac{5}{7}$
 $= 2 + \frac{7}{7} - \frac{5}{7}$
 $= 2 + \frac{2}{7} = 2\frac{2}{7}$

$4 - 1 = 3$ and $3 = 2 + 1$

$1 = \frac{7}{7}$

$\frac{7}{7} - \frac{5}{7} = \frac{7-5}{7} = \frac{2}{7}$

j) $4 - \frac{2}{5} =$
 $= 3 + 1 - \frac{2}{5}$
 $= 3 + \frac{5}{5} - \frac{2}{5}$
 $= 3 + \frac{3}{5} = \boxed{}$

k) $3 - \frac{5}{9} =$
 $=$
 $=$
 $=$
 $= \boxed{}$

l) $2 - \frac{3}{11} =$
 $=$
 $=$
 $=$
 $= \boxed{}$

m) $4 - 2\frac{2}{3} =$
 $= 2 - \frac{2}{3}$
 $= 1 + 1 - \frac{2}{3}$
 $= 1 + \frac{3}{3} - \frac{2}{3}$
 $= 1 + \frac{1}{3} = \boxed{}$

n) $2 - 1\frac{5}{8} =$
 $=$
 $=$
 $=$
 $= \boxed{}$

o) $5 - 2\frac{3}{10} =$
 $=$
 $=$
 $=$
 $= \boxed{}$

p) $4 - 1\frac{3}{7} =$
 $=$
 $=$
 $=$
 $= \boxed{}$

q) $3 - 2\frac{9}{10} =$
 $=$
 $=$
 $=$
 $= \boxed{}$

r) $5 - 1\frac{11}{12} =$
 $=$
 $=$
 $=$
 $= \boxed{}$

Skill 9.6 Adding fractions with different denominators - one denominator divides evenly into the other denominator (1).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Find the lowest common denominator of the fractions, which is the Lowest Common Multiple (LCM) of the denominators. In this case the LCM is the largest denominator.
- Change the fractions to equivalent fractions with the lowest common denominator.
- Add the fractions with the same denominators. (see skill 9.1, page 41)
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 9.1, page 41)

Hint: If unsure which is the LCM of the denominators, use their product as the common denominator.

Examples:

$$\frac{5}{6} + \frac{1 \times 3}{2 \times 3} = \frac{5}{6} + \frac{3}{6} = \frac{8}{6} = \frac{4}{3} = 1\frac{1}{3} \quad (\text{LCM of 6 and 2 is 6, because 2 divides evenly into 6})$$

OR

$$\frac{5}{6} + \frac{1}{2} = \frac{10}{12} + \frac{6}{12} = \frac{16}{12} = \frac{4}{3} = 1\frac{1}{3} \quad (\text{common denominator of 6 and 2 is } 6 \times 2 = 12)$$

To find the Lowest Common Multiple (LCM) of two numbers

- Write in ascending order some multiples of the smaller number first.
- Write in ascending order some multiples of the bigger number and stop when you find a multiple that appears in the first list \Rightarrow Lowest Common Multiple (LCM).

Hint: The lowest common multiple is the smallest number that the two numbers divide into.

LCM when one number divides evenly into the other number

| | | | |
|----|----|-----------------|------|
| 5 | 15 | LCM of 5 and 15 | |
| 5 | 15 | | stop |
| 10 | 30 | | |
| 15 | 45 | | |
| 20 | 60 | | |

Hint: LCM is the largest number.

LCM when the numbers have NO common factors other than 1

| | | | |
|---|----|----------------|------|
| 2 | 3 | LCM of 2 and 3 | |
| 2 | 3 | | stop |
| 4 | 6 | | |
| 6 | 9 | | |
| 8 | 12 | | |

Hint: LCM is the product of the numbers.

To find equivalent fractions

same area shaded

$\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8}$

different numerators and denominators

same value (equivalent fractions)

$$\frac{1 \times 2}{2 \times 2} = \frac{2}{4} \quad \frac{1 \times 3}{2 \times 3} = \frac{3}{6} \quad \frac{1 \times 4}{2 \times 4} = \frac{4}{8}$$

Equivalent fractions have the same value.

Equivalent fractions are formed by multiplying the numerator and denominator by the same number.

Skill 9.6

Adding fractions with different denominators - one denominator divides evenly into the other denominator (2).

Q. $\frac{3}{10} + \frac{3}{2} =$

A. $\frac{3}{10} + \frac{3}{2}$
 $= \frac{3}{10} + \frac{3 \times 5}{2 \times 5}$
 $= \frac{3}{10} + \frac{15}{10}$
 $= \frac{18}{10}$
 $= \frac{9}{5}$
 $= 1\frac{4}{5}$

LCM of 10 and 2 is 10

To give the second fraction a denominator of 10, multiply both the numerator and denominator by 5.

Add the fractions.

Simplify.

Change to a mixed number.

a) $\frac{2}{9} + \frac{1}{3} =$ LCM of 9 and 3 is 9
 $= \frac{2}{9} + \frac{1 \times 3}{3 \times 3}$
 $= \frac{2}{9} + \frac{3}{9} = \boxed{\frac{5}{9}}$

b) $\frac{3}{8} + \frac{5}{16} =$ LCM of 8 and 16 is 16
 $= \frac{3 \times 2}{8 \times 2} + \frac{5}{16}$
 $= \frac{6}{16} + \frac{5}{16} = \boxed{\frac{11}{16}}$

c) $\frac{1}{6} + \frac{2}{3} =$
 $= \frac{1}{6} + \frac{2 \times 2}{3 \times 2}$
 $= \frac{1}{6} + \frac{4}{6} = \boxed{\frac{5}{6}}$

d) $\frac{1}{2} + \frac{3}{8} =$
 $= \frac{1 \times 4}{2 \times 4} + \frac{3}{8}$
 $= \frac{4}{8} + \frac{3}{8} = \boxed{\frac{7}{8}}$

e) $\frac{1}{4} + \frac{1}{8} =$
 $= \frac{1 \times 2}{4 \times 2} + \frac{1}{8}$
 $= \frac{2}{8} + \frac{1}{8} = \boxed{\frac{3}{8}}$

f) $\frac{7}{10} + \frac{3}{20} =$
 $= \frac{7 \times 2}{10 \times 2} + \frac{3}{20}$
 $= \frac{14}{20} + \frac{3}{20} = \boxed{\frac{17}{20}}$

g) $\frac{3}{4} + \frac{1}{12} =$
 $= \frac{3 \times 3}{4 \times 3} + \frac{1}{12}$
 $= \frac{9}{12} + \frac{1}{12}$
 $= \frac{10}{12} = \boxed{\frac{5}{6}}$

h) $\frac{1}{5} + \frac{3}{10} =$
 $= \frac{1 \times 2}{5 \times 2} + \frac{3}{10}$
 $= \frac{2}{10} + \frac{3}{10} = \boxed{\frac{5}{10} = \frac{1}{2}}$

i) $\frac{1}{6} + \frac{5}{18} =$
 $= \frac{1 \times 3}{6 \times 3} + \frac{5}{18}$
 $= \frac{3}{18} + \frac{5}{18} = \boxed{\frac{8}{18} = \frac{4}{9}}$

j) $\frac{7}{15} + \frac{3}{5} =$
 $= \frac{7}{15} + \frac{3 \times 3}{5 \times 3}$
 $= \frac{7}{15} + \frac{9}{15} = \boxed{\frac{16}{15} = 1\frac{1}{15}}$

k) $\frac{5}{6} + \frac{1}{2} =$
 $= \frac{5}{6} + \frac{1 \times 3}{2 \times 3}$
 $= \frac{5}{6} + \frac{3}{6} = \boxed{\frac{8}{6} = 1\frac{2}{6} = 1\frac{1}{3}}$

l) $\frac{1}{2} + \frac{7}{12} =$
 $= \frac{1 \times 6}{2 \times 6} + \frac{7}{12}$
 $= \frac{6}{12} + \frac{7}{12} = \boxed{\frac{13}{12} = 1\frac{1}{12}}$

Skill 9.7 Adding fractions with different denominators - the denominators have no common factors other than 1 (e.g. 5 and 6).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Find the lowest common denominator of the fractions, which is the Lowest Common Multiple (LCM) of the denominators. In this case the LCM is the product of the denominators. (see skill 9.6, page 50)
- Change the fractions to equivalent fractions with the lowest common denominator.
- Add the fractions with the same denominators. (see skill 9.1, page 41)
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 9.1, page 41)

Q. $\frac{1}{3} + \frac{5}{8} =$

A. $\frac{1}{3} + \frac{5}{8}$
 $= \frac{1 \times 8}{3 \times 8} + \frac{5 \times 3}{8 \times 3}$
 $= \frac{8}{24} + \frac{15}{24}$
 $= \frac{23}{24}$

LCM of 3 and 8 is 24

Multiply the numerator and denominator of the first fraction by 8.

Multiply the numerator and denominator of the second fraction by 3.

Add the fractions.

a) $\frac{1}{7} + \frac{2}{3} =$
 $= \frac{1 \times 3}{7 \times 3} + \frac{2 \times 7}{3 \times 7}$
 $= \frac{3}{21} + \frac{14}{21} = \frac{17}{21}$

LCM of 7 and 3 is 21

b) $\frac{2}{5} + \frac{1}{6} =$
 $=$
 $=$ $=$

c) $\frac{2}{7} + \frac{3}{5} =$
 $=$
 $=$ $=$

d) $\frac{3}{5} + \frac{2}{9} =$
 $=$
 $=$

e) $\frac{1}{4} + \frac{2}{3} =$
 $=$
 $=$

f) $\frac{2}{3} + \frac{1}{5} =$
 $=$
 $=$

g) $\frac{3}{4} + \frac{3}{5} =$
 $=$
 $=$
 $=$

h) $\frac{1}{2} + \frac{4}{5} =$
 $=$
 $=$
 $=$

i) $\frac{2}{3} + \frac{4}{5} =$
 $=$
 $=$
 $=$

Skill 9.8 Subtracting fractions with different denominators - one denominator divides evenly into the other denominator.

- Find the lowest common denominator of the fractions, which is the Lowest Common Multiple (LCM) of the denominators. In this case the LCM is the largest denominator. (see skill 9.6, page 50)
- Change the fractions to equivalent fractions with the lowest common denominator.
- Subtract the fractions with the same denominators. (see skill 9.2, page 43)
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 9.1, page 41)

Hint: If unsure which is the LCM of the denominators, use their product as the common denominator.

Q. $\frac{3}{4} - \frac{3}{20} =$

A. $\frac{3}{4} - \frac{3}{20}$
 $= \frac{3 \times 5}{4 \times 5} - \frac{3}{20}$
 $= \frac{15}{20} - \frac{3}{20}$
 $= \frac{12}{20}$
 $= \frac{3}{5}$

LCM of 4 and 20 is 20

To give the first fraction a denominator of 20, multiply both the numerator and denominator by 5.

Subtract the fractions.

Simplify.

a) $\frac{5}{6} - \frac{2}{3} =$ LCM of 6 and 3 is 6
 $= \frac{5}{6} - \frac{2 \times 2}{3 \times 2}$
 $= \frac{5}{6} - \frac{4}{6} = \boxed{\frac{1}{6}}$

b) $\frac{4}{5} - \frac{3}{20} =$
 $= \frac{4 \times 4}{5 \times 4} - \frac{3}{20}$
 $= \frac{16}{20} - \frac{3}{20} = \boxed{\frac{13}{20}}$

c) $\frac{7}{8} - \frac{1}{2} =$
 $= \frac{7}{8} - \frac{4}{8} = \boxed{\frac{3}{8}}$

d) $\frac{3}{4} - \frac{5}{8} =$
 $= \frac{3 \times 2}{4 \times 2} - \frac{5}{8} = \frac{6}{8} - \frac{5}{8} = \boxed{\frac{1}{8}}$

e) $\frac{2}{7} - \frac{2}{21} =$
 $= \frac{2 \times 3}{7 \times 3} - \frac{2}{21} = \frac{6}{21} - \frac{2}{21} = \boxed{\frac{4}{21}}$

f) $\frac{3}{10} - \frac{3}{20} =$
 $= \frac{3 \times 2}{10 \times 2} - \frac{3}{20} = \frac{6}{20} - \frac{3}{20} = \boxed{\frac{3}{20}}$

g) $\frac{3}{4} - \frac{5}{12} =$
 $= \frac{3 \times 3}{4 \times 3} - \frac{5}{12} = \frac{9}{12} - \frac{5}{12} = \frac{4}{12} = \frac{1}{3} = \boxed{\frac{1}{3}}$

h) $\frac{5}{6} - \frac{7}{12} =$
 $= \frac{5 \times 2}{6 \times 2} - \frac{7}{12} = \frac{10}{12} - \frac{7}{12} = \frac{3}{12} = \frac{1}{4} = \boxed{\frac{1}{4}}$

i) $\frac{3}{10} - \frac{3}{50} =$
 $= \frac{3 \times 5}{10 \times 5} - \frac{3}{50} = \frac{15}{50} - \frac{3}{50} = \frac{12}{50} = \frac{6}{25} = \boxed{\frac{6}{25}}$

Skill 9.9 Subtracting fractions with different denominators -
the denominators have no common factors other than 1 (e.g. 5 and 6).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Find the lowest common denominator of the fractions, which is the Lowest Common Multiple (LCM) of the denominators. In this case the LCM is the product of the denominators. (see skill 9.6, page 50)
- Change the fractions to equivalent fractions with the lowest common denominator.
- Subtract the fractions with the same denominators. (see skill 9.2, page 43)
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 9.1, page 41)

Q. $\frac{4}{5} - \frac{2}{3} =$

A. $\frac{4}{5} - \frac{2}{3}$
 $= \frac{4 \times 3}{5 \times 3} - \frac{2 \times 5}{3 \times 5} =$
 $= \frac{12}{15} - \frac{10}{15}$
 $= \frac{2}{15}$

LCM of 5 and 3
is 15

Multiply the numerator and denominator of the first fraction by 3.

Multiply the numerator and denominator of the second fraction by 5.

Subtract the fractions.

a) $\frac{3}{2} - \frac{5}{9} =$
 $= \frac{3 \times 9}{2 \times 9} - \frac{5 \times 2}{9 \times 2}$
 $= \frac{27}{18} - \frac{10}{18} = \frac{17}{18}$

LCM of 2 and 9
is 18

b) $\frac{5}{7} - \frac{1}{4} =$
 $=$
 $=$ $=$

c) $\frac{4}{5} - \frac{1}{2} =$
 $=$
 $=$ $=$

d) $\frac{5}{7} - \frac{2}{3} =$
 $=$
 $=$ $=$

e) $\frac{2}{5} - \frac{1}{12} =$
 $=$
 $=$ $=$

f) $\frac{3}{5} - \frac{3}{11} =$
 $=$
 $=$ $=$

g) $\frac{7}{9} - \frac{3}{4} =$
 $=$
 $=$ $=$

h) $\frac{1}{2} - \frac{3}{7} =$
 $=$
 $=$ $=$

i) $\frac{2}{3} - \frac{3}{10} =$
 $=$
 $=$ $=$

j) $\frac{2}{5} - \frac{3}{8} =$
 $=$
 $=$ $=$

k) $\frac{5}{6} - \frac{2}{7} =$
 $=$
 $=$ $=$

l) $\frac{7}{9} - \frac{2}{5} =$
 $=$
 $=$ $=$

10. [Fraction \times, \div]

Skill 10.1 Multiplying a fraction by a whole number (1).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Multiply the numerator of the fraction by the whole number.
- Do not change the denominator.
- Simplify the resulting fraction and/or change it to a mixed number if necessary.

EITHER

- Cross simplify where possible before multiplying.

OR

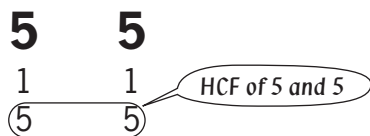
- Simplify at the end.

To find the Highest Common Factor (HCF) of two numbers

- Write all the factors of each number (the factors must divide exactly into the number).
- Find the largest number that appears on both lists.

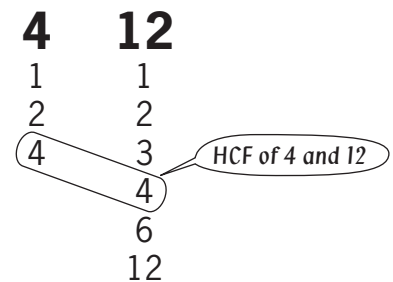
Hint: The Highest Common Factor is the largest number that divides evenly into both numbers.

HCF for Identical numbers



Hint: 5 is the HCF of 5 and 5 because 5 is the largest number that divides into 5 and 5.

HCF when one number divides evenly into the other number



Hint: 4 is the HCF of 4 and 12 because 4 is the largest number that divides into 4 and 12.

To change an improper fraction to a mixed number



- Divide the numerator by the denominator.

$$\frac{7}{2} = 7 \div 2 = 3 \text{ remainder } 1$$

- Write the result as the whole number and the remainder over the denominator.

$$3 \text{ remainder } 1 = 3\frac{1}{2}$$

To cross multiply a fraction and a whole number

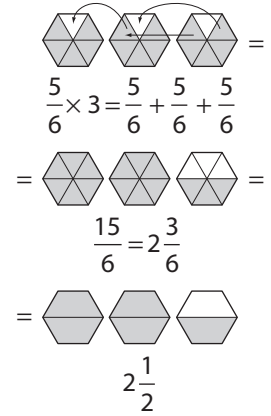
- Simplify the denominator of the fraction and the whole number. This means to divide them by the same number, usually by their Highest Common Factor.
- Cross out the denominator of the fraction and the whole number.
- Write the result of the division next to each crossed number.
- Multiply the top numbers together.

$$\begin{aligned} \frac{3}{10} \times 5 &= \frac{3}{\cancel{10}^5} \times \cancel{5}_5 && \text{Divide 5 and 10 by 5} \\ &= \frac{3}{2} \times 1 && \begin{matrix} 5 \div 5 = 1 \\ 10 \div 5 = 2 \end{matrix} \\ &= \frac{3}{2} = 1\frac{1}{2} \end{aligned}$$

Q. $\frac{5}{6} \times 3 =$

A. $\frac{5}{\cancel{6}^2} \times \frac{1}{\cancel{3}^3} =$
 $= \frac{5 \times 1}{2}$ *Divide 6 and 3 by 3*
 $= \frac{5}{2}$ *Change to mixed number*
 $= 2\frac{1}{2}$

OR A. $\frac{5}{6} \times 3 =$ *Multiply 5 by 3*
 $= \frac{5 \times 3}{6}$
 $= \frac{15}{6}$
 $= 2\frac{3}{6}$ *Simplify*
 $= 2\frac{1}{2}$



a) $9 \times \frac{2}{5} =$
 $= \frac{9 \times 2}{5} = \frac{18}{5}$ *Change to mixed number*

$= 18 \div 5 = 3\frac{3}{5}$

b) $\frac{5}{6} \times 5 =$

$=$

c) $3 \times \frac{5}{8} =$

$=$

d) $\frac{4}{5} \times 3 =$

$=$

e) $2 \times \frac{4}{7} =$

$=$

f) $2 \times \frac{2}{9} =$

$=$

g) $8 \times \frac{3}{4} =$
 $= \frac{\cancel{8}^2 \times 3}{\cancel{4}_1}$ *Divide 8 and 4 by 4*

$= \frac{2 \times 3}{1} = 6$

h) $\frac{5}{8} \times 2 =$

$=$

i) $2 \times \frac{5}{12} =$

$=$

j) $6 \times \frac{5}{12} =$

$=$

k) $\frac{3}{7} \times 14 =$

$=$

l) $\frac{3}{4} \times 20 =$

$=$

m) $2 \times \frac{5}{6} =$

$=$

n) $\frac{1}{4} \times 16 =$

$=$

o) $12 \times \frac{3}{4} =$

$=$

Skill 10.2 Finding a fraction of a quantity.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Replace the word “of” with the multiplication symbol.
- Multiply the fraction by the whole number. (see skill 10.1, page 55)
- Write the unit of measurement in the result.

Hint: To find a fraction of a whole number divide that number by the denominator of the fraction, and then multiply the result by the numerator.

Q. $\frac{5}{9}$ of \$180 =

A. $\frac{5}{9}$ of \$180 =

OR **A.** To find $\frac{5}{9}$ of \$180:

$$180 \div 9 = 20$$

$$20 \times 5 = \mathbf{\$100}$$

$$= \frac{5}{9} \times 180$$

$$= \frac{5 \times 20}{1}$$

Divide
9 and 180 by 9

$$= \mathbf{\$100}$$

Add the \$ sign

a) $\frac{3}{7}$ of 35 mL =

$$= \frac{3}{7} \times 35$$

Divide
7 and 35 by 7

$$= \frac{3 \times 5}{1} = \mathbf{15 \text{ mL}}$$

b) $\frac{1}{2}$ of 360 kg =

$$= \frac{1}{2} \times 360$$

$$= \quad = \mathbf{\quad}$$

c) $\frac{1}{4}$ of \$72 =

$$= \quad = \mathbf{\quad}$$

d) $\frac{3}{10}$ of 150 L =

$$= \quad = \mathbf{\quad}$$

e) $\frac{1}{5}$ of 1000 m =

$$= \quad = \mathbf{\quad}$$

f) $\frac{1}{9}$ of \$45 =

$$= \quad = \mathbf{\quad}$$

g) $\frac{2}{3}$ of 600 L =

$$= \quad = \mathbf{\quad}$$

h) $\frac{1}{6}$ of 120 cm =

$$= \quad = \mathbf{\quad}$$

i) $\frac{3}{4}$ of 60 m =

$$= \quad = \mathbf{\quad}$$

j) $\frac{1}{9}$ of 720 g =

$$= \quad = \mathbf{\quad}$$

k) $\frac{4}{5}$ of 40 mL =

$$= \quad = \mathbf{\quad}$$

l) $\frac{3}{8}$ of 80 kg =

$$= \quad = \mathbf{\quad}$$

Skill 10.3 Dividing a whole number by a fraction (1).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Copy the whole number and change “divide by” (\div) into “times” (\times).
- Invert the fraction.
- Multiply the whole number by the numerator of the fraction. Do not change the denominator.

To simplify:

EITHER

- Cross simplify where possible before multiplying.
(see skill 10.1, page 55)

OR

- Simplify at the end.

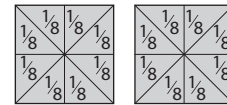
Q. $2 \div \frac{1}{8} =$

A. $2 \div \frac{1}{8} =$
 $= 2 \times \frac{8}{1}$
 $= \frac{2 \times 8}{1}$
 $= 16$

Change the sign to “ \times ”
Invert fraction

How many eighths are there in two wholes?

There are 16 eighths in two wholes.



$$2 \div \frac{1}{8} = 2 \times 8 = 16$$

a) $3 \div \frac{3}{5} =$
 $= 3 \times \frac{5}{3}$
 $= \frac{1 \times 5}{1} = 5$

Invert fraction
Divide 3 and 3 by 3

b) $5 \div \frac{5}{8} =$
 $=$
 $=$
 $=$

c) $4 \div \frac{4}{7} =$
 $=$
 $=$
 $=$

d) $6 \div \frac{6}{10} =$
 $=$
 $=$
 $=$

e) $7 \div \frac{7}{9} =$
 $=$
 $=$
 $=$

f) $5 \div \frac{5}{11} =$
 $=$
 $=$
 $=$

g) $3 \div \frac{1}{6} =$
 $= 3 \times \frac{6}{1}$
 $= \frac{3 \times 6}{1} =$

Invert fraction

h) $4 \div \frac{1}{5} =$
 $=$
 $=$
 $=$

i) $4 \div \frac{1}{7} =$
 $=$
 $=$
 $=$

Skill 10.3 Dividing a whole number by a fraction (2).

j) $2 \div \frac{3}{8} =$ *Invert fraction*
 $= 2 \times \frac{8}{3}$
 $= \frac{2 \times 8}{3} = \frac{16}{3} = 5\frac{1}{3}$

k) $4 \div \frac{3}{5} =$
 $=$
 $=$ $=$ $=$

l) $2 \div \frac{5}{6} =$
 $=$
 $=$ $=$ $=$

m) $3 \div \frac{7}{8} =$
 $=$
 $=$ $=$ $=$

n) $5 \div \frac{6}{7} =$
 $=$
 $=$ $=$ $=$

o) $6 \div \frac{7}{8} =$
 $=$
 $=$ $=$ $=$

p) $6 \div \frac{2}{9} =$ *Invert fraction*
 $= 6 \times \frac{9}{2}$
 $= \overset{3}{\cancel{6}} \times \frac{9}{\underset{2}{\cancel{2}}}$ *Divide 6 and 2 by 2*
 $= \frac{3 \times 9}{1} =$ $=$ $=$

q) $4 \div \frac{4}{9} =$
 $=$
 $=$ $=$ $=$

r) $5 \div \frac{5}{12} =$
 $=$
 $=$ $=$ $=$

s) $4 \div \frac{3}{6} =$
 $=$
 $=$ $=$ $=$

t) $4 \div \frac{2}{5} =$
 $=$
 $=$ $=$ $=$

u) $10 \div \frac{2}{3} =$
 $=$
 $=$ $=$ $=$

v) $8 \div \frac{2}{7} =$
 $=$
 $=$ $=$ $=$

w) $9 \div \frac{3}{7} =$
 $=$
 $=$ $=$ $=$

x) $8 \div \frac{4}{11} =$
 $=$
 $=$ $=$ $=$

Skill 10.4 Multiplying two fractions (1).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Multiply the numerators of the fractions.
 - Multiply the denominators of the fractions.
- To simplify:

EITHER

- Simplify where possible before multiplying.

OR

- Simplify at the end.

To cross multiply two fractions

- Simplify the numbers in the fractions diagonally (in a cross). This means to divide top and bottom numbers by the same number, usually by their Highest Common Factor. (see skill 10.1, page 55)
- Cross out the numbers in the fractions diagonally (in a cross).
- Write the result of the division next to each crossed number.
- Multiply the top results together.
- Multiply the bottom results together.

$$\frac{3}{4} \times \frac{8}{9} = \frac{\overset{+3}{\cancel{3}} \times \overset{+4}{\cancel{8}}}{\underset{+4}{\cancel{4}} \times \underset{+3}{\cancel{9}}} = \frac{\overset{1}{\cancel{3}} \times \overset{2}{\cancel{8}}}{\underset{1}{\cancel{4}} \times \underset{3}{\cancel{9}}} = \frac{1 \times 2}{1 \times 3} = \frac{2}{3}$$

Divide 3 and 9 by 3

Divide 4 and 8 by 4

Q. $\frac{3}{4} \times \frac{2}{9} =$

A. $\frac{3}{4} \times \frac{2}{9} =$

OR

A. $\frac{3}{4} \times \frac{2}{9} =$

$$\begin{array}{c} \overset{1}{\cancel{3}} \times \overset{1}{\cancel{2}} \\ \frac{3}{4} \times \frac{2}{9} = \\ \underset{2}{\cancel{4}} \times \underset{3}{\cancel{9}} \\ \hline \frac{1 \times 1}{2 \times 3} \\ \hline \frac{1}{6} \end{array}$$

Divide 3 and 9 by 3

Divide 2 and 4 by 2

$$\begin{array}{c} \frac{3 \times 2}{4 \times 9} \\ \hline \frac{6 \div 6}{36 \div 6} \\ \hline \frac{1}{6} \end{array}$$

Simplify

a) $\frac{1}{4} \times \frac{1}{7} =$

$$= \frac{1 \times 1}{4 \times 7} = \boxed{\frac{1}{28}}$$

b) $\frac{3}{5} \times \frac{3}{4} =$

$$= \boxed{\phantom{\frac{1}{28}}}$$

c) $\frac{1}{8} \times \frac{3}{4} =$

$$= \boxed{\phantom{\frac{1}{28}}}$$

d) $\frac{7}{10} \times \frac{1}{2} =$

$$= \boxed{\phantom{\frac{1}{28}}}$$

e) $\frac{2}{9} \times \frac{4}{5} =$

$$= \boxed{\phantom{\frac{1}{28}}}$$

f) $\frac{3}{5} \times \frac{4}{7} =$

$$= \boxed{\phantom{\frac{1}{28}}}$$

g) $\frac{4}{5} \times \frac{1}{3} =$

$$= \boxed{\phantom{\frac{1}{28}}}$$

h) $\frac{5}{6} \times \frac{1}{2} =$

$$= \boxed{\phantom{\frac{1}{28}}}$$

i) $\frac{1}{4} \times \frac{3}{11} =$

$$= \boxed{\phantom{\frac{1}{28}}}$$

Skill 10.4 Multiplying two fractions (2).

j) $\frac{2}{3} \times \frac{1}{2} =$

$= \frac{\overset{1}{\cancel{2}}}{3} \times \frac{1}{\underset{2}{\cancel{2}}} =$ *Simplify*

$= \frac{1 \times 1}{3 \times 1} = \boxed{\frac{1}{3}}$

k) $\frac{5}{6} \times \frac{6}{7} =$

$=$
 $=$
 $=$ $\boxed{}$

l) $\frac{3}{5} \times \frac{2}{3} =$

$=$
 $=$
 $=$ $\boxed{}$

m) $\frac{7}{9} \times \frac{2}{7} =$

$=$
 $=$
 $=$ $\boxed{}$

n) $\frac{1}{2} \times \frac{4}{9} =$

$=$
 $=$
 $=$ $\boxed{}$

o) $\frac{3}{5} \times \frac{1}{6} =$

$=$
 $=$
 $=$ $\boxed{}$

p) $\frac{3}{4} \times \frac{8}{11} =$

$=$
 $=$
 $=$ $\boxed{}$

q) $\frac{2}{5} \times \frac{3}{4} =$

$=$
 $=$
 $=$ $\boxed{}$

r) $\frac{4}{5} \times \frac{1}{2} =$

$=$
 $=$
 $=$ $\boxed{}$

s) $\frac{7}{9} \times \frac{1}{14} =$

$=$
 $=$
 $=$ $\boxed{}$

t) $\frac{5}{7} \times \frac{3}{10} =$

$=$
 $=$
 $=$ $\boxed{}$

u) $\frac{5}{12} \times \frac{6}{7} =$

$=$
 $=$
 $=$ $\boxed{}$

v) $\frac{3}{12} \times \frac{4}{6} =$

$=$
 $=$
 $=$ $\boxed{}$

w) $\frac{2}{5} \times \frac{10}{14} =$

$=$
 $=$
 $=$ $\boxed{}$

x) $\frac{3}{10} \times \frac{2}{9} =$

$=$
 $=$
 $=$ $\boxed{}$

y) $\frac{3}{10} \times \frac{5}{9} =$

$=$
 $=$
 $=$ $\boxed{}$

z) $\frac{3}{4} \times \frac{8}{15} =$

$=$
 $=$
 $=$ $\boxed{}$

A) $\frac{4}{9} \times \frac{3}{16} =$

$=$
 $=$
 $=$ $\boxed{}$

Skill 10.5 Dividing a fraction by a whole number (1).

MM4.2 11 22 3 4 4
MM5.1 11 22 3 4 4

- Copy the fraction and write the whole number as an improper fraction with denominator 1.
 - Change “divide by” (\div) into “times” (\times).
 - Invert the second fraction.
 - Multiply the fractions. (see skill 10.4, page 60)
- To simplify:

EITHER

- Cross simplify where possible before dividing.

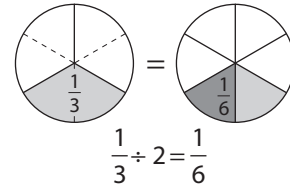
OR

- Simplify at the end.

Q. $\frac{1}{3} \div 2 =$

A. $\frac{1}{3} \div 2 =$
 $= \frac{1}{3} \div \frac{2}{1}$ *Invert second fraction*
 $= \frac{1}{3} \times \frac{1}{2}$
 $= \frac{1 \times 1}{3 \times 2}$
 $= \frac{1}{6}$

What is one third divided into 2 equal parts?



This can also be thought of as one half of a third.

$$\frac{1}{2} \text{ of } \frac{1}{3} = \frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$$

a) $\frac{4}{9} \div 4 =$

$$= \frac{4}{9} \div \frac{4}{1}$$

$$= \frac{4}{9} \times \frac{1}{4}$$

$$= \frac{\cancel{4}^1}{9} \times \frac{1}{\cancel{4}_1}$$
 Divide 4 and 4 by 4

$$= \frac{1 \times 1}{9 \times 1} = \boxed{}$$

b) $\frac{2}{5} \div 2 =$

$$=$$

$$=$$

$$=$$

$$=$$

$$= \boxed{}$$

c) $\frac{3}{7} \div 3 =$

$$=$$

$$=$$

$$=$$

$$=$$

$$= \boxed{}$$

d) $\frac{1}{3} \div 4 =$

$$=$$

$$=$$

$$= \boxed{}$$

e) $\frac{1}{5} \div 6 =$

$$=$$

$$=$$

$$= \boxed{}$$

f) $\frac{1}{7} \div 3 =$

$$=$$

$$=$$

$$= \boxed{}$$

g) $\frac{2}{5} \div 8 =$

$$= \frac{2}{5} \div \frac{8}{1}$$

$$= \frac{2}{5} \times \frac{1}{8}$$

$$= \frac{\cancel{2}^1}{5} \times \frac{1}{\cancel{8}_4} = \boxed{\frac{1}{20}}$$

h) $\frac{3}{7} \div 12 =$

$$=$$

$$=$$

$$= \boxed{}$$

i) $\frac{6}{11} \div 3 =$

$$=$$

$$=$$

$$= \boxed{}$$

j) $\frac{5}{8} \div 15 =$

$$=$$

$$=$$

$$= \boxed{}$$

k) $\frac{2}{7} \div 10 =$

$$=$$

$$=$$

$$= \boxed{}$$

l) $\frac{2}{9} \div 16 =$

$$=$$

$$=$$

$$= \boxed{}$$

m) $\frac{2}{3} \div 9 =$

$$=$$

$$=$$

$$= \boxed{}$$

n) $\frac{5}{6} \div 4 =$

$$=$$

$$=$$

$$= \boxed{}$$

o) $\frac{2}{11} \div 3 =$

$$=$$

$$=$$

$$= \boxed{}$$

p) $\frac{3}{4} \div 4 =$

$$=$$

$$= \boxed{}$$

q) $\frac{3}{5} \div 2 =$

$$=$$

$$= \boxed{}$$

r) $\frac{7}{10} \div 6 =$

$$=$$

$$= \boxed{}$$

Skill 10.6 Dividing two fractions (1).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Copy the first fraction and change “divide by” (\div) into “times” (\times).
 - Invert the second fraction.
 - Multiply the fractions. (see skill 10.4, page 60)
- To simplify:

EITHER

- Cross simplify where possible before multiplying. (see skill 10.4, page 60)

OR

- Simplify at the end.

Q. $\frac{2}{9} \div \frac{1}{3} =$

A. $\frac{2}{9} \div \frac{1}{3} =$ *Invert second fraction*

$$= \frac{2}{9} \times \frac{3}{1}$$

$$= \frac{2}{\cancel{9}^3} \times \frac{\cancel{3}^1}{1}$$

Divide 9 and 3 by 3

$$= \frac{2 \times 1}{3 \times 1}$$

$$= \frac{2}{3}$$

OR A. $\frac{2}{9} \div \frac{1}{3} =$

$$= \frac{2}{9} \times \frac{3}{1}$$

$$= \frac{2 \times 3}{9 \times 1}$$

$$= \frac{6^{\div 3}}{9^{\div 3}}$$

Simplify

$$= \frac{2}{3}$$

a) $\frac{3}{4} \div \frac{2}{5} =$

$$= \frac{3}{4} \times \frac{5}{2}$$

$$= \frac{3 \times 5}{4 \times 2} = \frac{15}{8} = 1\frac{7}{8}$$

b) $\frac{2}{9} \div \frac{3}{7} =$

$$=$$

$$=$$

$$=$$

c) $\frac{2}{7} \div \frac{3}{5} =$

$$=$$

$$=$$

$$=$$

d) $\frac{2}{3} \div \frac{3}{8} =$

$$=$$

$$=$$

$$=$$

e) $\frac{4}{9} \div \frac{7}{11} =$

$$=$$

$$=$$

$$=$$

f) $\frac{5}{12} \div \frac{2}{7} =$

$$=$$

$$=$$

$$=$$

g) $\frac{2}{3} \div \frac{3}{4} =$

$$=$$

$$=$$

$$=$$

h) $\frac{3}{7} \div \frac{5}{8} =$

$$=$$

$$=$$

$$=$$

i) $\frac{3}{10} \div \frac{2}{9} =$

$$=$$

$$=$$

$$=$$

Skill 10.6 Dividing two fractions (2).

j) $\frac{7}{10} \div \frac{1}{5} =$
 $= \frac{7}{10} \times \frac{5}{1}$

$= \frac{7}{\cancel{2}10} \times \frac{\cancel{5}^1}{1}$ Divide
10 and 5 by 5

$= \frac{7 \times 1}{2 \times 1} = \frac{7}{2} =$

k) $\frac{7}{9} \div \frac{2}{3} =$

$=$ _____

$=$ _____

$=$ _____ $=$

l) $\frac{2}{3} \div \frac{1}{6} =$

$=$ _____

$=$ _____

$=$ _____ $=$

m) $\frac{1}{4} \div \frac{1}{2} =$

$=$ _____

$=$ _____

$=$ _____ $=$

n) $\frac{1}{12} \div \frac{2}{3} =$

$=$ _____

$=$ _____

$=$ _____ $=$

o) $\frac{9}{10} \div \frac{2}{5} =$

$=$ _____

$=$ _____

$=$ _____ $=$

p) $\frac{5}{6} \div \frac{1}{3} =$

$=$ _____

$=$ _____

$=$ _____ $=$

q) $\frac{5}{8} \div \frac{1}{2} =$

$=$ _____

$=$ _____

$=$ _____ $=$

r) $\frac{3}{4} \div \frac{5}{16} =$

$=$ _____

$=$ _____

$=$ _____ $=$

s) $\frac{4}{5} \div \frac{3}{10} =$

$=$ _____

$=$ _____

$=$ _____ $=$

t) $\frac{5}{12} \div \frac{1}{6} =$

$=$ _____

$=$ _____

$=$ _____ $=$

u) $\frac{7}{10} \div \frac{3}{20} =$

$=$ _____

$=$ _____

$=$ _____ $=$

11. [Percentages]

Skill 11.1 Writing a number out of 100 as a percentage.

MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Write the number followed by the percent symbol “%”
Hint: “Percentage” means “per hundred” or “of each hundred”.

Q. Write as a percentage:
84 out of 100.

A. 84 out of 100 =
= **84%**

a) Write as a percentage:
60 out of 100.

60%

b) Write as a percentage:
32 out of 100.

c) Write as a percentage:
46 out of 100.

d) Write as a percentage:
12 out of 100.

e) Write as a percentage:
5 out of 100.

f) Write as a percentage:
9 out of 100.

g) Write as a percentage:
61 out of 100.

h) Write as a percentage:
53 out of 100.

i) Write as a percentage:
4 out of 100.

j) Write as a percentage:
7 out of 100.

k) Write as a percentage:
59 out of 100.

l) Write as a percentage:
91 out of 100.

m) Write as a percentage:
28 out of 100.

n) Write as a percentage:
79 out of 100.

- Subtract the given percentages from 100%, to find the remaining percentage.

Q. According to a projection for 2020, 39% of the population of the USA will be aged between 0 - 29 and 35% between 30 - 59. What percentage of the population will be aged 60 or more?

$$\begin{aligned} \text{A. } & 100\% - 39\% - 35\% \\ & = 100\% - 74\% \\ & = \mathbf{26\%} \end{aligned}$$

a) Approximately 59% of the athletes at the 2000 Sydney Olympics were male. What percentage of the athletes were female?

$$100\% - 59\% = \boxed{41\%}$$

b) School is approximately 60% of the calendar year in the Russian Federation. What percentage do holidays account for?

$$100\% - 60\% = \boxed{}$$

c) The green-yellow 18-carat gold is 75% gold and the rest is silver. What percentage is silver?

$$\dots\dots\dots = \boxed{}$$

d) If 89% of the West Point military academy graduates are male, what percentage are females?

$$\dots\dots\dots = \boxed{}$$

e) If 78% of the Supreme Court justices are male, what percentage are females?

$$\dots\dots\dots = \boxed{}$$

f) If the cucumber is 96% water, what percentage do the other components equal?

$$\dots\dots\dots = \boxed{}$$

g) In Mali 72% of people earn less than \$1 a day. What percentage of people earn more than \$1 a day?

$$\dots\dots\dots = \boxed{}$$

h) If 37.5% of the adult teeth are incisors and canines, what percentage is formed by molars and pre-molars?

$$\dots\dots\dots = \boxed{}$$

i) Approximately 60.5% of the world population lives in Asia and 13.5% lives in North and South America. What percentage of the population lives in the rest of the world?

$$100\% - 60.5\% - 13.5\% = \boxed{}$$

j) Approximately 27.2% of the world population is aged between 0 and 14 years and 65.2% between 15 and 64 years. What percentage of the population is aged 65 years and over?

$$\dots\dots\dots = \boxed{}$$

k) If England occupies 57% and Scotland occupies 34% of Great Britain (the main island of the United Kingdom), what percentage is occupied by Wales?

$$\dots\dots\dots = \boxed{}$$

l) At the 2012 London Olympics, 20% of the medals won by Australia were gold, and 46% were silver. What percentage of the medals were bronze?

$$\dots\dots\dots = \boxed{}$$

Skill 11.3 Finding a percentage of multiples of 100 (1).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

EITHER

- Change the percentage to a fraction out of 100.

Example: $40\% = \frac{40}{100}$

- Rewrite the question as a multiplication (change “of” to “×”).
- Change the whole number to a fraction over 1.

Example: $7 = \frac{7}{1}$

- Cross simplify the fractions before multiplying. (see skill 10.4, page 60)

OR

- First find 10%.
- Then multiply by the amount needed to make the required percentage, i.e. multiply by 3 to get 30%.

To find $10\% = \frac{1}{10} \Rightarrow$ divide by 10
 $5\% \Rightarrow$ half of 10%
 $20\% = \frac{1}{5} \Rightarrow$ divide by 5
 $25\% = \frac{1}{4} \Rightarrow$ divide by 4
 $50\% = \frac{1}{2} \Rightarrow$ divide by 2

Q. 40% of \$6.00 =

A. 40% of \$6.00 = 40% of 600 *Convert \$ to cents*
 $= \frac{40}{100} \times \frac{600}{1}$ *Simplify: ÷ 100*
 $= 40 \times 6$
 $= 240$ cents
 $= \$2.40$

OR A. $600 \div 10 = 60$ *Find 10%*
 $= 60$ cents
 $60 \times 4 = 240$ *Multiply by 4 to get 40%*
 $= 240$ cents
 $= \$2.40$

a) 24% of 100 = $\frac{24}{100} \times \frac{100}{1} = 24$ *Divide by 100*

b) 85% of 100 = $\frac{85}{100} \times \frac{100}{1} = 85$

c) 69% of 100 = $\frac{69}{100} \times \frac{100}{1} = 69$

d) 9% of \$100 = $\frac{9}{100} \times \frac{100}{1} = 9$ \$

e) 7% of \$100 = $\frac{7}{100} \times \frac{100}{1} = 7$ \$

f) 50% of \$100 = $\frac{50}{100} \times \frac{100}{1} = 50$ \$

g) 75% of \$400 = $\frac{75}{100} \times \frac{400}{1} = 75 \times 4 = 300$ \$

h) 10% of \$300 = $\frac{10}{100} \times \frac{300}{1} = 30$ \$ *Divide 300 by 10*

i) 30% of \$500 = $\frac{30}{100} \times \frac{500}{1} = 30 \times 5 = 150$ \$ *Find 10% first*

j) 60% of \$200 = $\frac{60}{100} \times \frac{200}{1} = 60 \times 2 = 120$ \$

k) 25% of \$800 = $\frac{25}{100} \times \frac{800}{1} = 25 \times 8 = 200$ \$

l) 70% of \$600 = $\frac{70}{100} \times \frac{600}{1} = 70 \times 6 = 420$ \$

Skill 11.3 Finding a percentage of multiples of 100 (2).

m) 5% of \$300 =

$$= \frac{5}{100} \times \frac{300}{1}$$

$$= 5 \times 3 = \$ \boxed{}$$

n) 5% of \$500 =

$$500 \div 10 = 50$$

$$50 \div 2 = \$ \boxed{}$$

o) 5% of \$700 =

$$= = \$ \boxed{}$$

p) 50% of \$700 =

$$= = \$ \boxed{}$$

q) 20% of \$200 =

$$= = \$ \boxed{}$$

r) 40% of \$500 =

$$= = \$ \boxed{}$$

s) 80% of \$400 =

$$= = \$ \boxed{}$$

t) 90% of \$300 =

$$= = \$ \boxed{}$$

u) 15% of \$400 =

$$= = \$ \boxed{}$$

v) 50% of \$5.00 =

$$= = \$ \boxed{}$$

w) 20% of \$3.00 =

$$= = \$ \boxed{}$$

x) 75% of \$6.00 =

$$= = \$ \boxed{}$$

y) 5% of \$4.00 =

$$= = \boxed{} \text{ ¢}$$

z) 40% of \$3.50 =

$$= = \boxed{} \text{ ¢}$$

A) 30% of \$4.50 =

$$= = \boxed{} \text{ ¢}$$

Skill 11.4 Finding a percentage of any number (1).

EITHER

- Change the percentage to a fraction out of 100.

Example: $40\% = \frac{40}{100}$

- Rewrite the question as a multiplication (change "of" to "×").
- Change the whole number to a fraction over 1.

Example: $7 = \frac{7}{1}$

- Cross simplify the fractions before multiplying. (see skill 10.4, page 60)

OR

- First find 10%.
- Then multiply by the amount needed to make the required percentage, i.e. multiply by 3 to get 30%.

To find $1\% = \frac{1}{100} \Rightarrow$ divide by 100
 $12.5\% = \frac{1}{8} \Rightarrow$ divide by 8
 $33\frac{1}{3}\% = \frac{1}{3} \Rightarrow$ divide by 3
 $66\frac{2}{3}\% = \frac{2}{3} \Rightarrow$ divide by 3
 multiply by 2

Q. $66\frac{2}{3}\%$ of 270 =

A. $66\frac{2}{3}\%$ of 270 =
 $= \frac{2}{3} \times \frac{270}{1}$ *Simplify: ÷ 3*
 $= 2 \times 90$
 $= 180$

Substitute $66\frac{2}{3}\%$ with $\frac{2}{3}$
 Change "of" to "×"
 Change 270 to $\frac{270}{1}$
 Multiply $\frac{2}{3}$ by $\frac{270}{1}$

a) 20% of 50 =
 $= \frac{20}{100} \times \frac{50}{1}$ *Simplify: ÷ 10, twice*
 $= 2 \times 5 = 10$

b) 70% of 240 = *Find 10% first*
 $240 \div 10 = 24$
 $24 \times 7 =$ *Multiply by 7 to get 70%*

c) 80% of 20 =
 =
 =

d) 40% of 80 =
 =
 =

e) 60% of 250 =
 =
 =

f) 30% of 140 =
 =
 =

g) 70% of 120 =
 =
 =

h) 5% of 40 =
 =
 =

i) 5% of 120 =
 =
 =

j) 15% of 60 = *Find 10% first*
 $10\% \quad 60 \div 10 = 6$
 $5\% \quad 6 \div 2 = 3$ *5% is half of 10%*
 $15\% \quad 6 + 3 =$

k) 35% of 80 =
 =
 =

l) 45% of 120 =
 =
 =

m) 25% of 180 =

$$= \frac{25}{100} \times \frac{180}{1}$$

Simplify: $\div 5$

$$= \frac{90}{2} = \boxed{}$$

Divide by 10

n) 75% of 40 =

$$= \frac{75}{100} \times \frac{40}{1}$$

$$= \frac{300}{100} = \boxed{}$$

o) 75% of 120 =

$$= \frac{75}{100} \times \frac{120}{1}$$

$$= \frac{9000}{100} = \boxed{}$$

p) 15% of 40 =

$$= \frac{15}{100} \times \frac{40}{1}$$

Simplify: $\div 10$

$$= \frac{60}{10} = \boxed{}$$

q) 6% of 30 =

$$= \frac{6}{100} \times \frac{30}{1}$$

$$= \frac{180}{100} = \boxed{}$$

r) 8% of 80 =

$$= \frac{8}{100} \times \frac{80}{1}$$

$$= \frac{640}{100} = \boxed{}$$

s) 1% of 300 =

$$= \frac{1}{100} \times \frac{300}{1}$$

$$= \frac{300}{100} = \boxed{}$$

t) 1% of 150 =

$$= \frac{1}{100} \times \frac{150}{1}$$

$$= \frac{150}{100} = \boxed{}$$

u) 2% of 50 =

$$= \frac{2}{100} \times \frac{50}{1}$$

$$= \frac{100}{100} = \boxed{}$$

v) 12.5% of 560 =

$$= \frac{12.5}{100} \times \frac{560}{1}$$

Simplify: $\div 8$

$$= \frac{7000}{80} = \boxed{}$$

w) 12.5% of 80 =

$$= \frac{12.5}{100} \times \frac{80}{1}$$

$$= \frac{1000}{80} = \boxed{}$$

x) 12.5% of 160 =

$$= \frac{12.5}{100} \times \frac{160}{1}$$

$$= \frac{2000}{80} = \boxed{}$$

y) $33\frac{1}{3}\%$ of 150 =

$$= \frac{1}{3} \times \frac{150}{1}$$

Simplify: $\div 3$

$$= \frac{150}{3} = \boxed{}$$

z) $33\frac{1}{3}\%$ of 180 =

$$= \frac{1}{3} \times \frac{180}{1}$$

$$= \frac{180}{3} = \boxed{}$$

A) $33\frac{1}{3}\%$ of 60 =

$$= \frac{1}{3} \times \frac{60}{1}$$

$$= \frac{60}{3} = \boxed{}$$

B) $66\frac{2}{3}\%$ of 90 =

$$= \frac{2}{3} \times \frac{90}{1}$$

$$= \frac{180}{3} = \boxed{}$$

C) $66\frac{2}{3}\%$ of 150 =

$$= \frac{2}{3} \times \frac{150}{1}$$

$$= \frac{300}{3} = \boxed{}$$

D) $66\frac{2}{3}\%$ of 210 =

$$= \frac{2}{3} \times \frac{210}{1}$$

$$= \frac{420}{3} = \boxed{}$$

To find the discount on an item

- Calculate the percentage of the given amount. (see skill 11.3, page 69 and skill 11.4, page 71)
Discount is associated with words like: *discounted, reduced, off, save, cash back*

To find the sale price if a discount is applied

- Calculate the percentage of the given amount.
- Subtract this result from the given amount.

Q. In a store a \$300 jacket is marked '20% off'. What is the sale price of the jacket?

A. *Discount:* 20% of 300 =

$$= \frac{20}{100} \times \frac{300}{1} \quad \text{Divide by 100}$$

$$= 20 \times 3 = 60$$

Sale price: 300 - 60 = **\$240**

a) If a \$30 T-shirt is reduced by 15%, what is the discount?

discount: 15% of 30 =

$$= \frac{15}{100} \times \frac{30}{1} = \frac{45}{10} = \boxed{\$4.50}$$

b) If a \$120 bike is reduced by 25%, what is the discount?

discount:

$$= \quad = \boxed{\$}$$

c) If a \$500 computer is reduced by 25%, what is the discount?

discount: 25% of 500 =

$$= \quad = \boxed{\$}$$

d) If an \$80 game is reduced by 40%, what is the discount?

discount:

$$= \quad = \boxed{\$}$$

e) If a \$3000 laptop is reduced by 20%, what is the sale price?

discount: 20% of 3000 =

$$= \frac{20}{100} \times \frac{3000}{1} = 600 \quad \text{Divide by 100}$$

sale price: \$3000 - \$600 = $\boxed{\$}$

f) If a \$500 dress is discounted by 40%, what is the sale price?

discount:

$$=$$

sale price: $\quad = \boxed{\$}$

g) In a store a \$125 skirt is marked '50% off'. What is the sale price of the skirt?

discount:

$$=$$

sale price: $\quad = \boxed{\$}$

h) In a store a \$240 suitcase is marked '10% off'. What is the sale price of the suitcase?

discount:

$$=$$

sale price: $\quad = \boxed{\$}$

- i) If a \$400 gold bracelet is discounted by 30%, what is the sale price?

discount:

=

sale price:

=

\$

- j) If a \$25 000 car is reduced by 10%, what is the sale price?

discount:

=

sale price:

=

\$

- k) In a store a \$900 canoe is labelled 'Save 60%'. What is the sale price of the canoe?

discount:

=

sale price:

=

\$

- l) In a store a \$300 pram is labelled 'Save 15%'. What is the sale price of the pram?

discount:

=

sale price:

=

\$

- m) A printer is priced at \$200. Which is the better deal?

- A) 20% off
B) \$50 cash back

sale price A:

=

sale price B:

=

⇒

- n) A watch is priced at \$450. Which is the better deal?

- A) Save 30%
B) Take \$100 off

sale price A:

=

sale price B:

=

⇒

- o) A utility is priced at \$15 000. Which is the better deal?

- A) 10% discount
B) Reduce by $\frac{1}{5}$

sale price A:

=

sale price B:

=

⇒

- p) A lounge suite is priced at \$6000. Which is the better deal?

- A) Save 25%
B) Reduce by $\frac{1}{3}$

sale price A:

=

sale price B:

=

⇒

EITHER

- Change the percentage to a fraction out of 100.

Example: $150\% = \frac{150}{100}$

- Rewrite the question as a multiplication (change “of” to “×”).
- Change the whole number to a fraction over 1.

Example: $7 = \frac{7}{1}$

- Cross simplify the fractions before multiplying. (see skill 10.4, page 60)

OR

- First find 100% or other multiples of 100%.
- Then find the remaining percentage.
- Add the results.

To find $200\% = \frac{2}{1} \Rightarrow$ multiply by 2
 $300\% = \frac{3}{1} \Rightarrow$ multiply by 3

Q. 350% of $40 =$

A. 350% of $40 =$

OR

A. 100% of 40 is 40

So 300% is triple that, or 120

50% of 40 is 20

So 350% of 40 is

$120 + 20 = 140$

$= \frac{350}{100} \times \frac{40}{1}$ *Simplify: ÷ 10, twice*
 $= 35 \times 4$
 $= 140$

a) 200% of $60 =$

$= \frac{200}{100} \times \frac{60}{1}$ *Simplify: ÷ 10, twice*

$= 20 \times 6 = 120$

b) 300% of $50 =$

$=$ $=$

c) 400% of $70 =$

$=$ $=$

d) 120% of $80 =$ *Find 100%*

100% of $80 = 80$

20% of $80 = 16$ *Find 20%*

Add the results
 $80 + 16 =$

e) 110% of $90 =$

$=$ $=$

f) 250% of $30 =$

$=$ $=$

g) 250% of $40 =$

$= \frac{250}{100} \times \frac{40}{1}$
 $= 25 \times 4 =$

h) 140% of $50 =$

$=$

i) 220% of $80 =$

$=$

j) 130% of $60 =$

$=$

k) 120% of $70 =$

$=$

l) 350% of $40 =$

$=$

Skill 11.7 Writing one number as a percentage of another number.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Form a fraction using the two numbers.

EITHER

- Multiply this fraction by 100%.
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 9.1, page 41)

OR

- Find an equivalent fraction with the denominator 100, by multiplying or dividing both the numerator and denominator by the same number.
- Write this fraction as a percentage. (see skill 12.11, page 92)

Hint: Both numbers must represent the same unit of measurement.

Multiplying by 100%

$$100\% = 1$$

Multiplying by 1 or 100% does not change the value.

Q. Write as a percentage: 23 out of 50.

A. $23 \text{ out of } 50 = \frac{23}{50} \times 100\%$

$= \frac{23}{50} \times \frac{100}{1}\%$ *Simplify: $\div 50$*

$= \frac{23}{1} \times 2\%$

$= 23 \times 2$

$= 46\%$

OR

A. $23 \text{ out of } 50 = \frac{23 \times 2}{50 \times 2}$

$= \frac{46}{100}$

$= 46\%$

- a)** Write as a percentage:

12 out of 60.

$$\frac{12 \div 12}{60 \div 12} = \frac{1}{5}$$

Simplify: $\div 12$

Find equivalent fraction

$$\frac{1 \times 20}{5 \times 20} = \frac{20}{100}$$

20%

- b)** In Australia 88 out of every 100 people live in an urban area. What percentage is this?

.....

.....

.....

- c)** At the 2010 Delhi Commonwealth Games, 3 out of the 4 medals won by Samoa were gold. What percentage is this?

.....

.....

.....

- d)** For every 20 Skype calls made, 8 calls are video to video. What percentage is this?

.....

.....

.....

- e)** A male lion weighs 225 kg. It eats 9 kg of food each day. What percentage of its own weight does a lion eat each day?

.....

.....

.....

- f)** Of the 1 billion cattle in the world, 200 million are in India. What percentage of the world's cattle are in India?

.....

.....

.....

- Calculate the profit or the loss, as the difference between the selling and the cost price.
- Express the profit or the loss as a percentage of the cost price. (see skill 11.7, page 76)

Q. A shop buys jackets in bulk for \$50 each, then sells them for \$95 each. Calculate the profit on each jacket as a percentage of the cost price.

A. *profit:* $\$95 - \$50 = \$45$
profit out of cost price: $\$45$ out of $\$50 = \frac{45}{50}$
 $= \frac{45}{50} \times \frac{100}{1} \% = \frac{450}{5} \%$
 $= 90\%$

a) Lorien lost \$40 on a ring costing \$400. What was her loss as a percentage of the cost price?

loss: \$40

loss out of cost: \$40 out of \$400 =

$= \frac{40}{400} \times \frac{100}{1} \% = \frac{40}{4} \% = 10\%$

b) The Cycle Centre made \$30 profit on a bicycle costing \$150. What was the profit as a percentage of the cost price?

profit:

profit out of cost:

=

c) John made \$20 profit on a tool box costing \$100. What was his profit as a percentage of the cost price?

profit:

profit out of cost:

=

d) Jason lost \$15 on a book costing \$30. What was his loss as a percentage of the cost price?

loss:

loss out of cost:

=

e) Serena bought a car for \$5000. If she later sold it for \$3500, find the loss as a percentage of the cost price.

.....

.....

=

f) A shop buys school uniforms in bulk for \$75 each, then sells them for \$100 each. Find the profit as a percentage of the cost price.

.....

.....

=

g) Amelia bought a table for \$400. If she later sold it for \$350, find the loss as a percentage of the cost price.

.....

.....

=

h) A painting was bought for \$6000. If it was later sold for \$7500, find the profit as a percentage of the cost price.

.....

.....

=

12. [Decimals / Fractions / Percentages]

Skill 12.1 Illustrating fractions and percentages.

MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

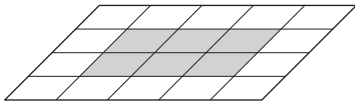
To recognise a shaded fraction of a shape

- Count the total number of equal parts in which the shape is divided.
- Use this number as the denominator of the fraction.
- Count the number of shaded parts.
- Use this number as the numerator of the fraction.
- Simplify the resulting fraction.
(see skill 9.1, page 41)

To recognise a shaded percentage of a shape

- Count the shaded parts.
- Relate the amount shaded to out of 100, by dividing the number of total parts into 100.
Hints: A percentage is a fraction out of 100. Compare to common fractions, like one half equals 50%, one quarter equals 25% or one tenth equals 10%.

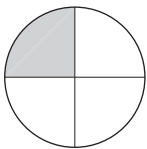
Q. What percentage of the shape is shaded?



A. 6 out of 20 parts =
 $\times 5 \left(\begin{array}{c} \times 5 \\ = 30 \text{ out of } 100 \text{ parts} \\ = 30\% \end{array} \right.$

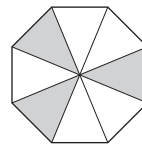
6 out of 20 parts are shaded. There are 5 lots of 20 in 100 so multiply 6×5 to get the percentage shaded.

a) What fraction of the shape is shaded?



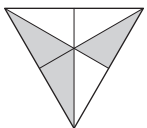
1 out of 4 parts = $\frac{1}{4}$

b) What fraction of the shape is shaded?



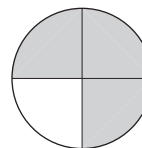
..... =

c) What fraction of the shape is shaded?



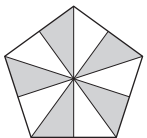
..... =

d) What fraction of the shape is shaded?



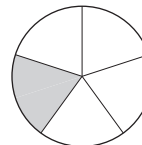
..... =

e) What percentage of the shape is shaded?



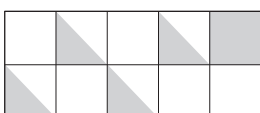
..... =

f) What percentage of the shape is shaded?



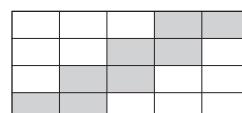
..... =

g) What percentage of the shape is shaded?



..... =

h) What percentage of the shape is shaded?



..... =

EITHER

- Divide both the numerator and the denominator by their Highest Common Factor (HCF).

OR

- Divide both the numerator and the denominator by any common factor.
- Divide again by another common factor, until the common factor of the numerator and the denominator is 1.

Hints: The fraction is in simplest form when it cannot be simplified.

If the numbers are both even then you can start with dividing by 2.

How to find the Highest Common Factor (HCF) of two numbers

- Write all the factors of each number (the factors must divide exactly into the number).
- Find the largest number that appears on both lists.

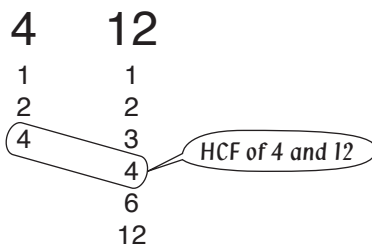
Hint: The Highest Common Factor is the largest number that divides evenly in both numbers.

HCF for Identical numbers



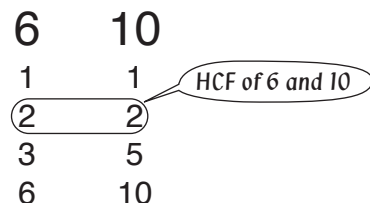
Hint: 5 is the HCF of 5 and 5 because 5 is the largest number that divides into 5 and 5.

HCF when one number divides evenly into the other number



Hint: 4 is the HCF of 4 and 12 because 4 is the largest number that divides into 4 and 12.

HCF when numbers have other common factors



Hint: 2 is the HCF of 6 and 10 because 2 is the largest number that divides into 6 and 10.

Q. Simplify $\frac{20}{30}$

A. $\frac{20}{30} = \frac{20 \div 10}{30 \div 10} = \frac{2}{3}$ (HCF of 20 and 30 is 10, Divide by 10)

OR A. $\frac{20 \div 2}{30 \div 2} = \frac{10 \div 5}{15 \div 5} = \frac{2}{3}$ (Divide by 2, Divide by 5)

a) Simplify $\frac{4}{10}$ (HCF of 4 and 10 is 2)
 $= \frac{4 \div 2}{10 \div 2} = \frac{2}{5}$

b) Simplify $\frac{3}{6}$
 $= \frac{\quad}{\quad}$

c) Simplify $\frac{4}{6}$
 $= \frac{\quad}{\quad}$

d) Simplify $\frac{3}{9}$
 $= \frac{\quad}{\quad}$

e) Simplify $\frac{2}{8}$
 $= \frac{\quad}{\quad}$

f) Simplify $\frac{2}{6}$
 $= \frac{\quad}{\quad}$

Skill 12.2 Simplifying fractions (2).

MM4.2 1 2 2 3 3 4 4
MM5.1 1 2 2 3 3 4 4

g) Simplify $\frac{9}{18}$

= $\frac{\quad}{\quad}$

h) Simplify $\frac{3}{30}$

= $\frac{\quad}{\quad}$

i) Simplify $\frac{12}{15}$

= $\frac{\quad}{\quad}$

j) Simplify $\frac{8}{12}$

= $\frac{\quad}{\quad}$

k) Simplify $\frac{5}{15}$

= $\frac{\quad}{\quad}$

l) Simplify $\frac{15}{20}$

= $\frac{\quad}{\quad}$

m) Simplify $\frac{6}{12}$

= $\frac{\quad}{\quad}$

n) Simplify $\frac{4}{40}$

= $\frac{\quad}{\quad}$

o) Simplify $\frac{10}{30}$

= $\frac{\quad}{\quad}$

p) Simplify $\frac{5}{25}$

= $\frac{\quad}{\quad}$

q) Simplify $\frac{8}{16}$

= $\frac{\quad}{\quad}$

r) Simplify $\frac{14}{21}$

= $\frac{\quad}{\quad}$

s) Simplify $\frac{9}{24}$

= $\frac{\quad}{\quad}$

t) Simplify $\frac{8}{20}$

= $\frac{\quad}{\quad}$

u) Simplify $\frac{24}{30}$

= $\frac{\quad}{\quad}$

v) Simplify $\frac{9}{15}$

= $\frac{\quad}{\quad}$

w) Simplify $\frac{9}{81}$

= $\frac{\quad}{\quad}$

x) Simplify $\frac{25}{35}$

= $\frac{\quad}{\quad}$

y) Simplify $\frac{20}{25}$

= $\frac{\quad}{\quad}$

z) Simplify $\frac{8}{28}$

= $\frac{\quad}{\quad}$

A) Simplify $\frac{12}{20}$

= $\frac{\quad}{\quad}$

To read a fraction

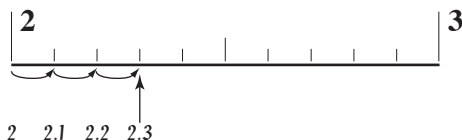
- Count the spaces between 0 and 1. (Always one more than the number of marks.)
- Write this number as the denominator of the fraction.
- Count the spaces to the dot.
- Write this number as the numerator of the fraction.

To read a mixed number

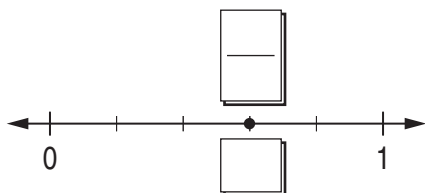
- Write the whole number from the number line in the mixed number.
- Count the spaces between two consecutive whole numbers. (Always one more than the number of marks.)
- Write this number as the denominator of the fraction.
- Count the spaces to the dot.
- Write this number as the numerator of the fraction.

To read a decimal

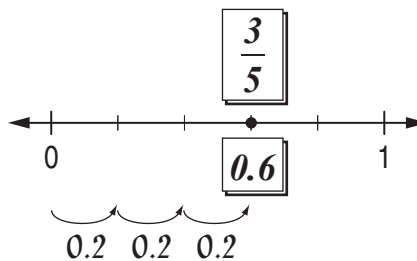
- Count the spaces between two consecutive whole numbers. (Always one more than the number of marks.)
- Work out the value of each space. Examples:
 - 1) 10 spaces between two numbers \Rightarrow
 $1 \div 10 = 0.1$
 Each mark is further along the number line by one tenth or 0.1
 - 2) 5 spaces between two numbers \Rightarrow
 $1 \div 5 = 0.2$
 Each mark is further along the number line by one tenth or 0.2
 - 3) 4 spaces between two numbers \Rightarrow
 $1 \div 4 = 0.25$
 Each mark is further along the number line by one tenth or 0.25
- Starting at the last whole number, count on by the value of each space. Point to each mark as you go.



Q. Name the fraction and the decimal at the marked point.

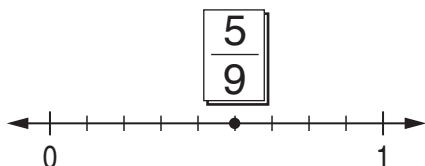


A.

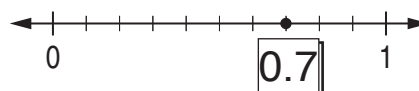


There are 5 spaces between 0 and 1.
There are 3 spaces to the dot.
Each space equals 0.2

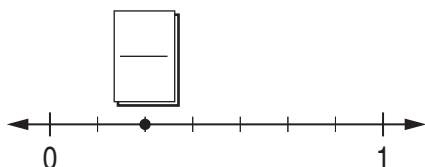
a) Name the fraction at the marked point.



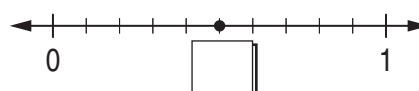
b) Name the decimal at the marked point.



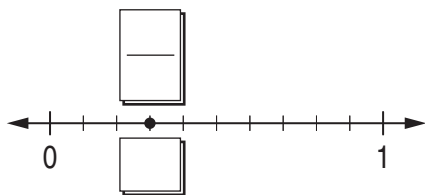
c) Name the fraction at the marked point.



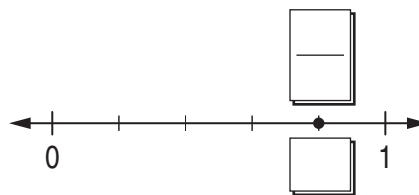
d) Name the decimal at the marked point.



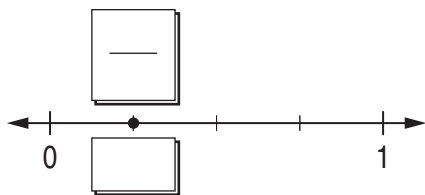
e) Name the fraction and the decimal at the marked point.



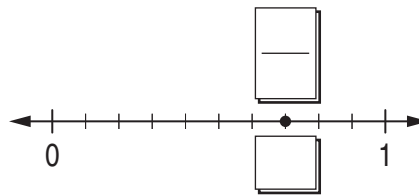
f) Name the fraction and the decimal at the marked point.



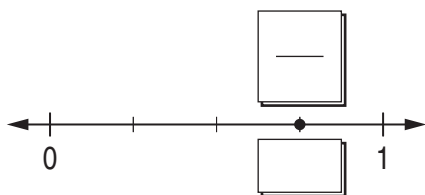
g) Name the fraction and the decimal at the marked point.



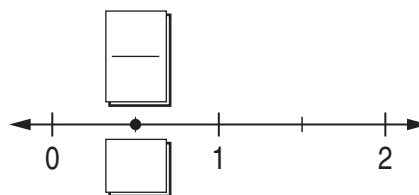
h) Name the fraction and the decimal at the marked point.



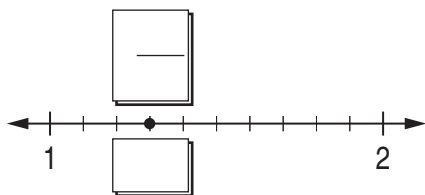
i) Name the fraction and the decimal at the marked point.



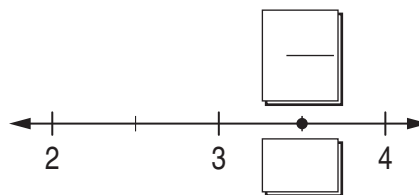
j) Name the fraction and the decimal at the marked point.



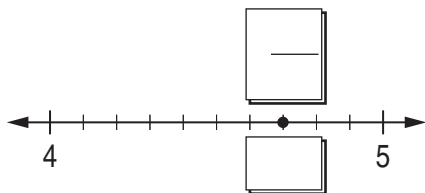
k) Name the mixed number and the decimal at the marked point.



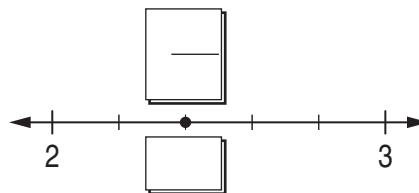
l) Name the mixed number and the decimal at the marked point.



m) Name the mixed number and the decimal at the marked point.



n) Name the mixed number and the decimal at the marked point.



To read a scale with marks between the whole numbers

- Count the spaces between two consecutive whole numbers on the scale.
- Work out the value of each space.

Examples:

1) 10 spaces $\Rightarrow 1 \div 10 = \frac{1}{10} = 0.1$

Each mark is further along the scale by one tenth or 0.1

2) 5 spaces $\Rightarrow 1 \div 5 = \frac{1}{5} = 0.2$

Each mark is further along the scale by one tenth or 0.2

3) 4 spaces $\Rightarrow 1 \div 4 = \frac{1}{4} = 0.25$

Each mark is further along the scale by one tenth or 0.25

- Starting at the last whole number, count on by the value of each space.

To read a scale with marks halfway between decimal numbers

Examples:

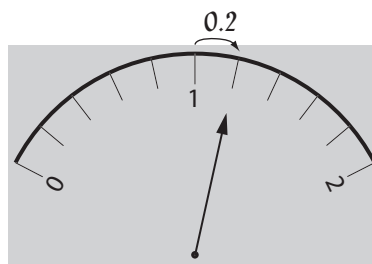
1) mark halfway between 0.1 and 0.2
 $\Rightarrow 0.15$

2) mark halfway between 0.01 and 0.02
 $\Rightarrow 0.015$

Q. What decimal number is shown on this meter?

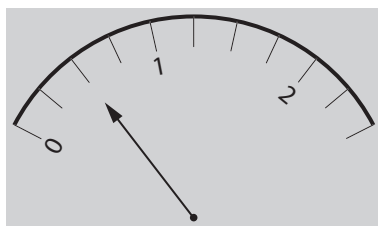


A. 1.2



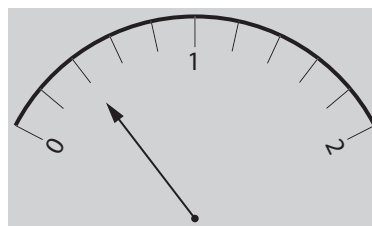
There are 5 spaces between 1 and 2.
Each space equals 0.2

a) What decimal number is shown on this meter?

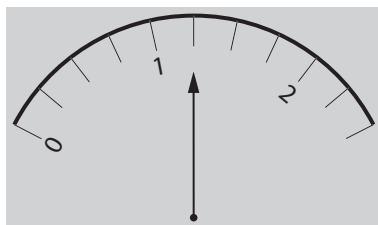


0.5

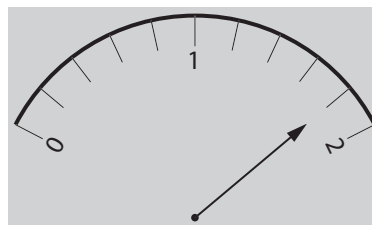
b) What decimal number is shown on this meter?



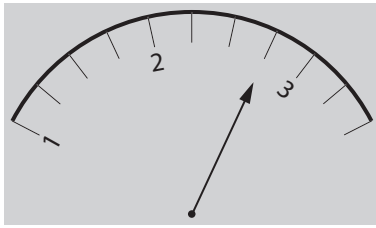
c) What decimal number is shown on this meter?



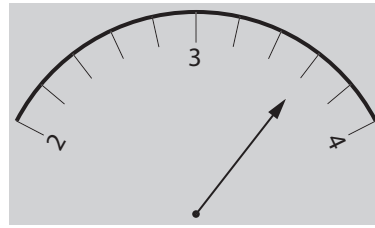
d) What decimal number is shown on this meter?



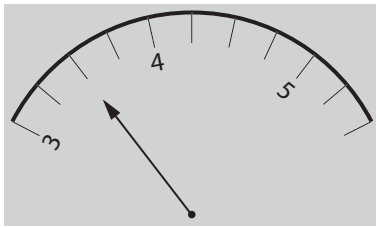
e) What decimal number is shown on this meter?



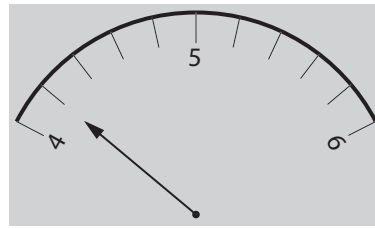
f) What decimal number is shown on this meter?



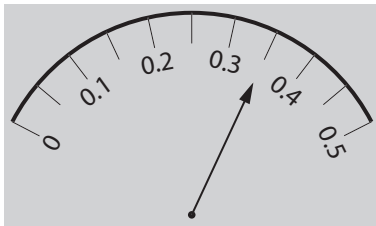
g) What decimal number is shown on this meter?



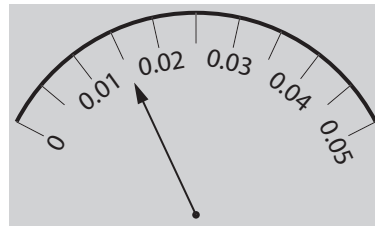
h) What decimal number is shown on this meter?



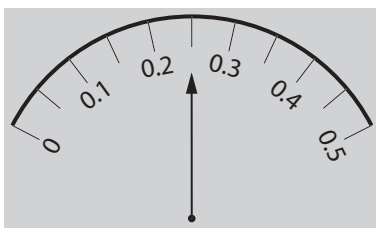
i) What decimal number is shown on this meter?



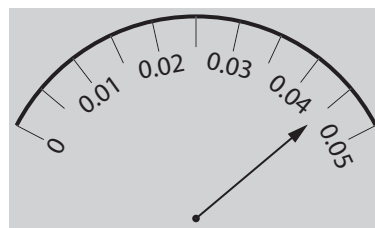
j) What decimal number is shown on this meter?



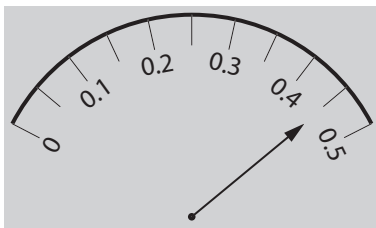
k) What decimal number is shown on this meter?



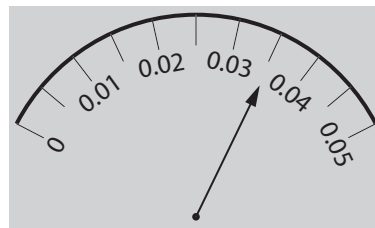
l) What decimal number is shown on this meter?



m) What decimal number is shown on this meter?



n) What decimal number is shown on this meter?



Skill 12.5 Finding equivalent fractions.

MM4.2 11 2 33 44
MM5.1 11 2 33 44

- Check if you need to multiply or divide the numerator or denominator of the first fraction to reach the numerator or denominator of the second fraction.
- Do the same operation to the top or the bottom of the fraction.

Example:

$$\frac{4}{5} = \frac{\boxed{?}}{15} \Rightarrow \frac{4 \times 3}{5 \times 3} = \frac{\boxed{12}}{15}$$

$\swarrow \times 3$

So $\frac{4}{5}$ and $\frac{12}{15}$ are equivalent fractions.

Q. Complete the equivalent fractions:

$$\frac{3}{5} = \frac{18}{\boxed{?}} = \frac{\boxed{?}}{90}$$

A.

$$\frac{3}{5} = \frac{18}{?} \Rightarrow \frac{3 \times 6}{5 \times 6} = \frac{18}{30}$$

$$\frac{3}{5} = \frac{?}{90} \Rightarrow \frac{3 \times 18}{5 \times 18} = \frac{54}{90}$$

$$\Rightarrow \frac{3}{5} = \frac{18}{\boxed{30}} = \frac{\boxed{54}}{90}$$

a) Complete the equivalent fractions:

$$\frac{\boxed{35}}{42} = \frac{5}{6}$$

$$\frac{?}{42} = \frac{5}{6} \Rightarrow ? \div 7 = 5 \Rightarrow ? = 35$$

$\swarrow \div 7$

b) Complete the equivalent fractions:

$$\frac{3}{4} = \frac{27}{\boxed{?}}$$

$$\frac{3}{4} = \frac{27}{?} \Rightarrow \frac{3 \times 9}{4 \times 9} = \frac{27}{36}$$

c) Complete the equivalent fractions:

$$\frac{2}{5} = \frac{\boxed{?}}{35}$$

\Rightarrow

d) Complete the equivalent fractions:

$$\frac{4}{\boxed{?}} = \frac{28}{49}$$

\Rightarrow

e) Complete the equivalent fractions:

$$\frac{9}{10} = \frac{\boxed{?}}{60}$$

\Rightarrow

f) Complete the equivalent fractions:

$$\frac{48}{60} = \frac{12}{\boxed{?}}$$

\Rightarrow

g) Complete the equivalent fractions:

$$\frac{2}{3} = \frac{\boxed{?}}{15} = \frac{40}{\boxed{?}}$$

\Rightarrow

and \Rightarrow

h) Complete the equivalent fractions:

$$\frac{3}{8} = \frac{12}{\boxed{?}} = \frac{\boxed{?}}{96}$$

\Rightarrow

and \Rightarrow

i) Complete the equivalent fractions:

$$\frac{3}{\boxed{?}} = \frac{6}{8} = \frac{\boxed{?}}{64}$$

\Rightarrow

and \Rightarrow

Skill 12.6 Writing a decimal number as a percentage.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Multiply the decimal number by 100, by moving the decimal point two places to the right.
 - Add the percentage sign.
- Hint: Zeros can be added at the end of any decimal number: $0.4 = 0.4000$*

Q. Write 0.07 as a percentage.

A. $0.07 = 0.\overline{07} \times 100\% = 7\%$ 2 zeros, 2 places to the right

a) Write 0.4 as a percentage.

$0.4 = 0.\overline{40} \times 100\% = 40\%$ Add a zero

b) Write 0.2 as a percentage.

..... =

c) Write 0.1 as a percentage.

..... =

d) Write 0.9 as a percentage.

..... =

e) Write 0.7 as a percentage.

..... =

f) Write 0.12 as a percentage.

..... =

g) Write 0.55 as a percentage.

..... =

h) Write 0.48 as a percentage.

..... =

i) Write 0.29 as a percentage.

..... =

j) Write 0.35 as a percentage.

..... =

k) Write 0.04 as a percentage.

..... =

l) Write 0.05 as a percentage.

..... =

m) Write 0.02 as a percentage.

..... =

n) Write 0.38 as a percentage.

..... =

o) Write 0.4 as a percentage.

..... =

p) Write 0.25 as a percentage.

..... =

q) Write 0.125 as a percentage.

..... =

r) Write 0.345 as a percentage.

..... =

- Write the percentage as a fraction out of 100.
- Divide the numerator of the fraction by 100, by moving the decimal point two places to the left.

Hints: Fractions are divisions.

There is a decimal point and zeros which are not written, at the end of any whole number:
27 = 27.00

Zeros can be used as place holders before any whole number: 27 = 0027.00

Q. Change 8.6% to a decimal.

$$\begin{aligned}
 \text{A. } 8.6\% &= \frac{8.6}{100} \\
 &= 8.6 \div 100 \\
 &= \overbrace{00}8.6 \div 100 \quad \text{2 zeros, 2 places to the left} \\
 &= \mathbf{0.086}
 \end{aligned}$$

a) Change 5% to a decimal.

$$5\% = \frac{5}{100} = \overbrace{00}5.0 \div 100 = \boxed{0.05}$$

b) Change 2% to a decimal.

$$2\% = \boxed{}$$

c) Change 88% to a decimal.

$$= \boxed{}$$

d) Change 42% to a decimal.

$$= \boxed{}$$

e) Change 60% to a decimal.

$$= \boxed{}$$

f) Change 40% to a decimal.

$$= \boxed{}$$

g) Change 0.5% to a decimal.

$$= \boxed{}$$

h) Change 1.8% to a decimal.

$$= \boxed{}$$

i) In Mali 72% of people earn less than \$1 each day. Write this percentage as a decimal.

$$= \boxed{}$$

j) In Oct 2010 the unemployment figure for Australia was 5.1%. Write this percentage as a decimal.

$$= \boxed{}$$

k) The percentage of Americans between 12 and 17 who play video games is 97%. Write this percentage as a decimal.

$$= \boxed{}$$

l) The Sun accounts for 99% of the mass of the solar system. Write this percentage as a decimal.

$$= \boxed{}$$

m) China has approximately 20% of the world's population. Write this percentage as a decimal.

$$= \boxed{}$$

n) On average Australians spend 3.8% of their day on facebook. Write this percentage as a decimal.

$$= \boxed{}$$

Decimal places = Zeros in the denominator

$$0.\underline{04} = \frac{4}{\underline{100}}$$

- Write the decimal number as the numerator of the fraction.
- Ignore any zeros at the start the number.
- Use the place value of the last digit of the decimal number to determine the size of the denominator.

Example:

| units | tenths | hundredths |
|-------|--------|------------|
| 0 | 0 | 4 |

$$= 4 \text{ hundredths} = \frac{4}{100}$$

Write the 4 as the numerator

4 in hundredths place, denominator = 100

- Write the fraction in simplest form. This means to divide both the numerator and the denominator by the same number.

Q. Write 0.6 as a fraction in simplest form.

A. $0.\underline{6} = \frac{6}{\underline{10}}$

Write 6 as the numerator

1 zero for 1 decimal place

$$= \frac{6 \div 2}{10 \div 2}$$

Simplify: $\div 2$

$$= \frac{3}{5}$$

a) Write 0.9 as a fraction.

$0.9 = \textit{nine tenths} = \frac{9}{10}$

b) Write 0.11 as a fraction.

$0.11 = \textit{eleven hundredths} = \frac{\quad}{\quad}$

c) Write 0.3 as a fraction.

$\dots\dots\dots = \frac{\quad}{\quad}$

d) Write 0.1 as a fraction.

$\dots\dots\dots = \frac{\quad}{\quad}$

e) Write 0.06 as a fraction in simplest form.

$\dots\dots\dots = \frac{\quad}{\quad}$

f) Write 0.02 as a fraction in simplest form.

$\dots\dots\dots = \frac{\quad}{\quad}$

g) Write 0.5 as a fraction in simplest form.

$\dots\dots\dots = \frac{\quad}{\quad}$

h) Write 0.28 as a fraction in simplest form.

$\dots\dots\dots = \frac{\quad}{\quad}$

i) Write 0.15 as a fraction in simplest form.

$\dots\dots\dots = \frac{\quad}{\quad}$

j) Write 0.8 as a fraction in simplest form.

$\dots\dots\dots = \frac{\quad}{\quad}$

Zeros in the denominator = Decimal places $\frac{4}{100} = 0.04$

When the denominator is a power of 10:

- Divide the numerator by the power of 10 by moving the decimal point to the left.

Example: $\frac{15}{100} = 15 \div 100$
 $= 015.0 \div 100$ (2 zeros, 2 places to the left)
 $= 0.15$

Hints: Fractions are just divisions.
 There is a decimal point and zeros which are not written, at the end of any whole number:
 $27 = 27.00$
 Zeros can be used as place holders before any whole number: $27 = 0027.00$

When the denominator is not a power of 10: EITHER

- Multiply both the numerator and denominator by the same number to make the denominator a power of 10. (e.g. 10, 100 or 1000).

Example: $\frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = 0.75$ (power of 10)

OR

- Divide the numerator by the denominator.

Example: $\frac{3}{4} = 3 \div 4 = 3.00 \div 4 = 0.75$

$$\begin{array}{r} 0.75 \\ 4 \overline{) 3.00} \end{array}$$

Q. Change $\frac{3}{5}$ to a decimal.

A. $\frac{3}{5} = \frac{3 \times 20}{5 \times 20}$
 $= \frac{60}{100}$ (Make denominator a power of 10)
 $= 60 \div 100$
 $= 060.0 \div 100$ (2 zeros, 2 places to the left)
 $= 0.60 = 0.6$

OR

A. $\frac{3}{5} = 3 \div 5$
 $= 3.0 \div 5$
 $= 0.6$

$$\begin{array}{r} 0.6 \\ 5 \overline{) 3.0} \end{array}$$

a) Change $\frac{3}{10}$ to a decimal.

$$\frac{3 \times 10}{10 \times 10} = \frac{30}{100}$$

$= 030.0 \div 100 = \boxed{0.3}$

b) Change $\frac{7}{20}$ to a decimal.

$= \dots = \boxed{}$

c) Change $\frac{9}{25}$ to a decimal.

$= \dots = \boxed{}$

d) Change $\frac{1}{2}$ to a decimal.

$= \dots = \boxed{}$

e) Change $1\frac{2}{5}$ to a decimal.

$= \dots = \boxed{}$

f) Change $2\frac{3}{4}$ to a decimal.

$= \dots = \boxed{}$

g) In 2008 a quarter of the Australian wheat exports went to Indonesia. Write this fraction as a decimal.

$= \dots = \boxed{}$

h) Approximately 9 out of 10 Nigerians attend church regularly. Write this fraction as a decimal.

$= \dots = \boxed{}$

i) People have the smelling ability of one-twentieth of that of a dog. Write this fraction as a decimal.

$= \dots = \boxed{}$

Skill 12.10 Writing a percentage as a fraction in simplest form.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Write the percentage as a fraction with the denominator of 100.
- Simplify the fraction by dividing both the numerator and the denominator by the same number.

Hints: Percent means “per hundred” or “out of a hundred”.

A percentage is another way of writing a fraction out of one hundred.

Example: 25% is said “25 percent” and means 25 out of 100.

Q. USA accounts for 24% of the European Union exports. Write this percentage as a fraction in simplest form.

$$\begin{aligned} \text{A. } 24\% &= \frac{24}{100} \xrightarrow{\text{Simplify: } \div 4} \\ &= \frac{6}{25} \end{aligned}$$

a) Write 47% as a fraction.

$$47\% = \frac{47}{100}$$

b) Write 9% as a fraction.

$$9\% = \frac{\quad}{\quad}$$

c) Write 15% as a fraction in simplest form.

$$15\% = \frac{15}{100} \xrightarrow{\text{Simplify: } \div 5} = \frac{3}{20}$$

d) Write 30% as a fraction in simplest form.

$$30\% = \frac{\quad}{\quad}$$

e) Write 4% as a fraction in simplest form.

$$4\% = \frac{\quad}{\quad}$$

f) Write 6% as a fraction in simplest form.

$$6\% = \frac{\quad}{\quad}$$

g) The common metal for medals is 84% copper. Write this percentage as a fraction in simplest form.

$$84\% = \frac{\quad}{\quad}$$

h) About 67 percent of all New Zealand males aged between 18 and 45 served in WWII. Write this percentage as a fraction in simplest form.

$$67\% = \frac{\quad}{\quad}$$

i) India is home to 40% of the world’s poor. Write this percentage as a fraction in simplest form.

$$40\% = \frac{\quad}{\quad}$$

j) In Belgium, 55% of government ministers are female. Write this percentage as a fraction in simplest form.

$$55\% = \frac{\quad}{\quad}$$

k) The average person’s left hand does 56% of the typing. Write this percentage as a fraction in simplest form.

$$56\% = \frac{\quad}{\quad}$$

l) The pupil of the eye expands up to 45% when a person looks at something pleasing. Write this percentage as a fraction in simplest form.

$$45\% = \frac{\quad}{\quad}$$

Skill 12.11 Writing a fraction as a percentage.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

$$\frac{\text{Number}}{100} = \text{Number } \%$$

$$\text{Fraction} \times \frac{100}{1} \% = \text{Percentage}$$

EITHER

- Find the equivalent fraction which has a denominator of 100.
- The numerator of this fraction is the equivalent percentage.

Example: $\frac{7}{10} = \frac{7 \times 10}{10 \times 10} = \frac{70}{100} = 70\%$

OR

- Multiply the fraction by $\frac{100}{1} \%$

Example: $\frac{7}{10} = \frac{7}{10} \times \frac{100}{1} \% \xrightarrow{\text{Simplify: } \div 10} = 70\%$

Q. Change $\frac{11}{20}$ to a percentage.

A. $\frac{11}{20} = \frac{11 \times 5}{20 \times 5} = \frac{55}{100} = 55\%$

OR A. $\frac{11}{20} = \frac{11}{20} \times \frac{100}{1} \% \xrightarrow{\text{Simplify: } \div 20} = 11 \times 5\% = 55\%$

a) Change $\frac{1}{10}$ to a percentage.

$$= \frac{1 \times 10}{10 \times 10} = \frac{10}{100} = \boxed{10\%}$$

b) Change $\frac{9}{50}$ to a percentage.

$$= \frac{9 \times 2}{50 \times 2} = \frac{18}{100} = \boxed{18\%}$$

c) Change $\frac{7}{25}$ to a percentage.

$$= \frac{7 \times 4}{25 \times 4} = \frac{28}{100} = \boxed{28\%}$$

d) Change $\frac{86}{100}$ to a percentage.

$$= \frac{86}{100} = \boxed{86\%}$$

e) Change $\frac{1}{2}$ to a percentage.

$$= \frac{1 \times 50}{2 \times 50} = \frac{50}{100} = \boxed{50\%}$$

f) Change $\frac{2}{5}$ to a percentage.

$$= \frac{2 \times 20}{5 \times 20} = \frac{40}{100} = \boxed{40\%}$$

g) Change $\frac{3}{5}$ to a percentage.

$$= \frac{3 \times 20}{5 \times 20} = \frac{60}{100} = \boxed{60\%}$$

h) Change $\frac{3}{4}$ to a percentage.

$$= \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = \boxed{75\%}$$

i) Change $\frac{1}{3}$ to a percentage.

$$= \frac{1 \times 33.33}{3 \times 33.33} = \frac{33.33}{100} = \boxed{33.33\%}$$

j) Change $\frac{13}{20}$ to a percentage.

$$= \frac{13 \times 5}{20 \times 5} = \frac{65}{100} = \boxed{65\%}$$

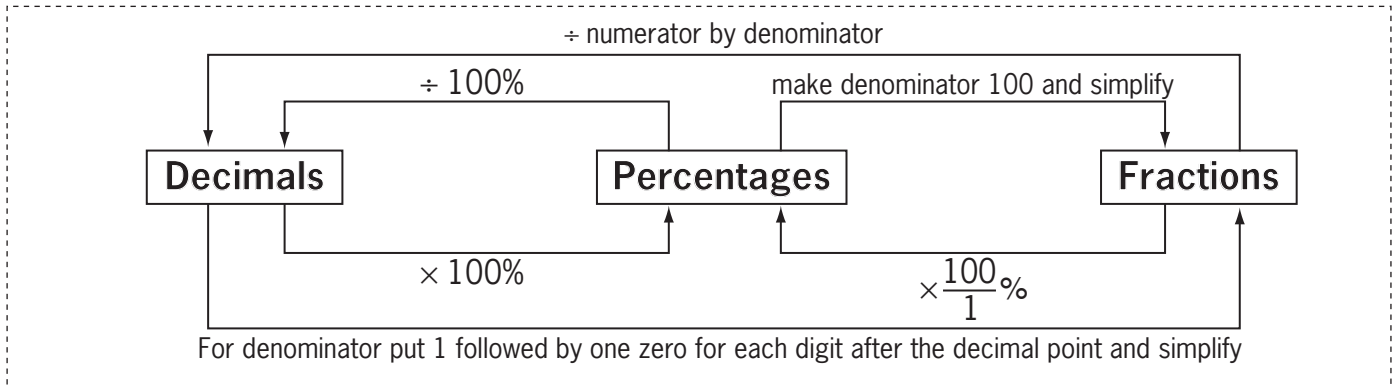
k) Change $\frac{1}{100}$ to a percentage.

$$= \frac{1}{100} = \boxed{1\%}$$

l) Change $\frac{2}{3}$ to a percentage.

$$= \frac{2 \times 33.33}{3 \times 33.33} = \frac{66.66}{100} = \boxed{66.66\%}$$

- Convert between decimals, fractions and percentages.
(see skills 12.4 to 12.9, pages 84 to 90)



Q. Complete the table:

| Decimal | Fraction | Percentage |
|---------|-----------------|------------|
| | $\frac{13}{50}$ | |

A.

$$\frac{13}{50} = \frac{13 \times 2}{50 \times 2} = \frac{26}{100}$$

Make denominator a power of 10

$$= \frac{26}{100} \div 100$$

$$= 0.26$$

Decimal

$$\frac{13}{50} = \frac{13}{50} \times \frac{100^2}{1} \%$$

Simplify: ÷ 50

$$= 13 \times 2\%$$

$$= 26\%$$

Percentage

| Decimal | Fraction | Percentage |
|---------|-----------------|------------|
| 0.26 | $\frac{13}{50}$ | 26% |

a) Complete the table:

| Decimal | Fraction | Percentage |
|---------|----------------|------------|
| 0.05 | $\frac{1}{20}$ | 5% |

$$0.05 = \frac{5}{100} \div 5 = \frac{1}{20}$$

.....

$$0.05 = 0.05 \times 100\% = 5\%$$

.....

b) Complete the table:

| Decimal | Fraction | Percentage |
|---------|----------|------------|
| | | 45% |

.....

.....

c) Complete the table:

| Decimal | Fraction | Percentage |
|---------|----------|------------|
| 0.6 | | |

.....

.....

d) Complete the table:

| Decimal | Fraction | Percentage |
|---------|----------------|------------|
| | $\frac{7}{20}$ | |

.....

.....

e) Complete the table:

| Decimal | Fraction | Percentage |
|---------|----------|------------|
| 0.07 | | |

.....

.....

f) Complete the table:

| Decimal | Fraction | Percentage |
|---------|----------|------------|
| | | 70% |

.....

.....

g) Complete the table:

| Decimal | Fraction | Percentage |
|---------|----------|------------|
| 0.1 | | |

.....

.....

h) Complete the table:

| Decimal | Fraction | Percentage |
|---------|----------------|------------|
| | $\frac{3}{10}$ | |

.....

.....

i) Complete the table:

| Decimal | Fraction | Percentage |
|---------|----------|------------|
| 0.4 | | |

.....

.....

j) Complete the table:

| Decimal | Fraction | Percentage |
|---------|----------|------------|
| | | 55% |

.....

.....

k) Complete the table:

| Decimal | Fraction | Percentage |
|---------|----------|------------|
| | | 90% |

.....

.....

l) Complete the table:

| Decimal | Fraction | Percentage |
|---------|-----------------|------------|
| | $\frac{17}{50}$ | |

.....

.....

- Convert the decimals, fractions and percentages to the same form, by writing all as decimals, or as fractions, or as percentages. (see skill 12.12, page 93)
- Compare the decimals, or the fractions, or the percentages.

Hint: The most convenient form is the decimal form. Write the fractions and percentages as decimals.

Q. Which is greater?

$\frac{1}{4}$ or 30%

A.

$$\begin{aligned} \frac{1}{4} &= \frac{1 \times 25}{4 \times 25} \\ &= \frac{25}{100} \\ &= \overbrace{25} \div 100 \\ &= \mathbf{0.25} \end{aligned}$$

Write the fraction as a decimal

Make denominator a power of 10

Fraction

$$\begin{aligned} 30\% &= \frac{30}{100} \\ &= \overbrace{30} \div 100 \\ &= \mathbf{0.3} \end{aligned}$$

Write the percentage as a decimal

Percentage

0.3 is greater than 0.25, so $30\% > \frac{1}{4}$
30% is greater.

a) Which is greater?
0.07 or 70%

$$70\% = \frac{70}{100} = \overbrace{70} \div 100 = 0.7$$

.....
 $0.7 > 0.07$ 70%

b) Which is greater?
20% or 0.25

.....

c) Which is greater?
 $\frac{9}{10}$ or 9%

.....

d) Which is greater?
 $\frac{4}{5}$ or 45%

.....

e) Which is greater?
 $\frac{1}{10}$ or 1%

.....

f) Which is greater?
 $\frac{2}{5}$ or 25%

.....

g) Which is greater?
0.6 or $\frac{5}{6}$

.....

h) Which is greater?
0.4 or $\frac{1}{4}$

.....

i) Which is greater?
 0.75 or 7.5%

.....
.....
.....

j) Which is greater?
 0.5 or 5%

.....
.....
.....

k) Which is greater?
 $\frac{3}{100}$ or 30%

.....
.....
.....

l) Which is greater?
 $\frac{3}{5}$ or 35%

.....
.....
.....

m) Which is greater?
 $\frac{8}{10}$ or 8%

.....
.....
.....

n) Which is greater?
 $\frac{1}{3}$ or 30%

.....
.....
.....

o) Which is greater?
 0.7 or $\frac{7}{8}$

.....
.....
.....

p) Which is greater?
 0.9 or $\frac{4}{5}$

.....
.....
.....

q) Which is greater?
 $\frac{3}{4}$ or 65%

.....
.....
.....

r) Which is greater?
 $\frac{1}{5}$ or 15%

.....
.....
.....

s) Which is greater?
 0.23 or $\frac{3}{20}$

.....
.....
.....

t) Which is greater?
 0.03 or $\frac{3}{10}$

.....
.....
.....

13. [Integers]

Skill 13.1 Comparing and ordering integers (1).

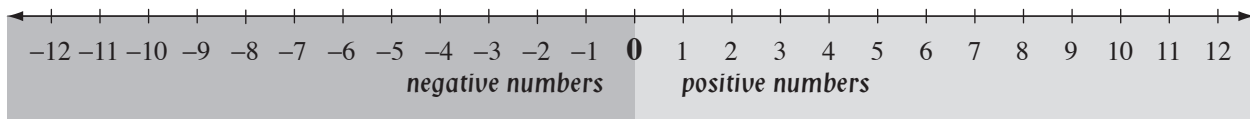
MM4.2 11 22 33 44
MM5.1 1 22 33 44

- Use a number line.

Hint: Numbers decrease as you move to the left or down and increase as you move to the right or up.

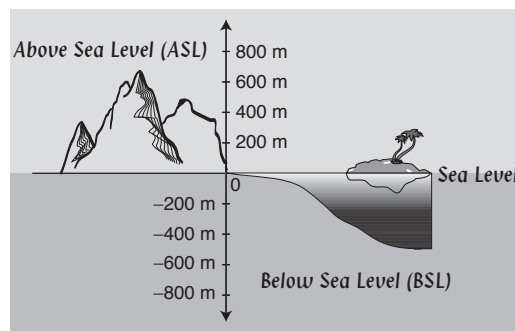
NUMBER LINE

A negative number is always smaller than a positive number.



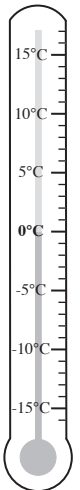
ALTITUDE

An altitude is lower when further down, below sea level (BSL) and higher when further up, above sea level (ASL).



TEMPERATURE

Temperatures below zero are lower than temperatures above zero.

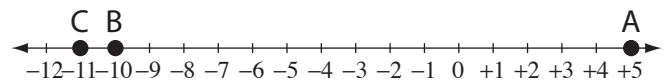


Q. Who won the 2010 Women's British Open Golf Tournament?

[Hint: In golf the lowest score wins.]

- A) +5 K. Webb
- B) -10 K. Hull
- C) -11 Y. Tseng

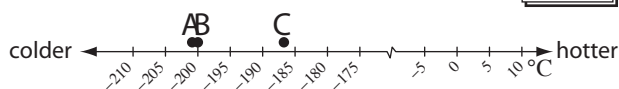
A. C Find the lowest score to determine the winner.



a) Which of Saturn's moons has the highest temperature?

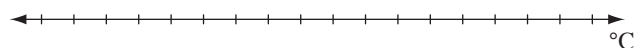
- A) -201°C Enceladus
- B) -200°C Mimas
- C) -187°C Tethys

C



b) Which temperature for oxygen is higher?

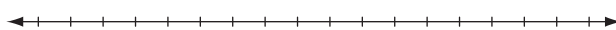
- A) -183°C boiling point
- B) -218°C melting point



c) Who won the 2010 British Open Golf Tournament?

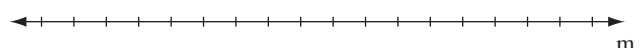
[Hint: In golf the lowest score wins.]

- A) -16 L. Oosthuizen
- B) +3 P. Senior
- C) -2 R. Allenby



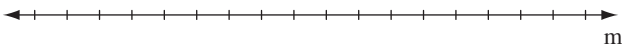
d) Which body of water is at the lowest altitude?

- A) -28 m Caspian Sea
- B) -408 m Dead Sea
- C) -15 m Lake Eyre



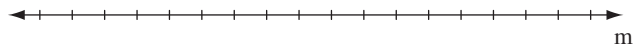
e) Which location has the lowest altitude?

- A) 3 m above sea level
Amsterdam (Netherlands)
- B) 133 m below sea level
Qattara Depression (Egypt)
- C) 2430 m above sea level
Machu Picchu (Peru)



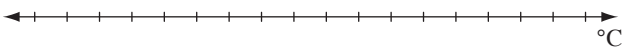
f) Which location has the highest altitude?

- A) 10 m below sea level
Laguna Salada (Mexico)
- B) 7 m below sea level
Lammefjord (Denmark)
- C) 19 m above sea level
Vatican City (Italy)



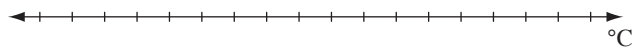
g) Which location recorded the lowest temperature?

- A) -25.6°C Kabul
- B) $+14.1^{\circ}\text{C}$ Christmas Island
- C) -15.2°C La Paz



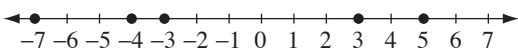
h) Which continent has the lowest recorded temperature?

- A) -63°C North America
- B) -23°C Australia
- C) -55°C Europe



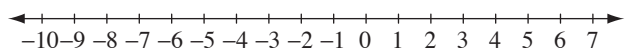
i) Arrange in ascending order:

$-4, -7, 5, -3, 3$



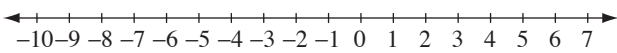
j) Arrange in order from largest to smallest:

$0, 8, -9, 6, -4$



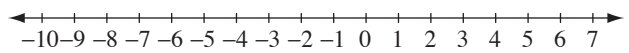
k) Arrange in descending order:

$-10, 8, 1, -8, 4$



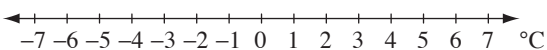
l) Arrange in order from smallest to largest:

$-2, -6, 0, -3, 5$



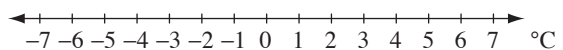
m) Arrange in order from coldest to warmest:

$2^{\circ}\text{C}, -3^{\circ}\text{C}, 4^{\circ}\text{C}, -5^{\circ}\text{C}$



n) Arrange in order from warmest to coldest:

$-1^{\circ}\text{C}, -5^{\circ}\text{C}, 5^{\circ}\text{C}, -3^{\circ}\text{C}$



- Use a number line.

Hint: A negative number is always smaller than a positive number.

The larger the negative number the lesser the value, e.g. -9 is less than ($<$) -2

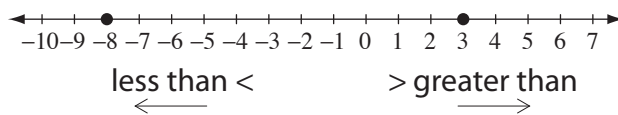
The smaller the negative number the greater the value, e.g. -4 is greater than ($>$) -6

Q. Use $<$ or $>$ to make a true statement.

$$3 \quad \square \quad -8$$

A. $3 > -8$

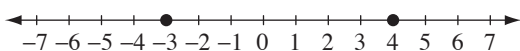
3 is greater than -8



a) Use $<$ or $>$ to make a true statement.

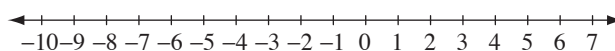
a negative number is less than a positive number

$$-3 \quad \square \quad 4$$



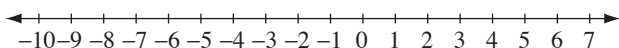
b) Use $<$ or $>$ to make a true statement.

$$-5 \quad \square \quad 0$$



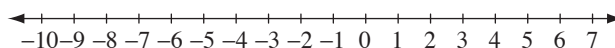
c) Use $<$ or $>$ to make a true statement.

$$-4 \quad \square \quad -9$$



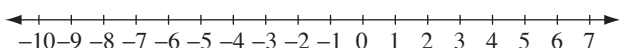
d) Use $<$ or $>$ to make a true statement.

$$-6 \quad \square \quad 3$$



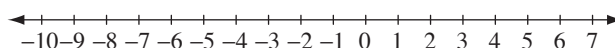
e) Use $<$ or $>$ to make a true statement.

$$2 \quad \square \quad -1$$



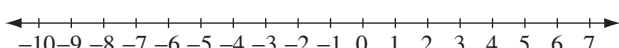
f) Use $<$ or $>$ to make a true statement.

$$-3 \quad \square \quad -7$$



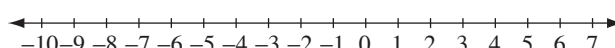
g) Use $<$ or $>$ to make a true statement.

$$-9 \quad \square \quad 0$$



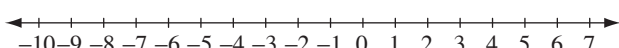
h) Use $<$ or $>$ to make a true statement.

$$3 \quad \square \quad -5$$



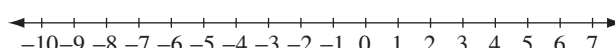
i) Use $<$ or $>$ to make a true statement.

$$4 \quad \square \quad -7$$



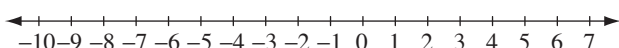
j) Use $<$ or $>$ to make a true statement.

$$-4 \quad \square \quad -2$$



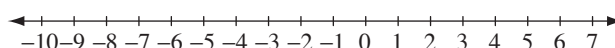
k) Use $<$ or $>$ to make a true statement.

$$-8 \quad \square \quad -5$$



l) Use $<$ or $>$ to make a true statement.

$$-2 \quad \square \quad -4$$

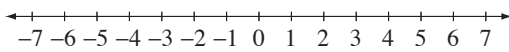


Skill 13.3 Modelling integer subtraction on a number line.

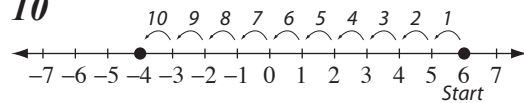
MM4.2 1 1 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Determine the value of each mark on the number line.
 - Count the number of spaces between the integers using the number line.
- Hint: Use short cuts such as: counting to zero, counting by tens.*

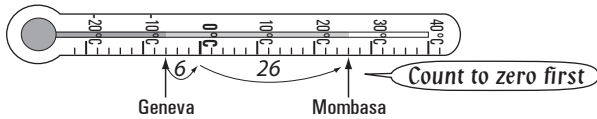
Q. How many units between 6 and -4 ?



A. 10



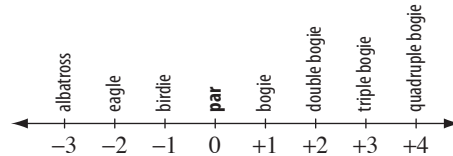
a) How much cooler is it in Geneva than Mombasa?



$$6 + 26$$

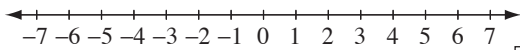
$$= \boxed{32 \text{ } ^\circ\text{C}}$$

b) If Karrie Webb scores a triple bogie and Greg Norman scores an eagle, what is the difference between their scores?



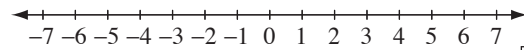
$$= \boxed{}$$

c) How many units between 5 and -4 ?



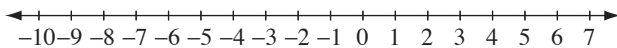
$$= \boxed{}$$

d) How many units between -5 and 3?



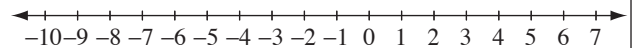
$$= \boxed{}$$

e) How many units between -9 and 2?



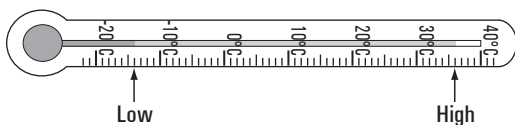
$$= \boxed{}$$

f) How many units between 6 and -7 ?



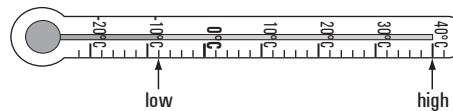
$$= \boxed{}$$

g) What is the difference between the highest and the lowest temperatures recorded in Dunedin, New Zealand?



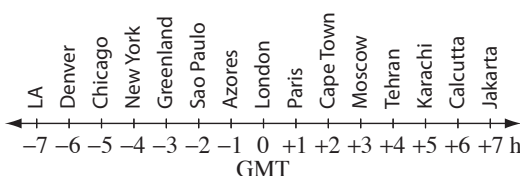
$$= \boxed{} \text{ } ^\circ\text{C}$$

h) What is the difference between the highest and the lowest temperatures recorded in Rome, Italy?



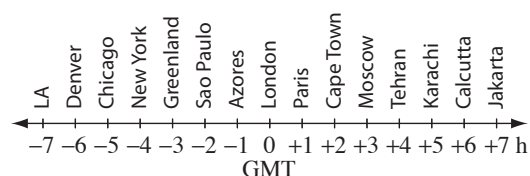
$$= \boxed{} \text{ } ^\circ\text{C}$$

i) What is the time difference in hours between Denver and Cape Town?



$$= \boxed{} \text{ h}$$

j) What is the time difference in hours between Karachi and New York?



$$= \boxed{} \text{ h}$$

- Visualise the position of the values on a number line.
- Translate the words to number sentences.
- Add the numbers ignoring their signs.

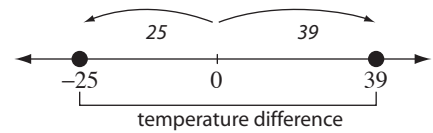
Hint: Taking away negative 5 is the same as adding positive 5.

$$0 - (-5) = +5$$

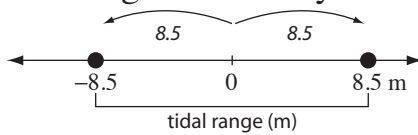
Q. In Vienna (Austria) the highest recorded temperature is 39°C and the lowest is -25°C . What is the temperature difference?

$$\begin{aligned} \text{A. } & 39 - (-25) \\ & = 39 + 25 \\ & = \mathbf{64^{\circ}\text{C}} \end{aligned}$$

Instead of subtracting negative 25, add positive 25 to 39.



a) The Bay of Fundy, Canada has a high tide of 8.5 m and a low tide of -8.5 m. What is the tidal range for the Bay of Fundy?



$$= 8.5 - (-8.5)$$

$$8.5 + 8.5$$

$$= \mathbf{17 \text{ m}}$$

b) The lowest point in Japan is Lake Hachirogata at -4 m and the highest point is Mt Fujiyama at 3776 m. What is the height difference?



$$=$$

$$= \mathbf{\text{m}}$$

c) Sparrow Hills station is the highest station in the Russian metro rail system with an altitude of 220 m above sea level. Park Pobedy is the lowest station at 90 m below sea level. What is their height difference?

$$= \mathbf{\text{m}}$$

d) In Reykjavik (Iceland) the highest recorded temperature is 26°C and the lowest is -25°C . What is the temperature difference?

$$= \mathbf{^{\circ}\text{C}}$$

e) In Luxembourg the highest recorded temperature is 38°C and the lowest is -23°C . What is the temperature difference?

$$= \mathbf{^{\circ}\text{C}}$$

f) In Shanghai (China) the highest recorded temperature is 40°C and the lowest is -12°C . What is the temperature difference?

$$= \mathbf{^{\circ}\text{C}}$$

g) The lowest point on the African continent is -156 m at Lake Assal and the highest is 5895 m at Mt Kilimanjaro. What is the height difference?

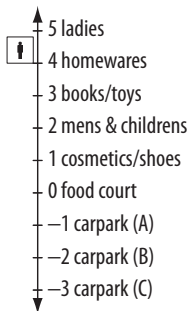
$$= \mathbf{\text{m}}$$

h) The highest point in Europe is 5642 m at Mt Elbrus and the lowest is -22 m in the Caspian Sea. What is the height difference in Europe?

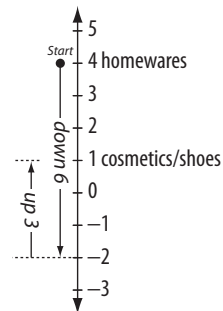
$$= \mathbf{\text{m}}$$

- Start at the given point on the number line.
- Count up or down the number of spaces as directed.

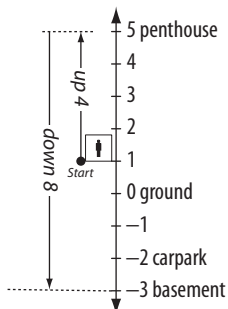
Q. From homewares Marion rides the elevator down 6 levels and up 3 levels. At what level is Marion now?



A. down 6 levels (add -6)
up 3 levels (add $+3$)
⇒ **Cosmetics/shoes**



a) From level 1 Hutch rides the elevator up 4 levels and down 8. At what level is Hutch now?

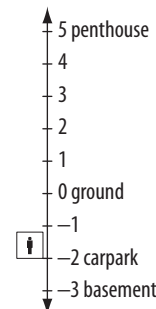


up 4 levels (add $+4$)

down 8 levels (add -8)

basement

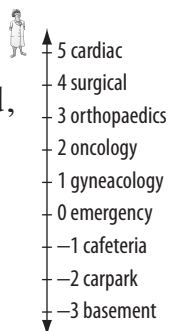
b) From the carpark Kwong rides the elevator down 1 level and up 3 levels. At what level is Kwong now?



⇒

.....
.....

c) A nurse starts in cardiac ward, goes down 6 levels and then up 3 levels. Where does she finish?

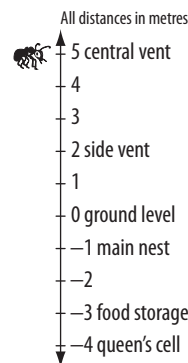


.....

⇒

.....

d) A termite entered his tower via the central vent and went to the main nest. How far did the termite travel?

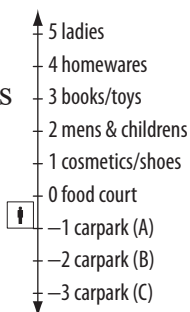


⇒

.....

m

e) From carpark (A) Todd rides the elevator down 2 levels and up 7 levels. At what level is Todd now?

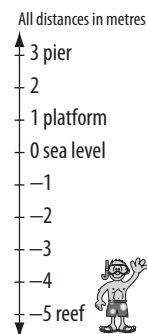


.....

⇒

.....

f) A snorkeller at the reef surfaces for lunch on the pier and then goes back to the reef. How far does he travel?



⇒

.....

m

- Start at the given point.
- Work in the given order.
- Visualise the position of the values on a number line.

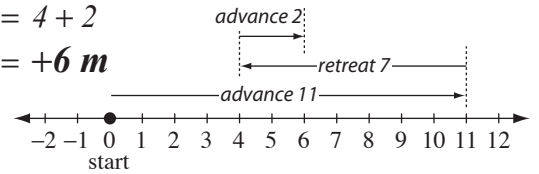
Hint: Positive words: up, above, over, forward, advance, gained, earned, later
Negative words: down, below, under, backward, retreat, lost, owed, earlier

Q. During a football game the ball advanced 11 m, retreated 7 m and then advanced 2 m. Where did the ball finish in relation to its starting point?

A. Start: $0 + 11 - 7 + 2$

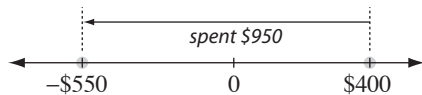
$= 4 + 2$

$= +6 \text{ m}$



a) If Pip had \$400 and spent \$950, what is her bank balance?

$= 400 - 950 = \boxed{-\$550}$



b) Harry owed \$350. If he earned \$420, how much does Harry now have?

$= \dots = \boxed{}$

c) Chan owes \$420. If he earned \$280, what is Chan's bank balance?

$= \dots = \boxed{}$

d) Carbon dioxide boils at -78°C . At 21°C below this, carbon dioxide solidifies. At what temperature does carbon dioxide solidify?

$= \dots = \boxed{}^{\circ}\text{C}$

e) The Persians destroyed the original Acropolis in 480 BC. Pericles rebuilt it 31 years later. What year was that?

$= \dots = \boxed{}$

f) Tutenkhamun reigned for 9 years up until 1323 BC. What year did Tutenkhamun come to the throne?

$= \dots = \boxed{}$

g) Oxygen boils at -183°C . At 35°C below this, oxygen solidifies. What is the temperature of solid oxygen?

$= \dots = \boxed{}^{\circ}\text{C}$

h) Helium boils at -269°C . At 3°C below this, helium solidifies. At what temperature does helium solidify?

$= \dots = \boxed{}^{\circ}\text{C}$

i) You bought \$1000 worth of stock. After the first year you lost \$480, but after the second year you gained \$220. What is the current value of your stock?

$= \dots = \boxed{}$

j) A bear weighs 67 kg. During hibernation it loses 20 kg. After hibernation it gains 14 kg. What does the bear weigh now?

$= \dots = \boxed{} \text{ kg}$

Hint: Every number has a sign attached to it, so if there is no sign, the number is positive. These signs should not be confused with the operations of addition and subtraction.

Using a number line

- Start at 0.
- When the number is “+” move that many to the right.
- When the number is “-” move that many to the left.

Using Addition Rules

Addition Rules

same signs:

Add the numbers, ignoring their signs.
Keep that sign.

Addition Rules

different signs:

Subtract the numbers, ignoring their signs.
Keep the sign of the larger number.

Example:

$$(+4) + (+3) = +(4 + 3) = +7 = 7 \text{ or simply}$$

$$4 + 3 = 7$$

$$(-5) + (-8) = -(5 + 8) = -13 \text{ or simply}$$

$$-5 + -8 = -13$$

Example:

$$(-9) + (+3) = -(9 - 3) = -6 \text{ or simply}$$

$$-9 + 3 = -6$$

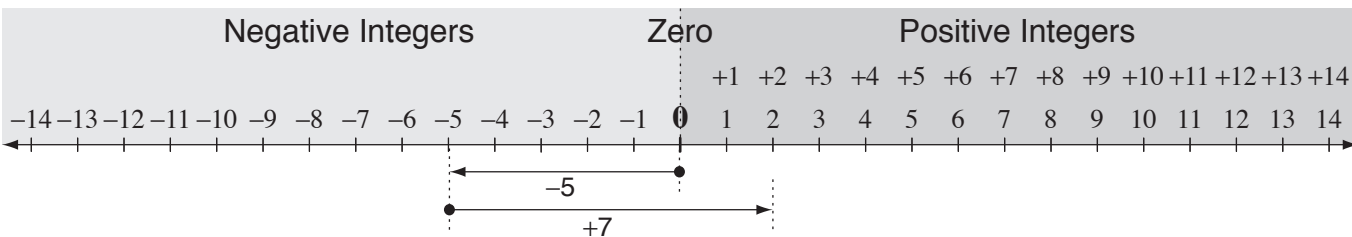
$$(-4) + (+11) = +(11 - 4) = +7 = 7 \text{ or simply}$$

$$-4 + 11 = 7$$

Q. $-5 + 7 =$

A. $-5 + 7 =$
 $= +(7 - 5)$
 $= 2$

Starting at 0 go 5 units to the left.
From this point, move 7 units right. You stop at positive 2.



a) $-2 + (-3) =$

$= -(2 + 3) =$ -5

both negative keep "-" *same signs, add*

b) $-4 + 3 =$

$=$

c) $-8 + 6 =$

$=$

d) $8 + (-5) =$

$=$

e) $2 + (-6) =$

$=$

f) $5 + (-3) =$

$=$

g) $-2 + 4 =$

$=$

h) $9 + (-2) =$

$=$

i) $-4 + (-2) =$

$=$

j) $-8 + 3 =$

$=$

k) $-2 + (-6) =$

$=$

l) $-3 + (-6) =$

$=$

Hint: Every number has a sign attached to it, so if there is no sign, the number is positive. These signs should not be confused with the operations of addition and subtraction.

Using a number line

- Start at 0.
- When the number is “+” move that many to the right.
- When the number is “-” move that many to the left.

Using Addition Rules

- Consider subtracting an integer as adding its opposite. So change the number to be subtracted to its opposite. Example: $8 - (-2) = 8 + (+2)$
- Then apply the addition rules.

Addition Rules

same signs:
Add the numbers, ignoring their signs.
Keep that sign.

Example:
 $(-9) - (-3) = (-9) + (+3) = -(9 - 3) = -6$
 or simply $-9 + 3 = -6$
 $(-4) - (-11) = (-4) + (+11) = +(11 - 4)$
 $= +7 = 7$ or simply $-4 + 11 = 7$

Addition Rules

different signs:
Subtract the numbers, ignoring their signs.
Keep the sign of the larger number.

Example:
 $(-5) - (+8) = (-5) + (-8) = -(5 + 8) = -13$
 or simply $-5 + -8 = -13$
 $(+4) - (-3) = (+4) + (+3) = +(4 + 3) = +7 = 7$
 or simply $4 + 3 = 7$

Q. $-3 - 6 =$

start at -3, move backward 6

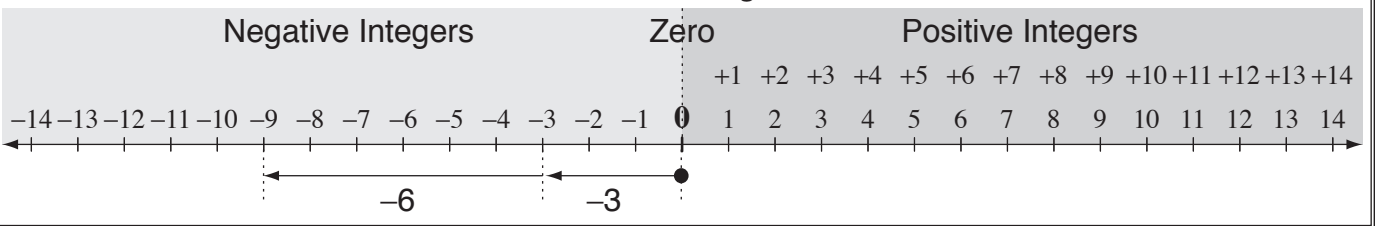
A. $-3 - 6 =$

$= -3 + (-6)$
 $= -(3 + 6)$
 $= -9$

Negative 3 take away positive 6 is the same as negative 3 plus negative 6.

OR Using a number line:

Starting at 0 go 3 units to the left. From this point, move 6 units left. You stop at negative 9.



a) $1 - 7 =$

subtract 7 means add -7

$= +1 + (-7)$

$= -(7 - 1) = -6$

b) $0 - 8 =$

$=$
 $=$ $=$

c) $4 - 8 =$

$=$
 $=$ $=$

d) $-3 - 5 =$

$=$
 $=$

e) $-9 - 2 =$

$=$
 $=$

f) $2 - (-1) =$

$=$
 $=$

g) $3 - (-4) =$

$$=$$
$$= \boxed{}$$

h) $-8 - (-4) =$

$$=$$
$$= \boxed{}$$

i) $-2 - (-2) =$

$$=$$
$$= \boxed{}$$

j) $-8 - 5 =$

$$=$$
$$= \boxed{}$$

k) $9 - (-6) =$

$$=$$
$$= \boxed{}$$

l) $-7 - (-3) =$

$$=$$
$$= \boxed{}$$

m) $2 - 11 =$

$$=$$
$$= \boxed{}$$

n) $5 - (+7) =$

$$=$$
$$= \boxed{}$$

o) $-8 - (-2) =$

$$=$$
$$= \boxed{}$$

p) $0 - (-5) =$

$$=$$
$$= \boxed{}$$

q) $-6 - (+2) =$

$$=$$
$$= \boxed{}$$

r) $-3 - 7 =$

$$=$$
$$= \boxed{}$$

s) $5 - (-2) =$

$$=$$
$$= \boxed{}$$

t) $-4 - (-10) =$

$$=$$
$$= \boxed{}$$

u) $8 - (-9) =$

$$=$$
$$= \boxed{}$$

v) $-6 - 10 =$

$$=$$
$$= \boxed{}$$

w) $3 - 9 =$

$$=$$
$$= \boxed{}$$

x) $-1 - 8 =$

$$=$$
$$= \boxed{}$$

y) $0 - 12 =$

$$=$$
$$= \boxed{}$$

z) $10 - (+3) =$

$$=$$
$$= \boxed{}$$

A) $-7 - 2 =$

$$=$$
$$= \boxed{}$$

Skill 13.9 Multiplying integers.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Multiply the integers ignoring the signs.
- Determine the sign of the result using the multiplication rules.

Multiplication Rules

same signs: positive \times positive = positive
negative \times negative = positive

Multiplication Rules

different signs: positive \times negative = negative
negative \times positive = negative

Example: $-9 \times (-3) = 27$
 (Signs: $- \times - = +$)

Example: $9 \times (-3) = -27$
 (Signs: $+ \times - = -$)

Q. $-4 \times (-7) =$

A. $-4 \times (-7) = 28$
 (Signs: $- \times - = +$)

$4 \times 7 = 28$
 Same signs, both negative
 \Rightarrow positive result.
 $\Rightarrow +28$

- a) $-6 \times 7 =$ b) $-2 \times 6 =$
- c) $-8 \times 3 =$
- d) $3 \times (-5) =$ e) $2 \times (-9) =$ f) $-8 \times (-8) =$
- g) $-8 \times (-5) =$ h) $-9 \times 4 =$ i) $5 \times (-6) =$
- j) $7 \times (-8) =$ k) $-4 \times 6 =$ l) $-7 \times 7 =$
- m) $3 \times (-9) =$ n) $-7 \times (-4) =$ o) $-6 \times (-3) =$
- p) $-4 \times (-4) =$ q) $5 \times (-9) =$ r) $-8 \times (-2) =$
- s) $-5 \times (-5) =$ t) $-4 \times 5 =$ u) $-9 \times 9 =$

Skill 13.10 Dividing integers.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Divide the integers ignoring the signs.
- Determine the sign of the result using the division rules.

Division Rules

same signs: positive \div positive = positive
negative \div negative = positive

Division Rules

different signs: positive \div negative = negative
negative \div positive = negative

Example: $-9 \div (-3) = 3$

Sign rule: $- \div - = +$

Example: $9 \div (-3) = -3$

Sign rule: $+ \div - = -$

Q. $-30 \div 6 =$

A. $-30 \div +6 = -5$

Sign rule: $- \div + = -$

$30 \div 6 = 5$
Different signs
 \Rightarrow negative result.
 $\Rightarrow -5$

a) $12 \div (-4) = -3$ b) $27 \div (-3) =$ c) $-54 \div (-9) =$

d) $-72 \div (-12) =$ e) $-45 \div 9 =$ f) $-32 \div 8 =$

g) $-18 \div 2 =$ h) $-24 \div (-8) =$ i) $-63 \div 9 =$

j) $25 \div (-5) =$ k) $-56 \div (-7) =$ l) $-21 \div 7 =$

m) $-45 \div 5 =$ n) $-28 \div (-7) =$ o) $-54 \div 6 =$

p) $28 \div (-4) =$ q) $-35 \div (-7) =$ r) $-40 \div (-5) =$

s) $-36 \div 6 =$ t) $63 \div (-7) =$ u) $-36 \div 9 =$

14. [Rates / Ratios]

Skill 14.1 Simplifying ratios by comparing two numbers.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

EITHER

- Find the largest number that divides evenly into each number of the ratio (Highest Common Factor).
- Divide each number by the HCF.

Hint: ':' means fraction and is read as 'to'.

Ratio $a : b = \frac{a}{b}$

OR

- Divide each number of the ratio by any factor until the ratio is reduced to simplest form.

Q. Simplify the ratio 32 : 56

A. $\begin{matrix} \div 8 & & \div 8 \\ \swarrow & & \searrow \\ 32 : 56 \\ \swarrow & & \searrow \\ 4 & & 7 \\ \hline 4 : 7 \end{matrix}$
 HCF of 32 and 56 is 8 so $\div 8$

OR A. $\begin{matrix} \div 2 & & \div 2 \\ \swarrow & & \searrow \\ 32 : 56 \\ \swarrow & & \searrow \\ 16 : 28 \\ \swarrow & & \searrow \\ 8 : 14 \\ \swarrow & & \searrow \\ 4 : 7 \end{matrix}$
 Simplify: $\div 2$
 Simplify: $\div 2$
 Simplify: $\div 2$

a) Simplify the ratio 4 : 6

$\begin{matrix} 2 & 3 \\ \swarrow & \searrow \\ 4 : 6 \\ \hline 2 : 3 \end{matrix}$ Simplify: $\div 2$

b) Simplify the ratio 6 : 12

$\begin{matrix} \div 6 \\ \swarrow & \searrow \\ 6 : 12 \\ \hline : \end{matrix}$ Simplify: $\div 6$

c) Simplify the ratio 30 : 50

$\begin{matrix} \div 10 \\ \swarrow & \searrow \\ 30 : 50 \\ \hline : \end{matrix}$

d) Simplify the ratio 10 : 15

$\begin{matrix} \div 5 \\ \swarrow & \searrow \\ 10 : 15 \\ \hline : \end{matrix}$

e) Simplify the ratio 45 : 15

$\begin{matrix} 3 & 1 \\ \swarrow & \searrow \\ 45 : 15 \\ \hline : \end{matrix}$ Simplify: $\div 15$

f) Simplify the ratio 18 : 24

$\begin{matrix} \div 6 \\ \swarrow & \searrow \\ 18 : 24 \\ \hline : \end{matrix}$

g) Simplify the ratio 100 : 70

$\begin{matrix} \div 10 \\ \swarrow & \searrow \\ 100 : 70 \\ \hline : \end{matrix}$

h) Simplify the ratio 32 : 8

$\begin{matrix} \div 8 \\ \swarrow & \searrow \\ 32 : 8 \\ \hline : \end{matrix}$

i) Simplify the ratio 24 : 96

$\begin{matrix} \div 24 \\ \swarrow & \searrow \\ 24 : 96 \\ \hline : \end{matrix}$

j) Simplify the ratio 30 : 54

$\begin{matrix} \div 6 \\ \swarrow & \searrow \\ 30 : 54 \\ \hline : \end{matrix}$

k) Simplify the ratio 27 : 36

$\begin{matrix} \div 9 \\ \swarrow & \searrow \\ 27 : 36 \\ \hline : \end{matrix}$

l) Simplify the ratio 24 : 16

$\begin{matrix} \div 8 \\ \swarrow & \searrow \\ 24 : 16 \\ \hline : \end{matrix}$

m) Simplify the ratio 150 : 45

$\begin{matrix} \div 15 \\ \swarrow & \searrow \\ 150 : 45 \\ \hline : \end{matrix}$

n) Simplify the ratio 90 : 240

$\begin{matrix} \div 30 \\ \swarrow & \searrow \\ 90 : 240 \\ \hline : \end{matrix}$

Skill 14.2 Simplifying ratios by comparing two quantities.

MM4.2 1 1 22 33 44
MM5.1 1 1 22 33 44

- Write the quantities of the ratio with the same unit of measurement.

EITHER

- Find the largest number that divides evenly into each quantity of the ratio (Highest Common Factor).
- Divide each quantity by the HCF.

OR

- Divide each quantity of the ratio by any factor until the ratio is reduced to simplest form.

Hints: The order of the quantities in a ratio matters.

' : ' means fraction and is read as 'to'.

Examples: The ratio of legs to ears in a cat is $4 : 2 = 2 : 1$

The ratio of ears to legs in a cat is $2 : 4 = 1 : 2$

$$\text{Ratio } a : b = \frac{a}{b}$$

Q. Simplify the ratio 2 h : 40 min

A. $2 \text{ h} = 2 \times 60 \text{ min} = 120 \text{ min}$ 1 h = 60 min

$$2 \text{ h} : 40 \text{ min}$$

$$= 120 \text{ min} : 40 \text{ min}$$

$$\begin{array}{c} \div 40 \\ \downarrow \quad \downarrow \\ = 120 \text{ min} : 40 \text{ min} \end{array} \div 40$$

HCF of 120 and 40 is 40 so $\div 40$

$$= 3 : 1$$

Ignore the units

a) Simplify the ratio 48 kg : 80 kg

$$= \overset{3}{48} : \overset{5}{80} \quad \text{Simplify: } \div 16 = \boxed{\quad} : \boxed{\quad}$$

b) Simplify the ratio 50 m : 125 m

$$= 50 : 125 \quad \text{Simplify: } \div 25 = \boxed{\quad} : \boxed{\quad}$$

c) Simplify the ratio 120 cm : 36 cm

$$= \quad : \quad = \boxed{\quad} : \boxed{\quad}$$

d) Simplify the ratio 150 g : 175 g

$$= \quad : \quad = \boxed{\quad} : \boxed{\quad}$$

e) Simplify the ratio \$3.00 : 40 cents

\$1 = 100¢

2 zeros, 2 places right

$$\$3.00 = 3.\overset{00}{00} \times 100 = 300¢$$

$$= \overset{15}{300}¢ : \overset{2}{40}¢ \quad \text{Simplify: } \div 20 = \boxed{15:2}$$

f) Simplify the ratio 40 s : 2 min

$$= \quad : \quad = \boxed{\quad} : \boxed{\quad}$$

g) Simplify the ratio 12 m : 60 cm

$$= \quad : \quad = \boxed{\quad} : \boxed{\quad}$$

h) Simplify the ratio \$4.00 : 25 cents

$$= \quad : \quad = \boxed{\quad} : \boxed{\quad}$$

i) Simplify the ratio 6 days : 4 weeks

$$= \quad : \quad = \boxed{\quad} : \boxed{\quad}$$

j) Simplify the ratio 5 min : 50 s

$$= \quad : \quad = \boxed{\quad} : \boxed{\quad}$$

$$\begin{aligned} \text{speed } (v) &= \frac{\text{distance travelled } (d)}{\text{time taken } (t)} & \text{OR } v &= \frac{d}{t} \\ \text{distance travelled } (d) &= \text{speed } (v) \times \text{time taken } (t) & \text{OR } d &= vt \\ \text{time taken } (t) &= \frac{\text{distance travelled } (d)}{\text{speed } (v)} & \text{OR } t &= \frac{d}{v} \end{aligned}$$

- Write the formula for speed or distance or time taken to travel.
- Convert the given units into the required units if necessary. (see Maths Facts, page 383)
Hints: If the speed must be calculated in km/h, convert the units for distance to km and the units for time to hours.
Changing from smaller units into larger units, always divide by the conversion factor.
Changing from larger units into smaller units, always multiply by the conversion factor.
- Substitute the known values into the formula.
- Simplify and evaluate.

Q. A jet travels at an average speed of 900 km/h. At this rate how long would it take to travel 4050 kilometres?

A. $t = \frac{\text{distance travelled}}{\text{speed}} = \frac{d}{v}$

$$= \frac{4050 \text{ km}}{900 \text{ km/h}} \quad \text{Substitute into the formula}$$

$$= \frac{4050}{900} \text{ h} \quad \text{Simplify: } \div 50$$

$$= \frac{81}{20} \text{ h} \quad \text{Simplify: } \div 9$$

$$= 4.5 \text{ h}$$

a) How far will John walk in 45 minutes if he walks at 10 km/h?

b) How far will a salmon swim in 12 minutes if it swims at 45 km/h?

$$t = 45 \text{ min} = 0.75 \text{ h} \quad (\text{three quarters of an hour})$$

$$t =$$

Use $d = rt$

$$d = 10 \text{ km/h} \times 0.75 \text{ h} = \boxed{7.5 \text{ km}}$$

$$d = \quad = \boxed{\text{ km}}$$

c) A cyclist rides at an average speed of 18 km/h. At this rate how long would it take to travel 45 km?

d) A hot air balloon travels at a speed of 21 km/h. At this rate how far will it travel in 40 minutes?

$$t = \frac{d}{v}$$

$$t =$$

$$= \frac{45 \text{ km}}{18 \text{ km/h}} \quad \text{Simplify: } \div 9 = \boxed{\text{ h}}$$

$$d = \quad = \boxed{\text{ km}}$$

e) The X-15 rocket plane is the fastest aircraft with a maximum speed of 7275 km/h, reached in 1967. At this speed how far could it travel in 4 hours?

f) An airplane flew from Sydney to Cairns a distance of 2000 km. If the plane travelled at an average speed of 800 km/h, how long did the trip take?

$$d =$$

$$= \quad = \boxed{\text{ km}}$$

$$t =$$

$$= \quad = \boxed{\text{ h min}}$$

- g) An airplane flew from Auckland to Wellington, a distance of 650 km. If the plane travelled 1.3 hours, how fast did it travel?

$$v = \frac{d}{t} = \frac{650 \text{ km}}{1.3 \text{ h}} = 500 \div 1 \text{ km/h}$$

Simplify: $\div 13$

$$= 500 \div 1 \text{ km/h} = \boxed{\text{km/h}}$$

- h) An airplane flew from Alice Springs to Darwin, a distance of 1300 km. If the plane travelled 2.5 hours, how fast did it travel?

$$v =$$

$$= \quad = \boxed{\text{km/h}}$$

- i) An emu can run 9 km in 12 minutes. What is its average speed in kilometres per hour?

$$v =$$

$$= \quad = \boxed{\text{km/h}}$$

- j) Some species of dolphin can swim 15 km at 60 km/h. How long would it take to swim this distance?

$$t =$$

$$= \quad = \boxed{\text{min}}$$

- k) A train travels at an average speed of 76 km/h. What distance would it travel in one hour and 15 minutes?

$$d =$$

$$= \quad = \boxed{\text{km}}$$

- l) A satellite orbits the earth at an average speed of 8 km/s. What distance does it travel in 20 minutes?

$$d =$$

$$= \quad = \boxed{\text{km}}$$

- m) Earth moves around the sun at an average speed of 108 000 km/h. What distance does it move in a quarter of an hour?

$$d =$$

$$= \quad = \boxed{\text{km}}$$

- n) In 1904 the first speeding ticket went to Harry Myers of Dayton, Ohio. Harry drove 20 km/h in town. At this speed how far could he travel in 15 minutes?

$$d =$$

$$= \quad = \boxed{\text{km}}$$

- o) A rifle was fired at a target 600 m away. If the bullet travelled at an average speed of 800 m/s, how long did the bullet take to hit the target?

$$t =$$

$$= \quad = \boxed{\text{s}}$$

- p) It is 18 km from Wodonga Creek to Doctors Point. If a Murray cod travelled at an average speed of 8 km/h, how long would this trip take?

$$t =$$

$$= \quad = \boxed{\text{h min}}$$

Skill 14.4 Simplifying ratios by comparing three numbers.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

EITHER

- Find the largest number that divides evenly into each number of the ratio (Highest Common Factor).
- Divide each number by the HCF.

OR

- Divide each number of the ratio by any factor until the ratio is reduced to simplest form.

Q. Simplify the ratio
24 : 6 : 30

A. $\begin{matrix} & 24 & : & 6 & : & 30 \\ \div 6 & \left(\begin{matrix} 4 & 1 & 5 \\ \hline 24 & 6 & 30 \end{matrix} \right) & \div 6 & & & \\ & = & 4 & : & 1 & : & 5 \end{matrix}$ HCF of 24, 6 and 30 is 6 so $\div 6$

OR A. $\begin{matrix} & 24 & : & 6 & : & 30 \\ \div 2 & \left(\begin{matrix} 12 & 3 & 15 \\ \hline 24 & 6 & 30 \end{matrix} \right) & \div 2 & & & \\ & = & 12 & : & 3 & : & 15 \\ \div 3 & \left(\begin{matrix} 4 & 1 & 5 \\ \hline 12 & 3 & 15 \end{matrix} \right) & \div 3 & & & \\ & = & 4 & : & 1 & : & 5 \end{matrix}$ Simplify: $\div 2$
Simplify: $\div 3$

a) Simplify the ratio 72 : 16 : 40

$= \overset{9}{\cancel{72}} : \overset{2}{\cancel{16}} : \overset{5}{\cancel{40}} = \boxed{9 : 2 : 5}$ Simplify: $\div 8$

b) Simplify the ratio 4 : 8 : 16

$= \dots\dots\dots = \boxed{\quad : \quad : \quad}$

c) Simplify the ratio 3 : 9 : 27

$= \dots\dots\dots = \boxed{\quad : \quad : \quad}$

d) Simplify the ratio 10 : 30 : 45

$= \dots\dots\dots = \boxed{\quad : \quad : \quad}$

e) Simplify the ratio 33 : 18 : 15

$= \dots\dots\dots = \boxed{\quad : \quad : \quad}$

f) Simplify the ratio 18 : 36 : 27

$= \dots\dots\dots = \boxed{\quad : \quad : \quad}$

g) Simplify the ratio 48 : 18 : 12

$= \dots\dots\dots = \boxed{\quad : \quad : \quad}$

h) Simplify the ratio 50 : 100 : 30

$= \dots\dots\dots = \boxed{\quad : \quad : \quad}$

i) Simplify the ratio 36 : 12 : 60

$= \dots\dots\dots = \boxed{\quad : \quad : \quad}$

j) Simplify the ratio 30 : 45 : 90

$= \dots\dots\dots = \boxed{\quad : \quad : \quad}$

k) Simplify the ratio 42 : 14 : 21

$= \dots\dots\dots = \boxed{\quad : \quad : \quad}$

l) Simplify the ratio 40 : 60 : 80

$= \dots\dots\dots = \boxed{\quad : \quad : \quad}$

Skill 14.5 Deciding if two ratios are equivalent.

MM4.2 11 22 3 4 4
MM5.1 11 22 3 4 4

- Write the two ratios as equal fractions side by side.
- Cross multiply the numerators and the denominators of the fractions.
- If the two products are equal, then the two ratios are equivalent (or form a proportion).

$$a:b = c:d \quad \text{2 ratios}$$

$$\frac{a}{b} \times \frac{c}{d} \quad \text{Cross product}$$

$$a \times d = b \times c$$

$$ad = bc$$

Q. Which ratio is equivalent to 5 : 7?

- A) 10 : 35 B) 15 : 14 C) 20 : 28

A. $\frac{5}{7} \times \frac{10}{35} \Rightarrow 5 \times 35 = 7 \times 10$
 $\Rightarrow 175 = 70 \Rightarrow \text{false}$ **A**

Cross multiply

$\frac{5}{7} \times \frac{15}{14} \Rightarrow 5 \times 14 = 7 \times 15$
 $\Rightarrow 70 = 105 \Rightarrow \text{false}$ **B**

$\frac{5}{7} \times \frac{20}{28} \Rightarrow 5 \times 28 = 7 \times 20$
 $\Rightarrow 140 = 140 \Rightarrow \text{true}$ **C**

The answer is **C**

a) 5 : 12 is equivalent to 25 : 60
True or false?

$$\frac{5}{12} \times \frac{25}{60} \Rightarrow 5 \times 60 = 12 \times 25$$

$$300 = 300 \Rightarrow \boxed{}$$

b) 4 : 9 is equivalent to 16 : 81
True or false?

$$\Rightarrow \boxed{}$$

c) Which ratio is equivalent to 3 : 5?
A) 9 : 25 B) 9 : 15 C) 18 : 25

A $\frac{3}{5} \times \frac{9}{25} \Rightarrow 3 \times 25 = 5 \times 9 \Rightarrow 75 = 45 \text{ (F)}$

B $\frac{3}{5} = \frac{9}{15} \Rightarrow$

C $\Rightarrow \Rightarrow \boxed{}$

d) Which ratio is equivalent to 5 : 6?
A) 10 : 30 B) 25 : 36 C) 35 : 42

A \Rightarrow

B \Rightarrow

C $\Rightarrow \Rightarrow \boxed{}$

e) Which ratio is equivalent to 2 : 7?
A) 8 : 28 B) 10 : 70 C) 4 : 49

A \Rightarrow

B \Rightarrow

C $\Rightarrow \Rightarrow \boxed{}$

f) Which ratio is equivalent to 7 : 9?
A) 21 : 36 B) 49 : 81 C) 35 : 45

A \Rightarrow

B \Rightarrow

C $\Rightarrow \Rightarrow \boxed{}$

Skill 14.6 Completing equivalent ratios (1).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Write the equivalent ratios as two equal fractions.
- Cross multiply the numerators and the denominators of the fractions.
- Equate the products.
- Solve the equation to find the missing number (x).

$$a:b = c:d \quad \text{2 ratios}$$

$$\frac{a}{b} = \frac{c}{d} \quad \text{Cross product}$$

$$a \times d = b \times c$$

$$ad = bc$$

Q. Complete the equivalent ratios:

$$\square : 28 = 12 : 7$$

A. $\frac{x}{28} = \frac{12}{7}$

$$\frac{x}{28} = \frac{12}{7} \quad \text{Cross multiply}$$

$$x \times 7 = 28 \times 12$$

$$7x = 28 \times 12$$

$$\frac{7x}{7} = \frac{28 \times 12}{7} \quad \text{Simplify: } \div 7$$

$$x = 4 \times 12$$

$$x = 48$$

a) Complete the equivalent ratios:

$$3 : \square = 12 : 16$$

$$\frac{3}{x} = \frac{12}{16} \quad \Rightarrow 3 \times 16 = x \times 12$$

$$\frac{12x}{12} = \frac{3 \times 16}{4} \quad \text{Simplify: } \div 3, \div 4$$

$$\Rightarrow x = 4$$

b) Complete the equivalent ratios:

$$24 : 15 = \square : 5$$

$$\frac{24}{15} = \frac{x}{5} \quad \Rightarrow 24 \times 5 = 15 \times x$$

$$\frac{15x}{15} = \frac{24 \times 5}{15} \quad \Rightarrow x =$$

c) Complete the equivalent ratios:

$$3 : 10 = \square : 90$$

\Rightarrow

$\Rightarrow x =$

d) Complete the equivalent ratios:

$$\square : 2 = 45 : 10$$

\Rightarrow

$\Rightarrow x =$

e) Complete the equivalent ratios:

$$\frac{5}{9} = \frac{35}{\square}$$

\Rightarrow

$\Rightarrow x =$

f) Complete the equivalent ratios:

$$\frac{3}{7} = \frac{18}{\square}$$

\Rightarrow

$\Rightarrow x =$

g) Complete the equivalent ratios:

$$\frac{1}{7} = \frac{\boxed{}}{56}$$

⇒

⇒ $x =$

h) Complete the equivalent ratios:

$$\frac{7}{20} = \frac{\boxed{}}{140}$$

⇒

⇒ $x =$

i) Complete the equivalent ratios:

$$\frac{24}{40} = \frac{3}{\boxed{}}$$

⇒

⇒ $x =$

j) Complete the equivalent ratios:

$$\frac{20}{15} = \frac{4}{\boxed{}}$$

⇒

⇒ $x =$

k) Complete the equivalent ratios:

$$\frac{10}{45} = \frac{\boxed{}}{9}$$

⇒

⇒ $x =$

l) Complete the equivalent ratios:

$$\frac{64}{80} = \frac{\boxed{}}{10}$$

⇒

⇒ $x =$

m) Complete the equivalent ratios:

$$\frac{63}{18} = \frac{\boxed{}}{2}$$

⇒

⇒ $x =$

n) Complete the equivalent ratios:

$$\frac{11}{5} = \frac{\boxed{}}{15}$$

⇒

⇒ $x =$

EITHER

- Find the unit price for each case, by dividing the cost price by the quantity.
- Compare the results.

OR

- Use any other method to make the cost price the same or the number the units the same for both deals, e.g. double, triple or halving the cost or the quantity.

Q. Which is cheaper per can?

- A) \$2.50 for a 6-pack
- B) \$6 for a 12-pack

A. Deal A)

$$\frac{\$2.50}{6 \text{ cans}} = \frac{\$0.42}{1 \text{ can}}$$

⇒ unit price = \$0.42

Deal B)

$$\frac{\$6.00}{12 \text{ cans}} = \frac{\$0.50}{1 \text{ can}}$$

⇒ unit price = \$0.50

Deal A) is cheaper.

OR

A. Make the same number of cans:

Deal A)

double the quantity ⇒
double the cost

\$2.50 for 6 cans ⇒
\$5.00 for 12 cans

Deal B)

\$6.00 for 12 cans ⇒

Deal A) is cheaper.

a) Which is cheaper per card?

- A) \$4 for 12 cards
- B) \$6 for 15 cards

make the same cost

A) \$4 for 12 cards ⇒ \$12 for 36 cards

B) \$6 for 15 cards ⇒ \$12 for 30 cards

A

b) Which is cheaper per pen?

- A) \$4 for 6 pens
- B) \$5 for 8 pens

make the same cost

A) _____

B) _____ ⇒

c) Which is cheaper per kilogram?

- A) \$20 for 10 kg
- B) \$40 for 22 kg

A) _____

B) _____ ⇒

d) Which is cheaper per kilogram?

- A) \$16 for 15 kg
- B) \$27 for 25 kg

A) _____

B) _____ ⇒

e) Which is cheaper per apple?

- A) \$4.80 for 4 apples
- B) \$6.50 for 6 apples

A) _____

B) _____ ⇒

f) Which is cheaper per metre?

- A) \$25 for 12 m
- B) \$40 for 17 m

A) _____

B) _____ ⇒

g) Which is the best buy?

- A) a 200 g Vegemite jar at \$3.60
B) a 500 g Vegemite jar at \$8.00

A)
B) ⇒

h) Which is the best buy?

- A) a 300 g pack of lollies at \$7.80
B) a 200 g pack of lollies at \$5.50

A)
B) ⇒

i) Which is the best buy?

- A) a 500 g cereal box at \$6.40
B) a 750 g cereal box at \$9.90

A)
B) ⇒

j) Which is the best buy?

- A) an 8 toilet roll pack at \$4.00
B) a 20 toilet roll pack at \$9.00

A)
B) ⇒

k) Which is the best buy?

- A) a 12 soft drink cans pack at \$20.00
B) an 18 soft drink cans pack at \$24.00

A)
B) ⇒

l) Which is the best buy?

- A) a box of 100 latex gloves at \$11.00
B) a box of 20 latex gloves at \$3.00

A)
B) ⇒

m) Which is the best buy?

- A) a 4 kg bag of onions at \$7.00
B) 4 kg of loose onions at \$1.95 per kg

A)
B) ⇒

n) Which is the best buy?

- A) 3 kg of loose oranges at \$2.50 per kg
B) a 3 kg bag of oranges at \$6.90

A)
B) ⇒

o) Which is the best buy?

- A) a 3 kg bag of potatoes at \$8.00
B) 3 kg of loose potatoes at \$2.98 per kg

A)
B) ⇒

p) Which is the best buy?

- A) a 2 kg bag of tomatoes at \$8.00
B) 2 kg of loose tomatoes at \$4.98 per kg

A)
B) ⇒

Skill 14.8 Finding the ratio of two quantities (1).

- Write the ratio in words.
- Replace the words with numbers.
- Simplify the ratio:

EITHER

- Find the largest number that divides evenly into each quantity of the ratio (Highest Common Factor) and divide each quantity by the HCF.

Hint: The order of the quantities in a ratio matters.

OR

- Divide each quantity of the ratio by any factor until the ratio is reduced to simplest form.

Q. The common metal for medals is 84% copper, and the rest is zinc. Find the ratio of zinc to copper.

A. $zinc = 100\% - 84\% = 16\%$

$zinc : copper$
 $= 16\% : 84\%$ (Ignore the % sign)
 $= \frac{16}{4} : \frac{84}{4}$ (Simplify: $\div 4$)
 $= 4 : 21$

a) The length of the school year in Egypt is 36 weeks and in Indonesia is 44 weeks. Find the ratio of the school year duration in Indonesia compared to Egypt.

Indonesia : Egypt

$44 : 36$ (Simplify: $\div 4$)
 $\div 4$ $\frac{11}{44} : \frac{9}{36}$ $\div 4$ = **11:9**

b) A computer screen with a diagonal of 60 cm has a length of 50 cm. Find the ratio of the length to the diagonal.

length : diagonal

$60 : 50$

= :

c) The alloy platinum is 90% platinum and 10% iridium. Find the ratio of iridium to platinum in the alloy.

iridium : platinum

$10 : 90$
 = :

d) In 1978 only 8% of U.S. households had microwave ovens. As of 2006 over 80% have them. Find the ratio of microwave oven ownership in 2006 to 1978.

$80 : 8$
 = :

e) The 8-carat gold is 33% gold, 20% silver and the rest is copper. Find the ratio of silver to other components.

$20 : 33 + 20$
 = :

f) For children aged 2 to 11 years, an airfare is 75% of the full adult airfare. Find the ratio of child to adult airfares.

$75 : 100$
 = :

g) The Southern Star Observation Wheel (Melbourne) has a capacity of 20 passengers per capsule, and the London Eye has a capacity of 25. Find the ratio of the London Eye passengers per capsule to the Southern Star.

$$= \frac{\quad}{\quad} = \boxed{\quad : \quad}$$

h) The London Eye has 32 capsules, and the Singapore Flyer observation wheel has 28 capsules. Find the ratio of capsules in the Singapore Flyer to capsules in the London Eye.

$$= \frac{\quad}{\quad} = \boxed{\quad : \quad}$$

i) In 2013, of the 100 seats in the US Senate, 20 are held by women. What is the ratio of women to men in the US Senate?

$$= \frac{\quad}{\quad} = \boxed{\quad : \quad}$$

j) Find the ratio of the height of the Statue of Liberty (93 m including the pedestal) to the height of the Eureka Tower, Melbourne (300 m).

$$= \frac{\quad}{\quad} = \boxed{\quad : \quad}$$

k) A soccer field is 120 metres long and 80 metres wide. Find the ratio of width to length.

$$= \frac{\quad}{\quad} = \boxed{\quad : \quad}$$

l) The highest temperature recorded in Africa is 57°C and in South America is 48°C. Find the ratio of the highest temperature in Africa compared to South America.

$$= \frac{\quad}{\quad} = \boxed{\quad : \quad}$$

m) The lowest temperature recorded in Europe is -55°C and in Antarctica is -90°C. Find the ratio of the lowest temperature in Europe compared to Antarctica.

$$= \frac{\quad}{\quad} = \boxed{\quad : \quad}$$

n) The sensory, language and memory centres are located in the temporal lobe, which is 22% of the total cerebral cortex volume in the brain. Find the ratio of the temporal lobe to the rest of the cortex.

$$= \frac{\quad}{\quad} = \boxed{\quad : \quad}$$

Skill 14.9 Finding other rates.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

$$\text{rate} = \frac{\text{amount}}{\text{time}}$$

Rate of change

- Divide the amount by the time taken.
Example: A 300 L bathtub can be filled in 10 minutes.

$$\text{Rate} = \frac{300 \text{ L}}{10 \text{ min}} = 30 \text{ L/min}$$

$$\text{amount} = \text{rate} \times \text{time}$$

Amount

- Multiply the rate by the time taken.
Example: Sam worked 7 h at a rate of \$16/h.

$$\text{Amount (pay)} = 16 \times 7 = \$112$$

$$\text{time} = \frac{\text{amount}}{\text{rate}}$$

Time taken

- Divide the amount by the rate.
Example: A Lexmark E232 prints 990 pages at a rate of 22 pages/min (ppm).

$$\text{Time} = \frac{990 \text{ p}}{22 \text{ ppm}} = 45 \text{ min}$$

Q. Some species of bamboo can grow up to 30 metres per year. At this rate how long will they grow in a month?

A. $\text{rate} = 30 \text{ m per year}$
 $1 \text{ year} = 12 \text{ months}$
 $\text{rate per month} = 30 \text{ m} \div 12 = 2.5 \text{ m}$

a) A Mini Cooper Diesel with a 1.6 L engine emits 104 g/km of the greenhouse gas carbon dioxide (CO₂). How many grams of CO₂ will be emitted during a 400 km trip?

$$\text{amount (g)} = \text{rate (g/km)} \times \text{distance (km)}$$

$$= 104 \text{ g/km} \times 400 \text{ km} = \boxed{41\,600 \text{ g}}$$

b) Most of the Lambert Glacier (Antarctica) moves around 150 metres in 4 months. At this rate how much will it move in 6 months?

$$\text{amount} =$$

$$= \dots = \boxed{\text{m}}$$

c) The Kudzu climbing plant can grow up to 104 m per year. What is this rate in metres per week?

$$1 \text{ year} = 52 \text{ weeks}$$

$$\text{rate/wk} = \dots = \boxed{}$$

d) It takes 45 minutes to fill a 2700 litre swimming pool. What is the average rate in litres per minute?

$$\text{rate} =$$

$$= \dots = \boxed{}$$

e) A Holden Cruze has a fuel consumption of 7 L of petrol per 100 km. How much petrol does it need for a 250 km trip?

$$\text{amount} =$$

$$= \dots = \boxed{ \text{ L}}$$

f) Every glass bottle recycled saves enough energy to light a 100-watt light bulb for 4 hours. How many bottles are needed to light the same bulb for a week?

$$1 \text{ week} =$$

$$\text{bottles} = \dots = \boxed{}$$

g) A Honda Civic Hybrid automatic has a highway consumption of 45 L of petrol per 1000 km. How much petrol does it need for a 200 km trip?

$$\text{amount} =$$

$$= \dots = \boxed{ \text{ L}}$$

h) The annual fuel cost for a Lamborghini Coupe is around \$2490. How much is the cost per month?

$$1 \text{ year} =$$

$$= \dots = \boxed{ \$}$$

15. [Indices / Square Roots]

Skill 15.1 Expressing powers as products and products as powers.

MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

To write a product as a power

- Write the factor as the base.
- Count how many times the factor is multiplied by itself and make the result the index.

To write a power as a product

- Multiply the base by itself the same number of times as indicated by the index.



Q. Write the power as a product:

$7^4 =$

A. $7^4 =$

$= 7 \times 7 \times 7 \times 7$

7 multiplied by itself 4 times

a) Write the product as a power:

$6 \times 6 \times 6 \times 6 \times 6 =$

6^5

5 factors of 6 \Rightarrow
6 is the base
5 the exponent

b) Write the product as a power:

$2 \times 2 \times 2 =$

c) Write the product as a power:

$5 \times 5 =$

d) Write the product as a power:

$4 \times 4 \times 4 \times 4 \times 4 \times 4 =$

e) Write the power as a product:

$8^3 =$

f) Write the power as a product:

$3^4 =$

g) Write the power as a product:

$2^5 =$

h) Write the power as a product:

$9^3 =$

i) Write the product as a power:

$1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 =$

j) Write the product as a power:

$7 \times 7 \times 7 =$

k) Write the power as a product:

$6^4 =$

l) Write the product as a power:

$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 =$

Skill 15.2 Squaring whole numbers.

MM4.2 1 1 2 2 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Multiply the number by itself.

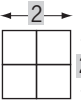
$$1^2 = \text{one squared}$$

$$= \boxed{1} 1 = 1 \text{ square}$$

$$= 1 \times 1$$

$$= \mathbf{1}$$

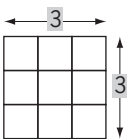
$$2^2 = \text{two squared}$$



$$= 2 \times 2$$

$$= \mathbf{4}$$

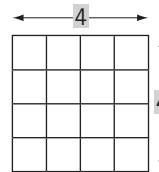
$$3^2 = \text{three squared}$$



$$= 3 \times 3$$

$$= \mathbf{9}$$

$$4^2 = \text{four squared}$$



$$= 4 \times 4$$

$$= \mathbf{16}$$

Q. $90^2 =$

A. $90^2 =$
 $= 90 \times 90$
 $= \mathbf{8100}$

90 multiplied by itself 2 times

$$\begin{array}{r} 8 \\ \times 90 \\ \hline 8100 \end{array}$$

a) $7^2 =$ *7 multiplied by itself 2 times*

$$= 7 \times 7 = \boxed{49}$$

b) $3^2 =$

$$= \dots = \boxed{}$$

c) $2^2 =$

$$= \dots = \boxed{}$$

d) $10^2 =$

$$= \dots = \boxed{}$$

e) $5^2 =$

$$= \dots = \boxed{}$$

f) $1^2 =$

$$= \dots = \boxed{}$$

g) $12^2 =$

$$= \dots = \boxed{}$$

h) $11^2 =$

$$= \dots = \boxed{}$$

i) $0^2 =$

$$= \dots = \boxed{}$$

j) $4^2 =$

$$= \dots = \boxed{}$$

k) $9^2 =$

$$= \dots = \boxed{}$$

l) $20^2 =$

$$= \dots = \boxed{}$$

m) $50^2 =$

$$= \dots = \boxed{}$$

n) $30^2 =$

$$= \dots = \boxed{}$$

o) $70^2 =$

$$= \dots = \boxed{}$$

p) $80^2 =$

$$= \dots = \boxed{}$$

q) $40^2 =$

$$= \dots = \boxed{}$$

r) $60^2 =$

$$= \dots = \boxed{}$$

Skill 15.3 Calculating powers of 10.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Put the same number of zeros in the answer as the index shows.

Example: $10^4 \Rightarrow$ index is 4 so the answer ends in 4 zeros
 $10^4 = 10\,000$

Q. $10^5 =$

A. $10^5 =$ Index is 5

$= 10 \times 10 \times 10 \times 10 \times 10$

$= 100\,000$ Answer ends in 5 zeros

a) $10^9 =$ 10 multiplied by itself 9 times

$= 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

$=$ 1 000 000 000

b) $10^2 =$

$=$

$=$

c) $10^7 =$

$=$

$=$

d) $10^4 =$

$=$

$=$

e) $10^1 =$

$=$

$=$

f) $10^5 =$

$=$

$=$

g) $10^6 =$

$=$

$=$

h) $10^3 =$

$=$

$=$

i) $10^8 =$

$=$

$=$

j) $10^{10} =$

$=$

$=$

Hint: Finding the square root of a number is the reverse of the procedure for squaring a number.

EITHER

- Use trial and error to find the number that, when multiplied by itself, equals the original number.

Example: The square root of 25

$\sqrt{25}$ = the number that when multiplied by itself equals 25

$5 \times 5 = 25$ so

$\sqrt{25} = \sqrt{5 \times 5} = 5$

OR

- Arrange that number of tiles in a square.
- Count the number of tiles along one side length.

← 5 →

| | | | | |
|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 |

Q. $\sqrt{49} =$

A. $\sqrt{49} =$
 $= \sqrt{7 \times 7}$
 $= 7$

The square root of 49 means:
 "what number multiplied by itself equals 49"
 $7 \times 7 = 49$
 $7^2 = 49$

← 7 →

| | | | | | | |
|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | 31 | 32 | 33 | 34 | 35 |
| 36 | 37 | 38 | 39 | 40 | 41 | 42 |
| 43 | 44 | 45 | 46 | 47 | 48 | 49 |

a) $\sqrt{25} =$ 5 multiplied by itself
 $= \sqrt{5 \times 5} =$ 5

b) $\sqrt{9} =$
 $=$

c) $\sqrt{36} =$
 $=$

d) $\sqrt{4} =$
 $=$

e) $\sqrt{16} =$
 $=$

f) $\sqrt{100} =$
 $=$

g) $\sqrt{144} =$
 $=$

h) $\sqrt{121} =$
 $=$

i) $\sqrt{64} =$
 $=$

j) $\sqrt{900} =$
 $=$

k) $\sqrt{4900} =$
 $=$

l) $\sqrt{2500} =$
 $=$

m) $\sqrt{8100} =$
 $=$

n) $\sqrt{3600} =$
 $=$

o) $\sqrt{12100} =$
 $=$

- Observe the index.
- Multiply the number (base) the same number of times by itself as the index shows.
(see skill 15.1, page 123)

Hints: Any number raised to the power of zero (except 0) equals 1.

Example $6^0 = 1$

Any number raised to the power of one equals the number itself.

Example $6^1 = 6$

Q. $5^4 =$

A. $5^4 =$
 $= 5 \times 5 \times 5 \times 5$
 $= 125 \times 5$
 $= 625$

5 multiplied by itself 4 times

"5 raised to the power of 4" means 4 lots of 5 in the equation.

a) $3^5 =$

3 multiplied by itself 5 times

$= 3 \times 3 \times 3 \times 3 \times 3$
 $= 9 \times 9 \times 3 = 243$

b) $2^4 =$

$=$
 $=$ $=$

c) $4^3 =$

$=$
 $=$ $=$

d) $1^4 =$

$=$
 $=$

e) $2^5 =$

$=$
 $=$

f) $4^4 =$

$=$
 $=$

g) $3^4 =$

$=$
 $=$

h) $0^2 =$

$=$
 $=$

i) $2^6 =$

$=$
 $=$

j) $4^0 =$

$=$
 $=$

k) $3^3 =$

$=$
 $=$

l) $5^3 =$

$=$
 $=$

m) $3^6 =$

$=$
 $=$

n) $8^3 =$

$=$
 $=$

o) $4^5 =$

$=$
 $=$

p) $7^0 =$

$=$
 $=$

q) $2^8 =$

$=$
 $=$

r) $9^3 =$

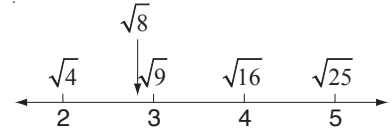
$=$
 $=$

Skill 15.6 Estimating square roots.

- Find the two perfect squares closest to the number under the square root:
one greater than ($>$) the number and
one less than ($<$) the number.
- Take square root of these two numbers to estimate the size of the square root.

Q. Between which two consecutive whole numbers does $\sqrt{8}$ lie?

A. $4 < 8 < 9$
 $\sqrt{4} < \sqrt{8} < \sqrt{9}$
 $\sqrt{4} = 2$
 $\sqrt{9} = 3$
 $2 < \sqrt{8} < 3$



The answer is **2 and 3**

a) Between which two consecutive whole numbers does $\sqrt{72}$ lie?

$\sqrt{64} = 8$ $\sqrt{81} = 9$ \Rightarrow **8 and 9**

b) Between which two consecutive whole numbers does $\sqrt{20}$ lie?

..... \Rightarrow **and**

c) Between which two consecutive whole numbers does $\sqrt{5}$ lie?

..... \Rightarrow **and**

d) Between which two consecutive whole numbers does $\sqrt{60}$ lie?

..... \Rightarrow **and**

e) Between which two consecutive whole numbers does $\sqrt{34}$ lie?

..... \Rightarrow **and**

f) Between which two consecutive whole numbers does $\sqrt{24}$ lie?

..... \Rightarrow **and**

g) Between which two consecutive whole numbers does $\sqrt{80}$ lie?

..... \Rightarrow **and**

h) Between which two consecutive whole numbers does $\sqrt{75}$ lie?

..... \Rightarrow **and**

i) Between which two consecutive whole numbers does $\sqrt{56}$ lie?

..... \Rightarrow **and**

j) Between which two consecutive whole numbers does $\sqrt{99}$ lie?

..... \Rightarrow **and**

k) Between which two consecutive whole numbers does $\sqrt{48}$ lie?

..... \Rightarrow **and**

l) Between which two consecutive whole numbers does $\sqrt{90}$ lie?

..... \Rightarrow **and**

Skill 15.7 Finding powers of negative whole numbers.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Observe the index.
- Multiply the number (base) the same number of times by itself as the index shows.
(see skill 15.1, page 123)
- Give the result a sign.

A negative number raised to an **even index** gives a **positive result**

$$\begin{aligned} (-5)^2 &= -5 \times (-5) \\ &= +25 \end{aligned}$$

A negative number raised to an **odd index** gives a **negative result**

$$\begin{aligned} (-5)^3 &= -5 \times (-5) \times (-5) \\ &= +25 \times (-5) \\ &= -125 \end{aligned}$$

Q. $(-6)^3 =$

A. $(-6^3) =$ *odd index*
 $= -6 \times (-6) \times (-6)$
 $= 36 \times (-6)$
 $= -216$ *negative result*

“-6 raised to the power of 3” means 3 lots of -6 in the equation.

a) $(-3)^4 =$ *even index*
 $= -3 \times (-3) \times (-3) \times (-3)$
 $= 9 \times 9 = 81$ *positive result*

b) $(-2)^4 =$
 $=$
 $=$ $=$

c) $(-6)^2 =$
 $=$
 $=$ $=$

d) $(-1)^7 =$
 $=$
 $=$

e) $(-3)^3 =$
 $=$
 $=$

f) $(-4)^2 =$
 $=$
 $=$

g) $(-2)^3 =$
 $=$
 $=$

h) $(-5)^2 =$
 $=$
 $=$

i) $(-3)^5 =$
 $=$
 $=$

j) $(-4)^4 =$
 $=$
 $=$

k) $(-1)^9 =$
 $=$
 $=$

l) $(-7)^2 =$
 $=$
 $=$

m) $(-2)^6 =$
 $=$
 $=$

n) $(-12)^2 =$
 $=$
 $=$

o) $(-10)^3 =$
 $=$
 $=$

16. [Order of Operations]

Skill 16.1 Using 'order of operations' mixing only \times and/or \div , or $+$ and/or $-$

MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

Order of operations rules

Multiply (\times) and/or divide (\div) in order from left to right.
Add ($+$) and/or subtract ($-$) in order from left to right.

Q. $21 \div 3 \times 4 =$

A. $21 \div 3 \times 4 =$ *work from left to right*
 $= 7 \times 4$ *divide first*
 $= 28$

a) $9 + 13 - 7 =$ *add first*
 $= 22 - 7 = \boxed{15}$

b) $9 - 5 + 3 =$
 $= \dots = \boxed{}$

c) $6 - 3 + 8 =$
 $= \dots = \boxed{}$

d) $3 + 6 - 5 =$
 $= \dots = \boxed{}$

e) $3 \times 6 \div 9 =$
 $= \dots = \boxed{}$

f) $3 \times 3 \times 2 =$
 $= \dots = \boxed{}$

g) $16 + 7 - 3 =$
 $= \dots = \boxed{}$

h) $32 \div 8 \div 2 =$
 $= \dots = \boxed{}$

i) $36 \div 9 \times 5 =$
 $= \dots = \boxed{}$

j) $2 \times 9 \div 3 =$
 $= \dots = \boxed{}$

k) $2 \times 3 \times 4 =$
 $= \dots = \boxed{}$

l) $27 \div 3 \div 3 =$
 $= \dots = \boxed{}$

m) $19 - 5 + 2 =$
 $= \dots = \boxed{}$

n) $13 - 8 + 6 =$
 $= \dots = \boxed{}$

o) $30 \div 6 \times 7 =$
 $= \dots = \boxed{}$

p) $4 \times 6 \div 2 =$
 $= \dots = \boxed{}$

q) $2 \times 5 \times 7 =$
 $= \dots = \boxed{}$

r) $72 \div 12 \times 3 =$
 $= \dots = \boxed{}$

Order of operations rules

Multiply (\times) and/or divide (\div) in order from left to right.
Add ($+$) and/or subtract ($-$) in order from left to right.

Q. $3 + 24 \div 4 \times 2 =$

A. $3 + 24 \div 4 \times 2 =$ *work from left to right*
 $= 3 + 6 \times 2$ *divide first*
 $= 3 + 12$
 $= 15$

a) $2 + 3 \times 5 =$ *multiply first*

$= 15 + 2 = \boxed{17}$

b) $6 + 9 \div 3 =$

$= \dots = \boxed{}$

c) $4 \times 3 - 7 =$

$= \dots = \boxed{}$

d) $2 + 7 \times 4 =$

$= \dots = \boxed{}$

e) $14 - 12 \div 2 =$

$= \dots = \boxed{}$

f) $2 \times 5 + 8 =$

$= \dots = \boxed{}$

g) $18 \div 6 - 3 =$

$= \dots = \boxed{}$

h) $9 + 8 \div 4 =$

$= \dots = \boxed{}$

i) $36 - 6 \times 5 =$

$= \dots = \boxed{}$

j) $14 + 21 \div 7 =$

$= \dots = \boxed{}$

k) $5 + 4 \times 9 =$

$= \dots = \boxed{}$

l) $17 - 12 \div 3 =$

$= \dots = \boxed{}$

m) $6 + 15 \div 3 \times 2 =$

$= 6 + 5 \times 2$ *divide first*
 $= 6 + 10 = \boxed{}$

n) $9 \times 5 - 4 \times 6 =$

$= \dots = \boxed{}$

o) $19 + 16 - 4 \times 7 =$

$= \dots = \boxed{}$

p) $21 \div 3 - 15 \div 5 =$

$= \dots = \boxed{}$

q) $28 + 9 - 7 \times 3 =$

$= \dots = \boxed{}$

r) $4 \times 8 - 18 \div 2 =$

$= \dots = \boxed{}$

s) $5 + 48 \div 8 \times 3 =$

$= \dots = \boxed{}$

t) $10 \times 2 - 44 \div 11 =$

$= \dots = \boxed{}$

u) $22 - 3 \times 6 + 9 =$

$= \dots = \boxed{}$

Order of operations rules

Multiply (×) and/or divide (÷) in order from left to right.
Add (+) and/or subtract (-) in order from left to right.

Q. $14 + (18 - 9) + 7 =$

A. $14 + (18 - 9) + 7 =$ *simplify inside the brackets*
 $= 14 + 9 + 7$ *work from left to right*
 $= 23 + 7$
 $= 30$

a) $16 + 7 - (11 + 9) =$

$= 16 + 7 - 20$

$= 23 - 20 = \boxed{3}$

b) $5 + 4 - (3 - 1) =$

$=$
 $=$ $=$ $\boxed{}$

c) $9 - (3 + 4) + 6 =$

$=$
 $=$ $=$ $\boxed{}$

d) $6 - (9 - 5) + 6 =$

$=$
 $=$ $=$ $\boxed{}$

e) $16 - 1 - (2 + 8) =$

$=$
 $=$ $=$ $\boxed{}$

f) $8 + 15 - (3 + 4) =$

$=$
 $=$ $=$ $\boxed{}$

g) $12 - (4 + 7) + 6 =$

$=$
 $=$ $=$ $\boxed{}$

h) $13 - (11 - 4) - 2 =$

$=$
 $=$ $=$ $\boxed{}$

i) $7 + 6 - (8 - 4) =$

$=$
 $=$ $=$ $\boxed{}$

j) $14 + 9 - (4 + 7) =$

$=$
 $=$ $=$ $\boxed{}$

k) $15 - (7 - 2) + 8 =$

$=$
 $=$ $=$ $\boxed{}$

l) $6 + 9 - (3 + 5) =$

$=$
 $=$ $=$ $\boxed{}$

m) $4 + (13 - 8) + 6 =$

$=$
 $=$ $=$ $\boxed{}$

n) $18 - (10 - 4) - 3 =$

$=$
 $=$ $=$ $\boxed{}$

o) $17 - (6 + 7) + 4 =$

$=$
 $=$ $=$ $\boxed{}$

p) $19 - (3 + 9) - 7 =$

$=$
 $=$ $=$ $\boxed{}$

q) $9 + 16 - (8 + 3) =$

$=$
 $=$ $=$ $\boxed{}$

r) $14 - (16 - 9) + 3 =$

$=$
 $=$ $=$ $\boxed{}$

Order of operations rules

First evaluate inside the brackets.
Then multiply (\times) and/or divide (\div) in order from left to right.
Finally add ($+$) and/or subtract ($-$) in order from left to right.

Q. $12 + 4 \times (3 + 9) =$

A. $12 + 4 \times (3 + 9) =$ *simplify inside the brackets*
 $= 12 + 4 \times 12$ *then multiply*
 $= 12 + 48$
 $= 60$

a) $4 \times (3 + 7) =$ *brackets first*

$= 4 \times 10 = \boxed{40}$

b) $3 \times (5 - 2) =$

$= \dots = \boxed{}$

c) $8 \div (1 + 3) =$

$= \dots = \boxed{}$

d) $18 \div (6 - 3) =$

$= \dots = \boxed{}$

e) $(23 - 3) \div 5 =$

$= \dots = \boxed{}$

f) $(42 - 6) \div 9 =$

$= \dots = \boxed{}$

g) $(12 - 7) \times 4 =$

$= \dots = \boxed{}$

h) $6 \times (8 - 3) =$

$= \dots = \boxed{}$

i) $5 \times (3 + 8) =$

$= \dots = \boxed{}$

j) $14 \div (2 + 5) =$

$= \dots = \boxed{}$

k) $28 \div (7 - 3) =$

$= \dots = \boxed{}$

l) $9 \times (5 + 7) =$

$= \dots = \boxed{}$

m) $9 \div (1 + 2) \times 4 =$

$= \dots$
 $= \dots = \boxed{}$

n) $7 \times 8 - (8 - 2) =$

$= \dots$
 $= \dots = \boxed{}$

o) $12 - 8 \div (2 + 2) =$

$= \dots$
 $= \dots = \boxed{}$

p) $7 + 32 \div (8 - 4) =$

$= \dots$
 $= \dots = \boxed{}$

q) $5 + 4 \times (6 + 2) =$

$= \dots$
 $= \dots = \boxed{}$

r) $6 + (11 - 4) \times 3 =$

$= \dots$
 $= \dots = \boxed{}$

s) $11 - (19 - 3 \times 5) =$

$= \dots$
 $= \dots = \boxed{}$

t) $(6 - 3) \times (9 - 4) =$

$= \dots$
 $= \dots = \boxed{}$

u) $(7 + 2 \times 8) - 15 =$

$= \dots$
 $= \dots = \boxed{}$

Order of operations rules

First evaluate inside the brackets.

Secondly evaluate the powers.

Then multiply (\times) and/or divide (\div) in order from left to right.Finally add ($+$) and/or subtract ($-$) in order from left to right.

Q. $24 - 4^2 \div 8 =$

$$\begin{aligned} \text{A. } 24 - 4^2 \div 8 &= && \text{evaluate the power} \\ &= 24 - 16 \div 8 && \text{then divide} \\ &= 24 - 2 && \text{work from left to right} \\ &= 22 \end{aligned}$$

a) $8 + 9^2 \times 2 =$

$= 8 + 81 \times 2$

$= 8 + 162 = \boxed{170}$

b) $9 - 2^2 \times 2 =$

$=$

$= \dots = \boxed{}$

c) $7 + 2^2 \times 5 =$

$=$

$= \dots = \boxed{}$

d) $3 + (9 - 5)^2 =$

$=$

$= \dots = \boxed{}$

e) $9 + 5^2 \times 2 =$

$=$

$= \dots = \boxed{}$

f) $2 \times (15 - 3)^2 =$

$=$

$= \dots = \boxed{}$

g) $(18 - 10)^2 \div 4 =$

$=$

$= \dots = \boxed{}$

h) $(12 - 7)^2 =$

$=$

$= \dots = \boxed{}$

i) $(8 - 1)^2 =$

$=$

$= \dots = \boxed{}$

j) $16 - 2^2 + 3 \times 1 =$

$=$

$= \dots = \boxed{}$

k) $27 - 18 \div 3^2 - 2 =$

$=$

$= \dots = \boxed{}$

l) $10^2 - (5 - 2) \times 8 =$

$=$

$= \dots = \boxed{}$

m) $(6 - 1 \times 2)^2 =$

$=$

$= \dots = \boxed{}$

n) $21 \div 3 + (9 - 5)^2 =$

$=$

$= \dots = \boxed{}$

o) $24 \div 8 + 2^2 - 4 =$

$=$

$= \dots = \boxed{}$

p) $2 \times 6 + 4 \times 5^2 =$

$=$

$= \dots = \boxed{}$

q) $32 - (9 + 7) \div 2^2 =$

$=$

$= \dots = \boxed{}$

r) $(15 - 9 \div 3)^2 =$

$=$

$= \dots = \boxed{}$

Order of operations rules

First evaluate inside the brackets.
Secondly evaluate the powers.
Then multiply (×) and/or divide (÷) in order from left to right.
Finally add (+) and/or subtract (-) in order from left to right.

Q. $8 + (-4)^3 \div (-2 - 2) =$

A. $8 + (-4)^3 \div (-2 - 2) =$ *evaluate the bracket* $-4 \times -4 \times -4 =$
 $= 8 + (-4)^3 \div -4$ *evaluate the power* $= 16 \times -4$
 $= 8 + (-64) \div -4$ *evaluate the division* $= -64$
 $= 8 + 16$
 $= 24$

a) $-4 - 60 + 3^3 \times 2 =$

$= -4 - 60 + 27 \times 2$

$= -4 - 60 + 54$ *work from left to right*

$= -64 + 54 = \boxed{-10}$

b) $(-3 - 2) \times (-2) - 4^2 =$

$=$

$=$

$=$ $= \boxed{}$

c) $3^2 - (8 + 4) \div (-3) =$

$=$

$=$

$=$ $= \boxed{}$

d) $(-3 - 2)^2 + 4 \times 1 =$

$=$

$=$

$=$ $= \boxed{}$

e) $5 \times 2 + (-3 - 4)^2 =$

$=$

$=$

$=$ $= \boxed{}$

f) $5^2 - (2 + 6) \times (-5) =$

$=$

$=$

$=$ $= \boxed{}$

g) $(-2 - 8)^2 \times 14 \div 7 =$

$=$

$=$

$=$ $= \boxed{}$

h) $10 + (-25) \div 5 - 2^3 =$

$=$

$=$

$=$ $= \boxed{}$

i) $-3 \times 5 - 4^2 \times 2 =$

$=$

$=$

$=$ $= \boxed{}$

j) $(-1)^3 - 2 \times 4 \div 2 =$

$= -1 - 2 \times 4 \div 2$

$=$

$=$ $= \boxed{}$

k) $1 + (-1)^3 \div (5 - 6) =$

$=$

$=$

$=$ $= \boxed{}$

l) $15 + 30 \div 6 - 2^3 =$

$=$

$=$

$=$ $= \boxed{}$

Order of operations rules

First evaluate inside the brackets.
Secondly evaluate the powers.
Then multiply (\times) and/or divide (\div) in order from left to right.
Finally add ($+$) and/or subtract ($-$) in order from left to right.

Q. $\sqrt{25} \times 2^3 - 7 =$

A. $\sqrt{25} \times 2^3 - 7 =$ *evaluate the square root*
 $= 5 \times 8 - 7$ *evaluate the power*
 $= 40 - 7$
 $= 33$

a) $\sqrt{25 + 144} =$

$= \sqrt{169}$

$= \sqrt{13 \times 13} =$

b) $\sqrt{16 + 9} =$

$=$
 $=$

c) $\sqrt{6^2 + 8^2} =$

$=$
 $=$

d) $\sqrt{64} \times 2 + 2^2 =$

$=$
 $=$
 $=$

e) $\sqrt{25} + 16 \div 2^2 =$

$=$
 $=$
 $=$

f) $\sqrt{81} \div 3^2 + 9 =$

$=$
 $=$
 $=$

g) $2^3 \times \sqrt{36} - 20 =$

$=$
 $=$
 $=$

h) $18 - 4^3 \div \sqrt{4} =$

$=$
 $=$
 $=$

i) $\sqrt{25} \times 2^3 - 7 =$

$=$
 $=$
 $=$

j) $50 - 3 \times \sqrt{100} + 2^3 =$

$=$
 $=$
 $=$

k) $3 \times \sqrt{49} + 4 - 2^3 =$

$=$
 $=$
 $=$

l) $13 + 5^2 \div \sqrt{25} =$

$=$
 $=$
 $=$

17. [Exploring Numbers]

Skill 17.1 Comparing whole numbers.

MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Compare the size of the digits in the same place, one at a time.
- Work from left to right across each number.

Q. Which number is the largest?

- A) 24 706
B) 24 670
C) 24 760

A. C

Tens of thousands and thousands:

All numbers have the same digit in the tens of thousands place (2), and the same digit in the thousands place (4).

Hundreds:

In the hundreds place 7 is greater than 6. So A and C are greater than B.

Tens:

In the tens place 6 is greater than 0. So 24 760 is greater than 24 706.

> means "is greater than"

< means "is less than"

a) $45\ 804 > 45\ 480$
True or false?

compare the hundreds place

$8 > 4$

⇒

true

b) $3207 < 3072$
True or false?

⇒

c) $60\ 198 > 61\ 980$
True or false?

⇒

d) $9137 < 9317$
True or false?

⇒

e) $52\ 620 > 52\ 260$
True or false?

⇒

f) $7548 > 7584$
True or false?

⇒

g) Which number is the largest?

- A) 1805
B) 1850
C) 1800

compare the digits in the tens place

$5 > 0$

⇒

B

h) Which number is the largest?

- A) 30 931
B) 30 391
C) 30 913

⇒

i) Which number is the largest?

- A) 19 054
B) 19 504
C) 19 450

⇒

j) Which number is the largest?

- A) 2380
B) 2083
C) 2308

⇒

k) Which number is the largest?

- A) 62 075
B) 62 570
C) 62 750

⇒

l) Which number is the largest?

- A) 47 091
B) 47 190
C) 47 019

⇒

Skill 17.2 Understanding and finding the place value of a digit in a number (1) MM4.2 1 1 2 2 3 3 4 4
AM5.1 1 1 2 2 3 3 4 4

- Compare the position of the digit to the position of the decimal point.
Hint: There is a decimal point which is not written, at the end of any whole number.

| Place value | tens of thousands | thousands | hundreds | tens | units | tenths | hundredths | thousandths |
|-------------|-------------------|-----------|----------|----------|----------|----------------|-----------------|------------------|
| Value | 30 000 | 6 000 | 100 | 50 | 8 | $\frac{2}{10}$ | $\frac{4}{100}$ | $\frac{7}{1000}$ |
| | 3 | 6 | 1 | 5 | 8 | . | 2 | 4 |
| | | | | | | | | |

↑
Decimal point

Q. What is the value of the underlined digit in the number 36 158.247? **A.** 30 000 Consider the position of the digit 3 to that of the decimal point. 3 is five places to the left so it is in the tens of thousands place. The 3 represents 3 tens of thousands or 30 000

a) In the number 14058 which digit is in the tens place? 5

b) In the number 9023 which digit is in the units place?

c) In the number 5836 which digit is in the hundreds place?

d) In the number 24 108 which digit is in the thousands place?

e) In the number 16.253 which digit is in the units place?

f) In the number 0.017 which digit is in the hundredths place?

g) In the number 45.809 which digit is in the tenths place?

h) In the number 0.0874 which digit is in the thousandths place?

i) What is the value of the underlined digit in the number 259?
5 tens ⇒ 50

j) What is the value of the underlined digit in the number 3270? ⇒

k) What is the value of the underlined digit in the number 16092? ⇒

l) What is the value of the underlined digit in the number 86925? ⇒

m) What is the value of the underlined digit in the number 5124?

..... ⇒

n) What is the value of the underlined digit in the number 73061?

..... ⇒

o) What is the value of the underlined digit in the number 29603?

..... ⇒

p) What is the value of the underlined digit in the number 8714?

..... ⇒

q) What is the value of the underlined digit in the number 35.043?

4 hundredths = $\frac{4}{100}$ =

r) What is the value of the underlined digit in the number 5.082?

2 thousandths =

s) What is the value of the underlined digit in the number 0.98?

..... =

t) What is the value of the underlined digit in the number 1.076?

..... =

u) In which number does the digit 4 have greater value? A) 4.65
B) 30.4

A) value 4

B) value 0.4 $4 > 0.4$ ⇒

v) In which number does the digit 6 have greater value? A) 20406
B) 1063

A)

B) ⇒

w) In which number does the digit 1 have greater value? A) 3.15
B) 1.98

A)

B) ⇒

x) In which number does the digit 9 have greater value? A) 4907
B) 10892

A)

B) ⇒

y) In which number does the digit 3 have greater value? A) 8.931
B) 1.375

A)

B) ⇒

z) In which number does the digit 5 have greater value? A) 0.652
B) 0.526

A)

B) ⇒

- Write the digits in order.
- Leave a space between the thousands and the hundreds, and between the millions and the hundreds of thousands.
- Write a zero in any place that is left empty between other digits.

Q. Express in numerals:
fifty thousand, six hundred and nine

A. 50 609

| <i>Tens of Th.</i> | <i>Th.</i> | <i>H</i> | <i>T</i> | <i>U</i> |
|--------------------|------------|----------|----------|----------|
| 5 | 0 | 6 | 0 | 9 |

First write 50 for the words "fifty thousand"; then write a comma.

Write the digit 6 for the hundreds, then write the digit 0, because there are no tens. Finally write the digit 9 for the units.

a) Express in numerals:
two hundred and fifteen

215

b) Express in numerals:
four thousand, one hundred
and fifty

c) Express in numerals:
six thousand and eighty-two

d) Express in numerals:
eight thousand, one hundred
and seventeen

e) Express in numerals:
nine hundred and two

f) Express in numerals:
three thousand, four hundred

g) Express in numerals:
two hundred and ninety-eight

h) Express in numerals:
seven thousand, three hundred
and nine

i) Express in numerals:
five hundred and thirty

j) Express in numerals:
twelve thousand, six hundred

k) Express in numerals:
seven hundred and fourteen

l) Express in numerals:
fourteen thousand and
sixty-three

m) Express in numerals:
sixty thousand, five hundred
and forty

n) Express in numerals:
thirty-one thousand and
seven

o) Express in numerals:
four hundred and three
thousand, two hundred

p) Express in numerals:
eight hundred thousand
and fifty

q) Express in numerals:
one million, nine hundred
thousand and twenty-six

r) Express in numerals:
seven million, six
hundred thousand and
forty

- Start from left and write the word for each digit (unless it is a 0), followed by its place value.
- Do not write anything for any 0's.

word first!

200 = two hundred

place next

To write 2-digit numbers in words

- Use a hyphen (-) to separate the word for the tens from the word for the units, for all numbers from 21 to 99; e.g. 67 is written as sixty-seven.

Hint: Some 2-digit numbers have names that do not follow the usual rules. Use the following:

| | | | | |
|-----------|------------|-------------|--------------|-------------|
| 10 ten | 50 fifty | 90 ninety | 14 fourteen | 18 eighteen |
| 20 twenty | 60 sixty | 11 eleven | 15 fifteen | 19 nineteen |
| 30 thirty | 70 seventy | 12 twelve | 16 sixteen | |
| 40 forty | 80 eighty | 13 thirteen | 17 seventeen | |

To write 3-digit numbers in words

- Describe the number of hundreds first. Always write 'hundred' not 'hundreds'.
- Write 'and' after the word 'hundred', if other values follow.

To write 4-digit numbers in words

- Describe the number of thousands first. Always write 'thousand' not 'thousands'.
- Write 'and' between the word 'thousand' and the following numerals when hundreds are missing.

To write 5-digit numbers in words

- Describe the number of thousands by following the rules for 2-digit numbers.

To write 6-digit numbers in words

- Describe the number of thousands by following the rules for 3-digit numbers.

Q. Write the number 7069 in words.

A. *seven thousand and sixty-nine*

| Th. | H | T | U |
|-----|---|---|---|
| 7 | 0 | 6 | 9 |

7 thousands, 0 hundreds, 6 tens and 9 units become in words:
seven thousand and sixty-nine

a) Write the number 318 in words.

three hundred and eighteen

b) Write the number 65 in words.

c) Write the number 90 in words.

d) Write the number 413 in words.

e) Write the number 706 in words.

f) Write the number 520 in words.

g) Write the number 800 in words.

h) Write the number 609 in words.

i) Write the number 570 in words.

j) Write the number 1600 in words.

k) Write the number 4200 in words.

l) Write the number 2004 in words.

m) Write the number 5007 in words.

n) Write the number 3012 in words.

o) Write the number 8040 in words.

p) Write the number 35 000 in words.

q) Write the number 86 000 in words.

r) Write the number 19 000 in words.

s) Write the number 10 700 in words.

t) Write the number 24 300 in words.

u) Write the number 15 090 in words.

v) Write the number 17 008 in words.

w) Write the number 903 000 in words.

x) Write the number 406 000 in words.

y) Write the number 102 000 in words.

z) Write the number 905 000 in words.

Skill 17.5 Rounding whole numbers to a given place.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Circle the digit to the right of the requested place.
- If this digit is 0, 1, 2, 3 or 4 (< 5) - **round down** - keep the digit in the requested place the same.
5, 6, 7, 8 or 9 (≥ 5) - **round up** - add 1 to the digit in the requested place.
- Keep the number of digits in the answer the same as in the question by using zeros to fill the vacated spaces.

Q. Round 4067 to the nearest hundred.

A. 4100

| Th. | H | T | U | ⇒ | Th. | H | T | U |
|-----|---|---|---|---|-----|---|---|---|
| 4 | 0 | 6 | 7 | | 4 | 1 | 0 | 0 |

The digit to the right of the hundreds place is 6.

$6 \geq 5$ so round up.

Add 1 to the 0 in the hundreds place to make 1.

Put zeros in the tens and units places.

a) Round 12 360 to the nearest thousand.

12360 3 < 5 round down
by keeping 2 ⇒ 12 000

b) Round 345 to the nearest ten.

..... ⇒

c) Round 2574 to the nearest hundred.

..... ⇒

d) Round 806 to the nearest ten.

..... ⇒

e) Round 221 to the nearest ten.

..... ⇒

f) Round 34 220 to the nearest thousand.

..... ⇒

g) Round 1657 to the nearest hundred.

..... ⇒

h) Round 71 635 to the nearest thousand.

..... ⇒

i) Round 4907 to the nearest ten.

..... ⇒

j) Round 1449 to the nearest hundred.

..... ⇒

k) Round 20 506 to the nearest thousand.

..... ⇒

l) Round 3650 to the nearest hundred.

..... ⇒

m) Round 168 to the nearest ten.

..... ⇒

n) Round 5630 to the nearest hundred.

..... ⇒

- Line up the decimal numbers at their decimal points.
- Compare digits in the same places, starting from the left, until you find the smallest digit.
Hint: The number with the smallest digit will be the smallest number.
- Look for the second smallest number.
- Continue in this way until you find the largest number.

Q. Place in ascending order:
0.27, 0.07, 0.207, 0.702

| | | | | | |
|--------------|----------|----------|----------|------------|-------------|
| | | units | tenths | hundredths | thousandths |
| | U | . | T | H | Th |
| 3rd | 0 | . | 2 | 7 | |
| smallest 1st | 0 | . | 0 | 7 | |
| 2nd | 0 | . | 2 | 0 | 7 |
| largest 4th | 0 | . | 7 | 0 | 2 |

A. 0.07, 0.207, 0.27, 0.702

Find the smallest digits.
Work from left to right.

Units: all 0
Tenths: $0 < 2 < 7$
so 0.07 is the smallest
0.702 is the largest
either 0.207 or 0.27 is the 2nd smallest
Hundredths: $0 < 7$
so 0.207 is the 2nd smallest
0.27 is the 3rd smallest

a) Place in order from largest to smallest:
0.096, 0.69, 0.609, 0.09

| | | | | |
|----------|----------|----------|----------|-----------|
| <u>U</u> | <u>.</u> | <u>T</u> | <u>H</u> | <u>Th</u> |
| 0 | . | 0 | 9 | 6 |
| 0 | . | 6 | 9 | |
| 0 | . | 6 | 0 | 9 |
| 0 | . | 0 | 9 | |

the largest number

the smallest number

b) Place in ascending order:
0.047, 0.74, 0.407, 0.074

| | | | | |
|----------|----------|----------|----------|-----------|
| <u>U</u> | <u>.</u> | <u>T</u> | <u>H</u> | <u>Th</u> |
| | . | | | |
| | . | | | |
| | . | | | |
| | . | | | |

c) Place in ascending order:
0.508, 0.08, 0.085, 0.58

d) Place in descending order:
0.135, 0.53, 0.105, 0.513

e) Place in ascending order:
0.807, 0.07, 0.87, 0.087, 0.708

f) Place in order from smallest to largest:
0.364, 0.063, 0.63, 0.34, 0.043

g) Place in order from largest to smallest:
0.239, 0.209, 0.093, 0.302, 0.3

h) Place in ascending order:
0.156, 0.105, 0.51, 0.016, 0.065

Skill 17.7 Comparing and ordering fractions.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Find the least common denominator of the fractions, which is the Lowest Common Multiple (LCM) of the denominators.
- Change the fractions to equivalent fractions with the lowest common denominator.
- Arrange the fractions in order of the numerators (the smallest fraction has the smallest numerator and so on).

smallest numerator = smallest fraction $\frac{1}{6} < \frac{3}{6} < \frac{5}{6}$ same denominator

Hint: If unsure which is the LCM of the denominators, use their product as the common denominator. When the smaller denominators divide evenly into the biggest denominator, this biggest number becomes the common denominator.

Q. Place in ascending order:

$$\frac{3}{5}, \frac{1}{2}, \frac{2}{3}$$

A. $\frac{1}{2}, \frac{3}{5}, \frac{2}{3}$

$$\frac{3}{5}, \frac{1}{2}, \frac{2}{3}$$

LCM of 2, 5 and 3
is $2 \times 5 \times 3 = 30$

$$\frac{3 \times 6}{5 \times 6} = \frac{18}{30}$$

$$\frac{1 \times 15}{2 \times 15} = \frac{15}{30}$$

$$\frac{2 \times 10}{3 \times 10} = \frac{20}{30}$$

$$\Rightarrow 15 < 18 < 20, \text{ so } \frac{15}{30} < \frac{18}{30} < \frac{20}{30}$$

$$\text{or } \frac{1}{2} < \frac{3}{5} < \frac{2}{3}$$

a) Which fraction has greater value?

$$\frac{3}{8} \text{ or } \frac{2}{5} \quad \text{LCM of 8 and 5 is 40}$$

$$\frac{3 \times 5}{8 \times 5} = \frac{15}{40} \quad \frac{2 \times 8}{5 \times 8} = \frac{16}{40} \Rightarrow \frac{15}{40} < \frac{16}{40} \Rightarrow \boxed{\frac{2}{5}}$$

b) Which fraction has greater value?

$$\frac{5}{8} \text{ or } \frac{5}{11}$$

$$\dots\dots\dots \boxed{\phantom{\frac{5}{11}}}$$

c) Which fraction has greater value?

$$\frac{3}{5} \text{ or } \frac{7}{10}$$

$$\dots\dots\dots \boxed{\phantom{\frac{7}{10}}}$$

d) Which fraction has greater value?

$$\frac{4}{9} \text{ or } \frac{5}{12}$$

$$\dots\dots\dots \boxed{\phantom{\frac{5}{12}}}$$

e) Place in order from smallest to largest:

$$\frac{1}{2}, \frac{5}{8}, \frac{3}{5} \quad \text{LCM of 2, 8 and 5 is } 8 \times 5 = 40$$

$$\frac{1 \times 20}{2 \times 20} = \frac{20}{40} \quad \frac{5 \times 5}{8 \times 5} =$$

$$\dots\dots\dots \boxed{\phantom{\frac{5 \times 5}{8 \times 5}}}$$

f) Place in order from largest to smallest:

$$\frac{5}{6}, \frac{4}{5}, \frac{9}{10}$$

$$\dots\dots\dots \boxed{\phantom{\frac{9}{10}}}$$

To round a decimal number to the nearest whole number

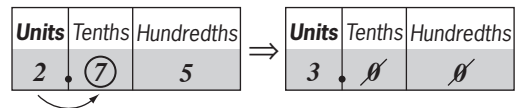
- Circle the first digit after the decimal point.
- If this digit is: 0, 1, 2, 3 or 4 (< 5) - **round down** - keep the unit digit unchanged and drop all the digits after the decimal point.
- 5, 6, 7, 8 or 9 (≥ 5) - **round up** - add 1 to the unit digit and drop all the digits after the decimal point.

To round a decimal number to a given place (One decimal place means tenths, two decimal places means hundredths and three decimal places means thousandths.)

- Circle the digit to the right of the requested place.
- If this digit is: 0, 1, 2, 3 or 4 (< 5) - **round down** - keep the digit in the requested place unchanged and drop all following digits.
- 5, 6, 7, 8 or 9 (≥ 5) - **round up** - add 1 to the digit in the requested place and drop all following digits.

Q. Round 2.75 to the nearest whole number.

A. 3



The first digit after the decimal point is 7.
 $7 \geq 5$ so round up.
 Add 1 to the 2 in the units place to make 3.
 Omit the digits after the decimal point.

a) Round 13.4 to the nearest whole number.

13.4 4 < 5 round down by keeping 3 ⇒ 13

b) Round 17.97 to the nearest whole number.

..... ⇒

c) Round 45.85 to the nearest whole number.

..... ⇒

d) Round 2.468 to the nearest whole number.

..... ⇒

e) Round 1.8736 to three decimal places.

1.8736 6 ≥ 5 round up by adding 1 to 3 ⇒

f) Round 18.683 to two decimal places.

..... ⇒

g) Round 0.59 to one decimal place.

..... ⇒

h) Round 9.81 to one decimal place.

..... ⇒

i) Round 7.843 to two decimal places.

..... ⇒

j) Round 0.0856 to three decimal places.

..... ⇒

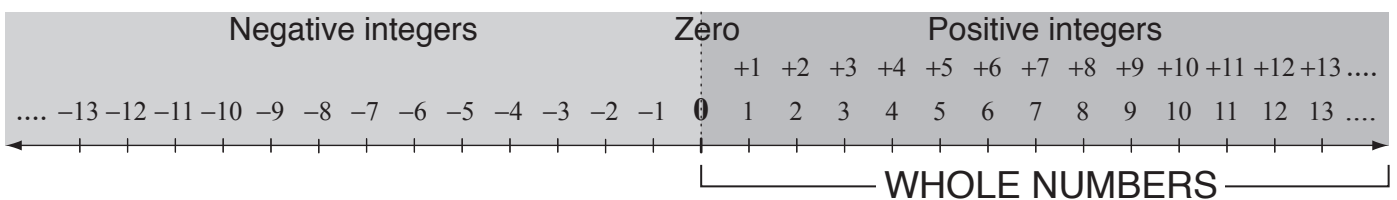
k) Round 0.52 to one decimal place.

..... ⇒

l) Round 0.1968 to three decimal places.

..... ⇒

INTEGERS



Whole Numbers

Negative integers, fractions and decimals are **not** whole numbers apart from these 2 situations:

- 1) Any positive fraction whose numerator is divisible by the denominator. $\frac{12}{4} = 3$
- 2) Any positive decimal with only zeros after the decimal point. $8.00 = 8$

Integers

Fractions and decimals are **not** integers, apart from these 2 situations:

- 1) Any fraction whose numerator is divisible by the denominator. $-\frac{5}{1} = -5$
- 2) Any decimal with only zeros after the decimal point. $-3.00 = -3$

Q. Choose the whole numbers from this list:

$-19, 8.2, \frac{6}{2}, -\frac{7}{5}, 34, 0$

A. -19 is negative, so not a whole number
 8.2 is a decimal, so not a whole number
 $\frac{6}{2} = 6 \div 2 = 3$ is a whole number
 $-\frac{7}{5}$ is a fraction, so not a whole number
 So $\frac{6}{2}, 34, 0$ are whole numbers.

a) Choose the whole numbers from this list:

$\textcircled{68}, \frac{9}{5}, -31, 0.24, \textcircled{7}$

68, 7

b) Choose the whole numbers from this list:

$7\frac{1}{6}, 52, -100, 3.14, 98$

c) Choose the whole numbers from this list:

$\frac{3}{10}, 79, -95, 4.86, 21$

d) Choose the whole numbers from this list:

$0.095, \frac{8}{11}, 250, -72, 13$

e) Choose the integers from this list:

$-1512, \frac{1}{14}, 54.32, 48, 60$

f) Choose the integers from this list:

$21, 1\frac{1}{9}, -4, -3.27, 7500$

g) Choose the integers from this list:

$-63, \frac{3}{5}, 0.72, 0, -824$

h) Choose the integers from this list:

$\frac{25}{5}, 7.823, -1, -\frac{4}{7}, 110$

i) Choose the integers from this list:

$-0.68, \frac{12}{4}, 71, -54, -1039$

j) Choose the integers from this list:

$30, -11, \frac{10}{2}, 6.25, 4000$

Rational Numbers

Include all **Integers**

$$-2, 0, 700, \frac{5}{1}, \frac{25}{5}$$

all **Fractions**

$$-\frac{3}{4}, \frac{12}{85}, \frac{23}{500}$$

all **Terminating decimals**

$$2.16, -5.753469$$

all **Square roots of perfect squares**

$$\sqrt{9}, \sqrt{16}$$

Q. Which numbers are rational?

A) 0.17

B) π

C) $\sqrt{3}$

D) -26

A. A) 0.17 is rational (terminating decimal)B) π is not rational (an infinite non-repeating decimal)C) $\sqrt{3}$ is not rational (square root of a prime number)

D) -26 is rational (negative integer)

So **A and D** are rational.**a)** Choose the rational numbers from the list:

$$\sqrt{12}, \left(\frac{1}{3}\right), (7.95), \pi, (-24)$$

b) Choose the rational numbers from the list:

$$-150, \frac{\pi}{2}, 0.72, \frac{18}{101}, -\sqrt{6}$$

c) Choose the rational numbers from the list:

$$-\frac{19}{3}, 3.1415, \sqrt{80}, 15, -4$$

d) Choose the rational numbers from the list:

$$\frac{14}{569}, 98, 3.58904, \sqrt{50}, -79$$

e) Which numbers are rational?

A) $\sqrt{10}$

B) π

C) 3.1415

D) $\frac{7}{8}$

and

f) Which numbers are rational?

A) π

B) 0.0004

C) $\frac{3}{4}$

D) $\sqrt{20}$

and

g) Which numbers are rational?

A) 8.2323

B) $\sqrt{3}$

C) $1\frac{1}{7}$

D) $-\frac{\pi}{4}$

and

h) Which numbers are rational?

A) -1

B) $\sqrt{5}$

C) $\frac{\pi}{3}$

D) $\frac{23}{800}$

and

i) Which is **not** a rational number?

A) $\sqrt{7}$

B) -360

C) 2.518

D) $-\frac{4}{9}$

j) Which is **not** a rational number?

A) 0.085

B) -1996

C) $-\frac{\pi}{2}$

D) $\frac{34}{71}$

18. [Multiples / Factors / Primes]

Skill 18.1 Finding the multiples of a number.

MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

EITHER

- Count by the number i.e. add the number to itself continuously.

OR

- Multiply the number by 1, then 2, 3, 4, 5, etc. to get the multiples in order.

Q. List all the multiples of 5 up to 25.

A. $5 \times 1 = 5$

$5 \times 2 = 10$

$5 \times 3 = 15$

$5 \times 4 = 20$

$5 \times 5 = 25$

$\Rightarrow 5, 10, 15, 20, 25$

a) List all the multiples of 8 up to 32.

b) List all the multiples of 2 up to 14.

$8 + 8 = 16, 16 + 8 = 24, 24 + 8 = 32$ *keep adding 8*

8, 16, 24, 32

c) List all the multiples of 10 up to 50.

d) List all the multiples of 3 up to 21.

e) List all the multiples of 6 up to 36.

f) List all the multiples of 11 up to 66.

g) List all the multiples of 8 up to 40.

h) List all the multiples of 9 up to 45.

i) List all the multiples of 7 up to 35.

j) List all the multiples of 12 up to 60.

Skill 18.2 Finding the common multiples of two numbers.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- List the multiples of each number.
- Compare the lists to find any numbers the same (common multiples).

Q. List the common multiples of 4 and 5 up to 50.

A. *Multiples of 4:*
4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52
Multiples of 5:
5, 10, 15, 20, 25, 30, 35, 40, 45, 50
Common multiples of 4 and 5 up to 50:
⇒ 20, 40

a) List the common multiples of 3 and 6 up to 20.

3, 6, 9, 12, 15, 18 *multiples of 3*

6, 12, 18 *multiples of 4*

6, 12, 18

b) List the common multiples of 4 and 7 up to 30.

c) List the common multiples of 2 and 9 up to 60.

d) List the common multiples of 6 and 8 up to 50.

e) List the common multiples of 4 and 6 up to 32.

f) List the common multiples of 3 and 8 up to 60.

g) List the common multiples of 5 and 8 up to 90.

h) List the common multiples of 7 and 9 up to 100.

Skill 18.3 Finding the lowest common multiple (LCM) of two numbers.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- List the multiples of each number.
 - Compare the lists and find the lowest matching number (Lowest Common Multiple, LCM).
- Hints: If one number divides evenly into the other number then the LCM is the larger number.
If two numbers have 1 as their only common factor then the LCM is their product.*

Q. What is the lowest common multiple (LCM) of 10 and 12?

A. *Multiples of 10:*
10, 20, 30, 40, 50, 60, 70, 80
Multiples of 12:
12, 24, 36, 48, 60, 72, 84
Lowest Common Multiple (LCM):
60

a) What is the lowest common multiple (LCM) of 3 and 8?

3, 6, 9, 12, 15, 18, 21, 24, 27 multiples of 3

8, 16, 24, 32 multiples of 8

24

b) What is the lowest common multiple (LCM) of 4 and 7?

.....

.....

c) What is the lowest common multiple (LCM) of 2 and 11?

.....

.....

d) What is the lowest common multiple (LCM) of 5 and 9?

.....

.....

e) What is the lowest common multiple (LCM) of 3 and 18?

.....

.....

f) What is the lowest common multiple (LCM) of 4 and 20?

.....

.....

g) What is the lowest common multiple (LCM) of 6 and 12?

.....

.....

h) What is the lowest common multiple (LCM) of 6 and 8?

.....

.....

i) What is the lowest common multiple (LCM) of 8 and 12?

.....

.....

j) What is the lowest common multiple (LCM) of 9 and 15?

.....

.....

To decide if a number is a factor of another number

- Divide the first number into the second number.
- Check the remainder:
 - If the number divides evenly, then it is a factor.
 - If the number does not divide evenly, then it is not a factor.

Hint: A number always has at least 2 factors, 1 and the number itself.

To find all the factors of a number

- Use trial and error. Be systematic.
Divide 2 into the number. If 2 divides evenly then 2 and the result are factors of the number.
Divide 3 into the number. If 3 divides evenly then 3 and the result are factors of the number.
Divide 4 into the number. If 4 divides evenly then 4 and the result are factors of the number.

Q. List all the factors of 10 in ascending order.

A. $10 \div 1 = 10$
 $10 \div 2 = 5$
 $10 \div 3 = 3 \text{ remainder } 1$
 $10 \div 4 = 2 \text{ remainder } 2$
 $10 \div 5 = 2$ — Back to 5 & 2 so possibilities exhausted
 $\Rightarrow 1, 2, 5, 10$

a) Is 2 a factor of 471?

$$471 \div 2 = 235 \text{ remainder } 1$$

no

b) Is 6 a factor of 282?

$$282 \div 6 =$$

c) Is 3 a factor of 142?

d) Is 4 a factor of 212?

e) List all the factors of 25 in ascending order.

f) List all the factors of 28 in ascending order.

g) What is the smallest positive integer that has exactly three factors?

h) What is the smallest positive integer that has exactly nine factors?

i) The number 25 has exactly three factors: 1, 5, 25. Find the next number after 25 that has exactly three factors.

j) The number 12 has exactly six factors: 1, 2, 3, 4, 6 and 12. Find the next number after 12 that has exactly six factors.

Skill 18.5 Finding the common factors of two numbers.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- List the factors of each number.
- Compare the lists and find any matching numbers (common factors).

Q. List all the common factors of 18 and 42.

A. *Factors of 18:*

1, 2, 3, 6, 9, 18

Factors of 42:

1, 2, 3, 6, 7, 14, 21, 42

Common factors of 18 and 42:

1, 2, 3, 6

a) List all the common factors of 8 and 36.

1, 2, 4, 8 factors of 8

1, 2, 3, 4, 6, 9, 12, 18, 36 factors of 36

1, 2, 4

b) List all the common factors of 12 and 15.

.....
.....
.....

c) List all the common factors of 20 and 44.

.....
.....

d) List all the common factors of 20 and 50.

.....
.....

e) List all the common factors of 27 and 45.

.....
.....

f) List all the common factors of 15 and 50.

.....
.....

g) List all the common factors of 18 and 54.

.....
.....

h) List all the common factors of 28 and 70.

.....
.....

Skill 18.6 Finding the highest common factor (HCF) of two numbers.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- List the factors of each number.
- Compare the lists and find the highest matching number (Highest Common Factor, HCF).

Q. What is the highest common factor (HCF) of 24 and 60?

A. *Factors of 24:*

1, 2, 3, 4, 6, 8, 12, 24

Factors of 60:

1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

Highest common factor (HCF):

⇒ 12

a) What is the highest common factor (HCF) of 24 and 32?

1, 2, 3, 4, 6, 8, 12, 24 factors of 24

1, 2, 4, 8, 16, 32 factors of 32

8

b) What is the highest common factor (HCF) of 16 and 26?

.....

.....

c) What is the highest common factor (HCF) of 30 and 35?

.....

.....

d) What is the highest common factor (HCF) of 20 and 50?

.....

.....

e) What is the highest common factor (HCF) of 24 and 48?

.....

.....

f) What is the highest common factor (HCF) of 45 and 63?

.....

.....

g) What is the highest common factor (HCF) of 28 and 42?

.....

.....

h) What is the highest common factor (HCF) of 24 and 54?

.....

.....

i) What is the highest common factor (HCF) of 12 and 44?

.....

.....

j) What is the highest common factor (HCF) of 30 and 75?

.....

.....

To decide if a number is prime

- Find all the factors of the number to determine if it has exactly 2 factors, 1 and itself. (see skill 18.4, page 154)

Hint: 0 and 1 are not prime or composite numbers.

To decide if a number is composite

- Find all the factors of the number to determine if it has more than 2 factors.

Q. List all the prime numbers between 7 and 14.

A. List the factors of each number:

- | | |
|-------------------|--------------------------|
| 7 (1,7) | 11 (1,11) |
| 8 (1,8), (2,4) | 12 (1, 12), (2,6), (3,4) |
| 9 (1,9), (3,3) | 13 (1, 13) |
| 10 (1, 10), (2,5) | 14 (1,14), (2,7) |

Prime numbers (only 2 factors):

⇒ 7, 11, 13

a) Choose the composite numbers:

0, 1, 2, 3, 4, 5, 6, 7

0 & 1 are not composite; 3, 5 & 7 are prime

2 is the only even prime; 4 & 6 are even

4, 6

b) Choose the composite numbers:

8, 9, 10, 11, 12, 13, 14, 15

.....
.....

c) What is the prime number just before 53?

.....

d) What is the next prime number after 100?

.....

e) What is the next prime number after 41?

.....

f) What is the next prime number after 79?

.....

g) List all the prime numbers between 40 and 50

.....
.....

h) Choose the composite numbers: 16, 17, 18, 19, 20, 21, 22, 23

.....
.....

i) What is the prime number just before 88?

.....

j) What is the next prime number after 90?

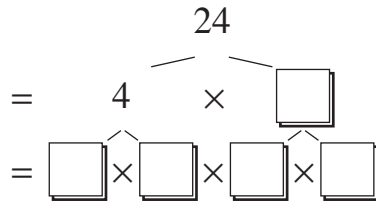
.....

Skill 18.8 Expressing a number as a product of its prime factors using a factor tree (1).

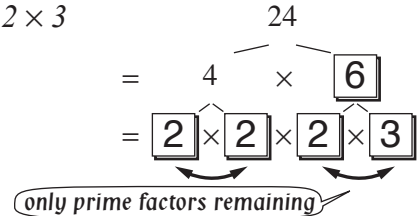
MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Write the number as a product of any two factors excluding 1 (not necessarily prime numbers).
- Then write each of these two numbers as a product of any two factors excluding 1.
- Continue in this way until only prime factors remain.

Q. Express 24 as a product of prime numbers by completing the factor tree.



A. $24 = 4 \times 6$
 $4 = 2 \times 2$ and $6 = 2 \times 3$
 $\Rightarrow 24 = 2 \times 2 \times 2 \times 3$

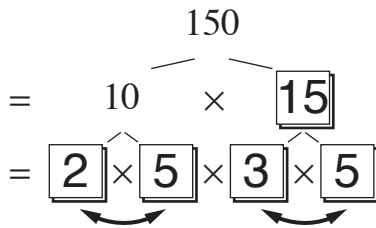


a) Express 150 as a product of prime numbers by completing the factor tree.

$150 = 10 \times 15$

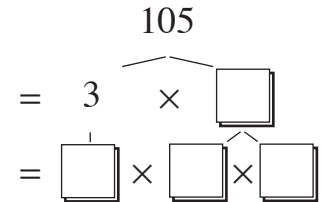
$10 = 2 \times 5$

$15 = 3 \times 5$



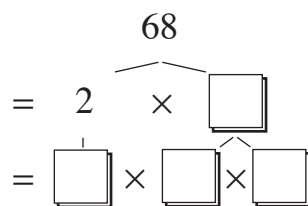
b) Express 105 as a product of prime numbers by completing the factor tree.

$105 = 3 \times \dots$



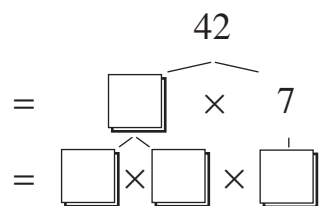
c) Express 68 as a product of prime numbers by completing the factor tree.

$68 = \dots$



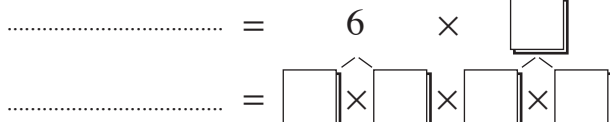
d) Express 42 as a product of prime numbers by completing the factor tree.

\dots



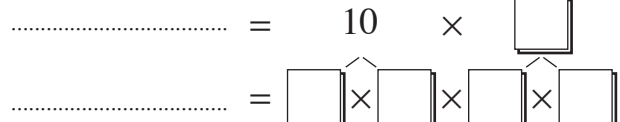
e) Express 54 as a product of prime numbers by completing the factor tree.

\dots



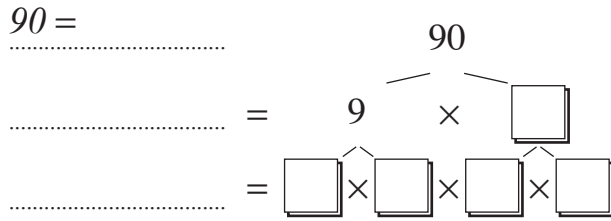
f) Express 100 as a product of prime numbers by completing the factor tree.

\dots

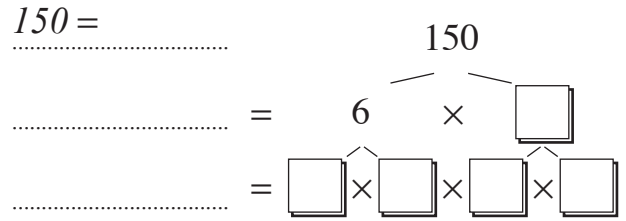


Skill 18.8 Expressing a number as a product of its prime factors using a factor tree (2).

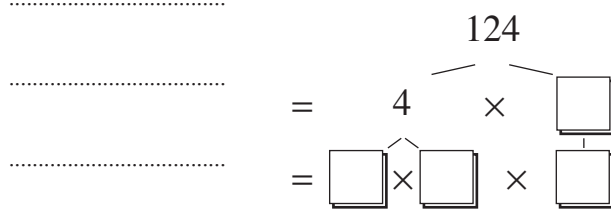
g) Express 90 as a product of prime numbers by completing the factor tree.



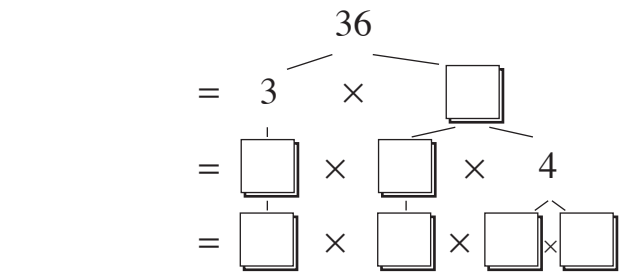
h) Express 150 as a product of prime numbers by completing the factor tree.



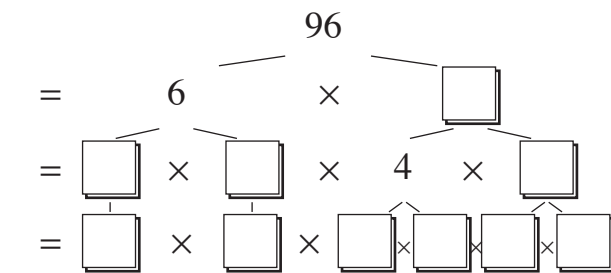
i) Express 124 as a product of prime numbers by completing the factor tree.



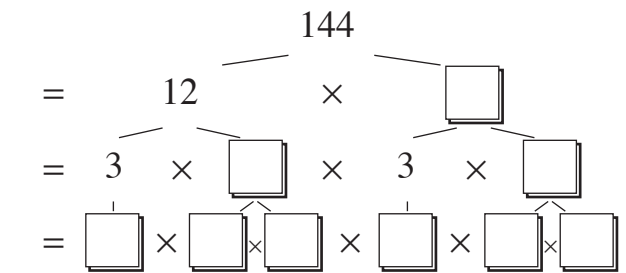
j) Express 36 as a product of prime numbers by completing the factor tree.



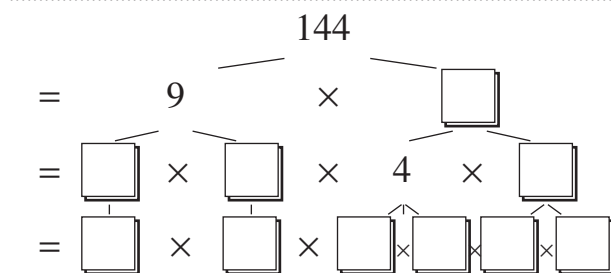
k) Express 96 as a product of prime numbers by completing the factor tree.



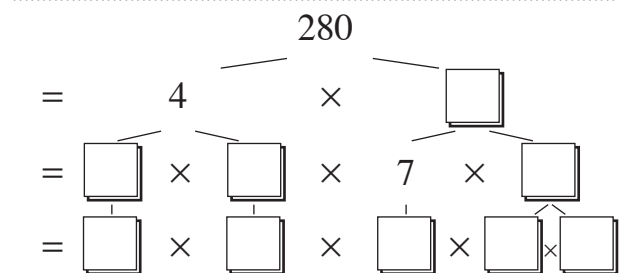
l) Express 144 as a product of prime numbers by completing the factor tree.



m) Express 144 as a product of prime numbers by completing the factor tree.



n) Express 280 as a product of prime numbers by completing the factor tree.



Skill 18.9 Expressing a number as a product of its prime factors using consecutive divisions.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Find a prime number that divides evenly into the given number.
- Write this prime number next to the given number.
- Divide and write the result under the given number.
- Continue in this way until the result of the last division equals 1.
- Show all the resulting prime numbers as factors of the original number.

EITHER

- Use divisibility tests. (see Glossary, page 337)

Hints: All even numbers are divisible by 2

All numbers ending in 0 are divisible by 10 (2×5)

OR

- Use a factor tree. (see skill 18.8, page 158)

Q. Express 84 as a product of its prime factors.

A. $84 \div 2 = 42$ Even numbers divide by 2 $84 \begin{array}{l} 2 \\ 2 \\ 3 \\ 7 \\ 1 \end{array}$
 $42 \div 2 = 21$
 $21 \div 3 = 7$ 21 divides evenly by 3
 $\Rightarrow 84 = 2 \times 2 \times 3 \times 7$

a) Express 110 as a product of its prime factors.

$110 \div 2 = 55$
 $55 \div 5 = 11$

| | |
|-----|----|
| 110 | 2 |
| 55 | 5 |
| 11 | 11 |
| 1 | |

$110 = 2 \times 5 \times 11$

b) Express 65 as a product of its prime factors.

$65 \div$

| | |
|----|--|
| 65 | |
|----|--|

$65 =$

c) List the prime factors of 69.

69

| | |
|----|--|
| 69 | |
|----|--|

d) List the prime factors of 27.

.....

| | |
|----|--|
| 27 | |
|----|--|

e) Express 124 as a product of its prime factors.

.....

| | |
|--|--|
| | |
|--|--|

$124 =$

f) Express 198 as a product of its prime factors.

.....

| | |
|--|--|
| | |
|--|--|

$198 =$

g) Express 81 as a product of its prime factors.

.....

| | |
|----|--|
| 81 | |
|----|--|

$81 =$

h) Express 40 as a product of its prime factors.

.....

| | |
|----|--|
| 40 | |
|----|--|

$40 =$

Skill 18.10 Expressing a number as a product of its prime factors using index notation.

- Express the number as a product of its prime factors. (see skill 18.8, page 158 and skill 18.9, page 160)
- Group like factors in ascending order.
- Use index notation to simplify like factors. (see skill 15.1, page 123)

Q. Express 126 as a product of its prime factors using index notation.

A. $126 \div 2 = 63$ *126 divides evenly by 2* $126 \begin{array}{l} 2 \\ 63 \\ 21 \\ 7 \\ 1 \end{array}$

$63 \div 3 = 21$ *21 divides evenly by 3*

$21 \div 3 = 7$

$126 = 2 \times 3 \times 3 \times 7$

$\Rightarrow 126 = 2 \times 3^2 \times 7$

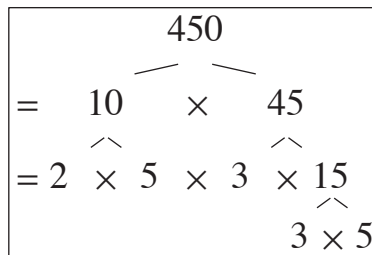
a) Express 450 as a product of its prime factors using index notation.

$450 = 10 \times 45$

$10 = 2 \times 5$

$45 = 3 \times 3 \times 5$

$450 = 2 \times 3 \times 3 \times 5 \times 5$



$450 = 2 \times 3^2 \times 5^2$

b) Express 200 as a product of its prime factors using index notation.



$200 =$

c) Express 360 as a product of its prime factors using index notation.

.....
.....
.....
.....

$360 =$

d) Express 64 as a product of its prime factors using index notation.

.....
.....
.....

$64 =$

e) Express 900 as a product of its prime factors using index notation.

.....
.....
.....

$900 =$

f) Express 576 as a product of its prime factors using index notation.

.....
.....
.....

$576 =$

19. [Number Patterns]

Skill 19.1 Completing number patterns by adding the same number.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Look at consecutive terms of the pattern.
- Find the number and operation (in this case addition) used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

2, 11, 20, 29, ,

A. 2, 11, 20, 29, , First note that each term in the pattern is increasing.

+9 +9 +9

Rule: Add 9 to each term.

$29 + 9 = 38$

$38 + 9 = 47$

2, 11, 20, 29, **38**, **47**

Then find by how much.

a) Complete the pattern:

0, 4, 8, 16, ,

+4 +4 +4 +4 +4

$16 + 4 = 20$, $20 + 4 = 24$

b) Complete the pattern:

1, 4, 7, 10, 13, ,

+3 +3 +3 +3 +3

c) Complete the pattern:

3, 8, 13, 18, 23, ,

d) Complete the pattern:

3, 5, 7, 9, 11, ,

e) Complete the pattern:

2, 5, 8, 11, ,

f) Complete the pattern:

3, 7, 11, 15, ,

g) Complete the pattern:

3, 11, 19, 27, ,

h) Complete the pattern:

2, 9, 16, 23, ,

i) Complete the pattern:

2, 8, 14, 20, ,

j) Complete the pattern:

5, 14, 23, 32, ,

Skill 19.2 Completing number patterns by subtracting the same number.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Look at consecutive terms of the pattern.
- Find the number and operation (in this case subtraction) used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

45, 36, 27, 18,

A. 45, 36, 27, 18,

$\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \\ -9 & -9 & -9 & \end{array}$

Rule: Subtract 9 from each term.

$$18 - 9 = 9$$

$$9 - 9 = 0$$

45, 36, 27, 18, **9, 0**

First note that each term in the pattern is decreasing. Then find by how much.

a) Complete the pattern:

18, 15, 12, 9,

$\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ -3 & -3 & -3 & -3 \end{array}$

$$9 - 3 = 6, \quad 6 - 3 = 3$$

b) Complete the pattern:

16, 14, 12, 10, 8,

$\begin{array}{cccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright \\ -2 & -2 & -2 & -2 \end{array}$

c) Complete the pattern:

20, 17, 14, 11, 8,

d) Complete the pattern:

35, 30, 25, 20, 15,

e) Complete the pattern:

30, 26, 22, 18, 14,

f) Complete the pattern:

38, 32, 26, 20,

g) Complete the pattern:

98, 88, 78, 68,

h) Complete the pattern:

38, 31, 24, 17,

i) Complete the pattern:

42, 34, 26, 18,

j) Complete the pattern:

50, 41, 32, 23,

Skill 19.3 Completing number patterns by adding or subtracting decimal numbers.

MM4.2 11 2 2 3 3 4 4
MM5.1 1 2 2 3 3 4 4

- Look at consecutive terms of the pattern.
- Find the number and operation used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

0.8, 1, 1.2, 1.4, ,

A. 0.8 , 1 , 1.2 , 1.4 , ,

$$+0.2 +0.2 +0.2$$

Rule: Add 0.2 to each term.

$$1.4 + 0.2 = 1.6$$

$$1.6 + 0.2 = 1.8$$

0.8, 1, 1.2, 1.4, **1.6, 1.8**

First note that each term in the pattern is increasing. Then find by how much.

a) Complete the pattern:

0.2, 0.8, 1.4, 2, ,

$$+0.6 +0.6 +0.6+0.6 +0.6$$

.....
 $2 + 0.6 = 2.6, \quad 2.6 + 0.6 = 3.2$

b) Complete the pattern:

1.8, 1.5, 1.2, 0.9, ,

$$-0.3 -0.3 -0.3 -0.3 -0.3$$

c) Complete the pattern:

1.5, 1.7, 1.9, 2.1, 2.3, ,

d) Complete the pattern:

1, 1.5, 2, 2.5, ,

e) Complete the pattern:

1, 1.4, 1.8, 2.2, 2.6, ,

f) Complete the pattern:

3.1, 2.9, 2.7, 2.5, ,

g) Complete the pattern:

2.9, 2.6, 2.3, 2, ,

h) Complete the pattern:

1, 2.1, 3.2, 4.3, ,

i) Complete the pattern:

0.8, 1.4, 2, 2.6, ,

j) Complete the pattern:

2.9, 2.5, 2.1, 1.7, ,

Skill 19.4 Completing number patterns by adding or subtracting fractions.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Look at consecutive terms of the pattern.
- Find the number and operation used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

$$\frac{2}{9}, \frac{3}{9}, \frac{4}{9}, \frac{5}{9}, \boxed{\quad, \quad}$$

A. $\frac{2}{9}, \frac{3}{9}, \frac{4}{9}, \frac{5}{9}, \quad, \quad$

$$\begin{array}{c} \curvearrowright \quad \curvearrowright \quad \curvearrowright \\ +\frac{1}{9} \quad +\frac{1}{9} \quad +\frac{1}{9} \end{array}$$

First note that each numerator in the pattern is increasing. Then find by how much.

Rule: Add $\frac{1}{9}$ to each term.

$$\frac{5}{9} + \frac{1}{9} = \frac{6}{9}$$

$$\frac{6}{9} + \frac{1}{9} = \frac{7}{9}$$

$$\frac{2}{9}, \frac{3}{9}, \frac{4}{9}, \frac{5}{9}, \frac{6}{9}, \frac{7}{9}$$

a) Complete the pattern:

$$\frac{3}{8}, \frac{4}{8}, \frac{5}{8}, \frac{6}{8}, \boxed{\frac{7}{8}, \frac{8}{8}}$$

$$\frac{6}{8} + \frac{1}{8} = \frac{7}{8},$$

$$\frac{7}{8} + \frac{1}{8} = \frac{8}{8}$$

b) Complete the pattern:

$$\frac{1}{10}, \frac{3}{10}, \frac{5}{10}, \frac{7}{10}, \boxed{\quad, \quad}$$

$$\begin{array}{c} \curvearrowright \\ +\frac{2}{10} \end{array}$$

c) Complete the pattern:

$$\frac{2}{11}, \frac{5}{11}, \frac{8}{11}, \frac{11}{11}, \boxed{\quad, \quad}$$

d) Complete the pattern:

$$\frac{23}{11}, \frac{21}{11}, \frac{19}{11}, \frac{17}{11}, \boxed{\quad, \quad}$$

e) Complete the pattern:

$$\frac{34}{13}, \frac{33}{13}, \frac{32}{13}, \frac{31}{13}, \boxed{\quad, \quad}$$

f) Complete the pattern:

$$\frac{25}{12}, \frac{23}{12}, \frac{21}{12}, \frac{19}{12}, \boxed{\quad, \quad}$$

g) Complete the pattern:

$$\frac{30}{11}, \frac{26}{11}, \frac{22}{11}, \frac{18}{11}, \boxed{\quad, \quad}$$

h) Complete the pattern:

$$\frac{28}{9}, \frac{24}{9}, \frac{20}{9}, \frac{16}{9}, \boxed{\quad, \quad}$$

Skill 19.5 Completing number patterns in table format by adding the same number.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Look at consecutive terms of the pattern.
- Find the number and operation used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next term of the pattern.

Q. Complete the table:

High-rise buildings

| | | | | | |
|---------------|---|---|----|----|---|
| No. of floors | 2 | 3 | 4 | 5 | 6 |
| No. of rooms | 4 | | 10 | 13 | |

A. 4, ?, 10, 13, ?

↖
+3

Rule: Add 3 to each term.

$$4 + 3 = 7$$

$$13 + 3 = 16$$

4, 7, 10, 13, 16

First note that each term in the pattern is increasing. Then find by how much.

High-rise buildings

| | | | | | |
|---------------|---|---|----|----|----|
| No. of floors | 2 | 3 | 4 | 5 | 6 |
| No. of rooms | 4 | 7 | 10 | 13 | 16 |

a) Complete the table:

Growth (mm)

| | | | | | |
|------------|-----|---|-----|---|-----|
| fingernail | 2 | 4 | 6 | 8 | 10 |
| toenail | 0.5 | 1 | 1.5 | 2 | 2.5 |

↖ ↖ ↖ ↖
+0.5 +0.5 +0.5 +0.5

$$1.5 + 0.5 = 2, \quad 2 + 0.5 = 2.5$$

b) Complete the table:

Bouquets

| | | | | | |
|-------------|---|---|---|---|----|
| white roses | 2 | 4 | 6 | 8 | 10 |
| red roses | 3 | 6 | 9 | | |

↖ ↖ ↖
+3 +3 +3

c) Complete the table:

Food intake of a baby robin

| | | | | | | |
|---------------------|---|---|----|---|---|---|
| No. of days | 1 | 2 | 3 | 4 | 5 | 6 |
| Length of worms (m) | 4 | 8 | 12 | | | |

d) Complete the table:

Children (9 - 13)

| | | | | | |
|---------------------|----|----|---|---|----|
| calories (hundreds) | 17 | 34 | | | 85 |
| days | 1 | 2 | 3 | 4 | 5 |

e) Complete the table:

Rent

| | | | | | |
|--------------------|-----|---|-----|-----|---|
| No. of bedrooms | 1 | 2 | 3 | 4 | 5 |
| Cost per week (\$) | 200 | | 350 | 425 | |

f) Complete the table:

Shark teeth regeneration (thousands)

| | | | | | | |
|-------------------|----|-----|-----|-----|----|----|
| No. of days | 10 | 20 | 30 | 40 | 50 | 60 |
| Teeth regenerated | 3 | 3.6 | 4.2 | 4.8 | | |

g) Complete the table:

Exercise program

| | | | | | |
|---------------|-----|-----|-----|----|----|
| time (min) | 10 | 15 | 20 | 25 | 30 |
| energy (cal.) | 240 | 280 | 320 | | |

h) Complete the table:

Equilateral triangle

| | | | | | | |
|-------------|-----|-----|-----|-----|---|-----|
| Side length | 0.4 | 0.8 | 1.2 | 1.6 | 2 | 2.4 |
| Perimeter | 1.2 | 2.4 | 3.6 | 4.8 | | |

Skill 19.6 Completing number patterns by multiplying by the same number.

MM4.2 11 2 2 33 44
MM5.1 11 2 2 33 44

- Look at consecutive terms of the pattern.
- Find the number and operation (in this case multiplication) used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

$$\frac{1}{16}, \frac{1}{4}, 1, 4, \boxed{\quad, \quad}$$

A. $\frac{1}{16}, \frac{1}{4}, 1, 4, \underline{\quad}, \underline{\quad}$

$\begin{array}{ccccccc} & \nearrow & & \nearrow & & \nearrow & \\ & \times 4 & & \times 4 & & \times 4 & \\ & \nwarrow & & \nwarrow & & \nwarrow & \end{array}$

First note that each term in the pattern is increasing. Then find by how much.

Rule: Multiply each term by 4

$$4 \times 4 = 16$$

$$16 \times 4 = 64$$

$$\frac{1}{16}, \frac{1}{4}, 1, 4, \mathbf{16}, \mathbf{64}$$

a) Complete the pattern:

$$2, 6, 18, 54, \boxed{162, 486}$$

$\begin{array}{ccccccc} & \nearrow & & \nearrow & & \nearrow & \\ & \times 3 & & \times 3 & & \times 3 & \\ & \nwarrow & & \nwarrow & & \nwarrow & \end{array}$

$$54 \times 3 = 162, \quad 162 \times 3 = 486$$

b) Complete the pattern:

$$1, 2, 4, 8, \boxed{\quad, \quad}$$

$\begin{array}{ccccccc} & \nearrow & & \nearrow & & \nearrow & \\ & \times 2 & & \times 2 & & \times 2 & \\ & \nwarrow & & \nwarrow & & \nwarrow & \end{array}$

c) Complete the pattern:

$$4, 12, 36, 108, \boxed{\quad, \quad}$$

d) Complete the pattern:

$$5, 15, 45, 135, \boxed{\quad, \quad}$$

e) Complete the pattern:

$$0.25, 0.5, 1, 2, \boxed{\quad, \quad}$$

f) Complete the pattern:

$$\frac{3}{4}, 3, 12, 48, \boxed{\quad, \quad}$$

g) Complete the pattern:

$$\frac{1}{16}, \frac{1}{8}, \frac{1}{4}, \frac{1}{2}, \boxed{\quad, \quad}$$

h) Complete the pattern:

$$\frac{2}{9}, \frac{2}{3}, 2, 6, \boxed{\quad, \quad}$$

i) Complete the pattern:

$$0.02, 0.1, 0.5, 2.5, \boxed{\quad, \quad}$$

j) Complete the pattern:

$$\frac{3}{1000}, \frac{3}{100}, \frac{3}{10}, 3, \boxed{\quad, \quad}$$

Skill 19.7 Completing number patterns by dividing by the same number.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Look at consecutive terms of the pattern.
- Find the number and operation (in this case division) used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

640, 320, 160, 80,

A. 640, 320, 160, 80, , First note that each term in the pattern is decreasing. Then find by how much.

Rule: Divide each term by 2.

$$80 \div 2 = 40$$

$$40 \div 2 = 20$$

640, 320, 160, 80, **40**, **20**

First note that each term in the pattern is decreasing. Then find by how much.

a) Complete the pattern:

9375, 1875, 375, 75,

$$\begin{array}{cccccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & \\ \div 5 & \div 5 & \div 5 & \div 5 & \div 5 & \end{array}$$

$$75 \div 5 = 15, \quad 15 \div 5 = 3$$

b) Complete the pattern:

128, 64, 32, 16,

$$\begin{array}{cccccc} \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & \\ \div 2 & \div 2 & \div 2 & \div 2 & \div 2 & \end{array}$$

c) Complete the pattern:

6250, 1250, 250, 50,

d) Complete the pattern:

640, 320, 160, 80, 40,

e) Complete the pattern:

1000, 100, 10, 1, 0.1,

f) Complete the pattern:

729, 243, 81, 27,

g) Complete the pattern:

3.2, 1.6, 0.8, 0.4,

h) Complete the pattern:

312.5, 62.5, 12.5, 2.5,

i) Complete the pattern:

70000, 7000, 700, 70,

j) Complete the pattern:

512, 128, 32, 8,

Skill 19.8 Completing number patterns by using changing values in the rule.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Look at consecutive terms of the pattern.
- Find the number and operation used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

3, 6, 12, 21, 33, ,

A. 3, 6, 12, 21, 33, ,

+3 +6 +9 +12

Rule: Add 3 then 6 then 9 etc. to each term.

(i.e. consecutive multiples of 3)

$$33 + 15 = 48$$

$$48 + 18 = 66$$

3, 6, 12, 21, 33, **48, 66**

First note that each term in the pattern is increasing. Then find by how much.

a) Complete the pattern:

18, 20, 24, 30, 38, ,

+2 +4 +6 +8 +10 +12

$$38 + 10 = 48, \quad 48 + 12 = 60$$

b) Complete the pattern:

2, 6, 14, 26, 42, ,

+4 +8 +12 +16 +? +?

c) Complete the pattern:

49, 46, 40, 31, ,

d) Complete the pattern:

45, 33, 23, 15, 9, ,

e) Complete the pattern:

14, 13, 10, 9, 6, ,

f) Complete the pattern:

1, 3, 7, 9, 13, ,

g) Complete the pattern:

3, 4, 7, 12, 19, ,

h) Complete the pattern:

144, 100, 64, 36, ,

$$144 = 12^2, \quad 100 = 10^2, \quad 64 = 8^2$$

i) Complete the pattern:

1, 9, 25, 49, ,

j) Complete the pattern:

343, 216, 125, 64, ,

Skill 19.9 Completing number patterns involving negative integers by adding or subtracting the same integer.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Look at consecutive terms of the pattern.
- Find the number and operation used to get from one term to the next.
- Define the rule of the pattern.
- Apply this rule to the last given term and find the next two terms of the pattern.

Q. Complete the pattern:

3, -1, -5, -9, ,

A. 3, -1, -5, -9, ,

$\begin{array}{ccccccc} 3 & , & -1 & , & -5 & , & -9 & , & _ & , & _ \\ & & \swarrow & & \swarrow & & \swarrow & & & & \\ & & -4 & & -4 & & -4 & & & & \end{array}$

Rule: Subtract 4 from each term.

$-9 - 4 = -13$

$-13 - 4 = -17$

3, -1, -5, -9, **-13**, **-17**

First note that each term in the pattern is decreasing. Then find by how much.

a) Complete the pattern:

29, 21, 13, 5, -3, ,

$\begin{array}{ccccccc} & \swarrow & \swarrow & \swarrow & \swarrow & \swarrow & \swarrow \\ -8 & & -8 & & -8 & & -8 & & -8 & & -8 \end{array}$

$-3 - 8 = -11, \quad -11 - 8 = -19$

b) Complete the pattern:

-17, -14, -11, -8, -5, ,

$\begin{array}{ccccccc} & \swarrow & \swarrow & \swarrow & \swarrow & \swarrow & \swarrow \\ +3 & & +3 & & +3 & & +3 & & +3 & & +3 \end{array}$

c) Complete the pattern:

-22, -17, -12, -7, -2, ,

d) Complete the pattern:

1, -1, -3, -5, -7, ,

e) Complete the pattern:

10, 6, 2, -2, ,

f) Complete the pattern:

-13, -7, -1, 5, ,

g) Complete the pattern:

17, 8, -1, -10, ,

h) Complete the pattern:

-23, -16, -9, -2, ,

i) Complete the pattern:

7, 3, -1, -5, ,

j) Complete the pattern:

-23, -15, -7, 1, ,

EITHER

- Find the terms in order until you get to the required term.

OR

- Draw up a table and match the term numbers with the given terms in the pattern.
- Use observation and trial and error to find a relationship between the term number and its value in the pattern.
- Based on this relationship, find the requested term in the pattern.

Q. Find the 8th term in the pattern:

8, 14, 20, 26, ...

A. 8, 14, 20, 26 ...

$$\begin{array}{ccc} \curvearrowright & \curvearrowright & \curvearrowright \\ +6 & +6 & +6 \end{array}$$
Rule: Add 6 to each term.

$26 + 6 = 32$

$32 + 6 = 38$

$38 + 6 = 44$

$44 + 6 = 50$

8, 14, 20, 26, ..., **50**

First note that each term in the pattern is increasing. Then find by how much. Count on.

OR

| term number | 1 | 2 | 3 | 4 | .... | 8 |
|--------------|------------------|------------------|------------------|------------------|------|------------------|
| pattern | 8 | 14 | 20 | 26 | | ? |
| relationship | $6 \times 1 + 2$ | $6 \times 2 + 2$ | $6 \times 3 + 2$ | $6 \times 4 + 2$ | | $6 \times 8 + 2$ |

Relationship: 6 times the term number + 2

The 8th term of the pattern is $6 \times 8 + 2 = 50$

a) Find the 14th term in the pattern:

1, 3, 5, 7, ...

27

| term number | 1 | 2 | 3 | 4 | .... | 14 |
|--------------|------------------|------------------|------------------|------------------|------|-------------------|
| pattern | 1 | 3 | 5 | 7 | | 27 |
| relationship | $2 \times 1 - 1$ | $2 \times 2 - 1$ | $2 \times 3 - 1$ | $2 \times 4 - 1$ | | $2 \times 14 - 1$ |

Relationship: 2 times the term number - 1

The 14th term of the pattern is $2 \times 14 - 1 = 27$

b) Find the 12th term in the pattern:

2, 3, 4, 5, ...

| term number | 1 | 2 | 3 | 4 | .... | 12 |
|--------------|---------|---|---|---|------|----|
| pattern | 2 | 3 | 4 | 5 | | ? |
| relationship | $1 + 1$ | | | | | |

Relationship:

The 12th term of the pattern is

c) Find the 20th term in the pattern:

2, 4, 6, 8, 10, ...

| term number | 1 | 2 | 3 | 4 | .... | 20 |
|--------------|---|---|---|---|------|----|
| pattern | 2 | 4 | 6 | 8 | | ? |
| relationship | | | | | | |

Relationship:

The 20th term of the pattern is

d) Find the 15th term in the pattern:

5, 10, 15, 20, 25, ...

| term number | 1 | 2 | 3 | 4 | .... | 15 |
|--------------|---|----|----|----|------|----|
| pattern | 5 | 10 | 15 | 20 | | ? |
| relationship | | | | | | |

Relationship:

The 15th term of the pattern is

e) Find the 18th term in the pattern:

14, 24, 34, 44, 54, ...

| term number | 1 | 2 | 3 | 4 | .... | 18 |
|--------------|----|----|----|----|------|----|
| pattern | 14 | 24 | 34 | 44 | | ? |
| relationship | | | | | | |

Relationship:

The 18th term of the pattern is

f) Find the 10th term in the pattern:

1, 8, 27, 64, ...

| term number | 1 | 2 | 3 | 4 | .... | 10 |
|--------------|---|---|----|----|------|----|
| pattern | 1 | 8 | 27 | 64 | | ? |
| relationship | | | | | | |

Relationship:

The 10th term of the pattern is

g) Find the 14th term in the pattern:

5, 7, 9, 11, 13, ...

| term number | 1 | 2 | 3 | 4 | .... | 14 |
|--------------|---|---|---|----|------|----|
| pattern | 5 | 7 | 9 | 11 | | ? |
| relationship | | | | | | |

h) Find the 12th term in the pattern:

2, 5, 8, 11, 14, ...

| term number | 1 | 2 | 3 | 4 | .... | 12 |
|--------------|---|---|---|----|------|----|
| pattern | 2 | 5 | 8 | 11 | | ? |
| relationship | | | | | | |

i) Find the 11th term in the pattern:

3, 7, 11, 15, 19, ...

| term number | 1 | 2 | 3 | 4 | .... | 11 |
|--------------|---|---|----|----|------|----|
| pattern | 3 | 7 | 11 | 15 | | ? |
| relationship | | | | | | |

j) Find the 20th term in the pattern:

12, 14, 16, 18, ...

| term number | 1 | 2 | 3 | 4 | .... | 20 |
|--------------|----|----|----|----|------|----|
| pattern | 12 | 14 | 16 | 18 | | ? |
| relationship | | | | | | |

k) Find the 10th term in the pattern:

$\frac{1}{2}, \frac{1}{4}, \frac{1}{6}, \frac{1}{8}, \dots$

l) Find the 8th term in the pattern:

$\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \dots$

Skill 19.11 Finding a particular term of a sequence given its general rule.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Identify the value of n for the requested term of the sequence.
Hint: If the 20th term needs to be found, the value of n is 20.
- Substitute the value of n in the formula for the general rule of the pattern.
- Calculate the value of the particular term of the sequence.

Q. If the general rule of a pattern is $15 + n$ find the 15th term ($n = 15$).

$$\begin{aligned} \text{A. } & 15 + n \\ & = 15 + 15 \quad \text{substitute } n = 15 \\ & = 30 \end{aligned}$$

a) If the general rule of a pattern is $n - 4$ find the 10th term ($n = 10$).

$$\begin{aligned} & n - 4 \\ = & 10 - 4 = \boxed{6} \end{aligned}$$

b) If the general rule of a pattern is $n + 5$ find the 20th term ($n = 20$).

$$\begin{aligned} & n + 5 \\ = & + 5 = \boxed{} \end{aligned}$$

c) If the general rule of a pattern is $n - 8$ find the 13th term ($n = 13$).

$$\begin{aligned} & - 8 \\ = & - 8 = \boxed{} \end{aligned}$$

d) If the general rule of a pattern is $n + 8$ find the 16th term ($n = 16$).

$$\begin{aligned} & + 8 \\ = & + 8 = \boxed{} \end{aligned}$$

e) If the general rule of a pattern is $2n + 1$ find the 20th term ($n = 20$).

$$\begin{aligned} & 2n + 1 \\ = & + 1 = \boxed{} \end{aligned}$$

f) If the general rule of a pattern is $50 - 5n$ find the 6th term ($n = 6$).

$$\begin{aligned} & 50 - 5n \\ = & 50 - 5() = \boxed{} \end{aligned}$$

g) If the general rule of a pattern is $5n + 7$ find the 9th term ($n = 9$).

$$\begin{aligned} & 5n + 7 \\ = & 5() + 7 = \boxed{} \end{aligned}$$

h) If the general rule of a pattern is $14 - 2n$ find the 6th term ($n = 6$).

$$\begin{aligned} & 14 - 2n \\ = & 14 - 2() = \boxed{} \end{aligned}$$

i) If the general rule of a pattern is $n^2 + 1$ find the 10th term ($n = 10$).

$$\begin{aligned} & n^2 + 1 \\ = & ()^2 + 1 = \boxed{} \end{aligned}$$

j) If the general rule of a pattern is $n^2 + 6$ find the 8th term ($n = 8$).

$$\begin{aligned} & n^2 + 6 \\ = & ()^2 + 6 = \boxed{} \end{aligned}$$

20. [Expressions]

Skill 20.1 Simplifying expressions by adding and subtracting like terms (coefficient = 1).

MM4.2 11 2 2 3 3 4 4
MM5.1 1 2 2 3 3 4 4

- Add or subtract, as instructed, all like terms. (see Glossary, page 346)
- In your answer, write the coefficient (number) first followed by the variable (letter) (see glossary, pages 330 and 375)

Hint: In the term m , 1 is the coefficient: $m = 1 \times m$

Q. Simplify
 $kl + kl + kl - kl + kl$

A. $kl + kl + kl \rightarrow \cancel{kl} + \cancel{kl}$ cancel first
 $= 3kl$

coefficient first

a) Simplify
 $n + n + n + n$

$4n$

b) Simplify
 $a + a$

c) Simplify
 $u + u$

d) Simplify
 $t + t + t$

e) Simplify
 $w + w + w + w$

f) Simplify
 $z + z + z + z + z$

g) Simplify
 $x - x + x$

h) Simplify
 $b + b + b - b$

i) Simplify
 $e + e - e + e$

j) Simplify
 $k + k + k + k - k - k$

k) Simplify
 $p + p - p - p + p$

l) Simplify
 $c - c + c - c + c + c$

m) Simplify
 $ab + ab$

n) Simplify
 $hi + hi + hi$

o) Simplify
 $fg + fg + fg + fg$

p) Simplify
 $op + op + op + op$

q) Simplify
 $tu + tu + tu + tu + tu$

r) Simplify
 $uv + uv - uv + uv$

s) Simplify
 $ab - ab + ab + ab - ab$

t) Simplify
 $wx + wx - wx + wx + wx$

u) Simplify
 $de + de - de + de - de + de$

Skill 20.2 Simplifying expressions by adding and subtracting like terms
(coefficient ≥ 1).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Add or subtract the coefficients (numbers) first.
 - Write the variable (letters) next.
- Hint: In the term m , 1 is the coefficient: $m = 1 \times m$

Q. Simplify
 $7b - 2b + b$

A. $7b - 2b + b$
 $= 5b + b$
 $= 6b$

a) Simplify $3m + 2m$ 5m b) Simplify $2h + 4h$ c) Simplify $3g + 4g$

d) Simplify $3j + j$ e) Simplify $z + 5z$ f) Simplify $7e - 2e$

g) Simplify $5q - q$ h) Simplify $5a - 4a$ i) Simplify $3k - k$

j) Simplify $r + 2r + r$
 $= 3r + r$ k) Simplify $f + 2f + 4f$
 $=$ l) Simplify $3a + a + 2a$
 $=$

m) Simplify $y + y + 5y$
 $=$ n) Simplify $4m + 2m + m$
 $=$ o) Simplify $h + 5h + 3h$
 $=$

p) Simplify $j - j + 5j$
 $=$ q) Simplify $2c + 2c - c$
 $=$ r) Simplify $k + 5k - k$
 $=$

s) Simplify $op + 5op$
 $=$ t) Simplify $4ab - 2ab$
 $=$ u) Simplify $7kl - kl$
 $=$

v) Simplify $5mn + 2mn$
 $=$ w) Simplify $2ij - ij$
 $=$ x) Simplify $5de - 3de$
 $=$

- Write the expression using the variables and/or the numbers mentioned in the word problem.
- Decide about the operation or operations needed in the expression.

Example: $a + b$ (sum of a and b), $4n$ (product of 4 and n), $m - 20$ (20 less than m)

Hint: "Sum, altogether, in total, more than" \Rightarrow addition $\Rightarrow +$
 "Difference, less than, change" \Rightarrow subtraction $\Rightarrow -$
 "Product, times, lots of" \Rightarrow multiplication $\Rightarrow \times$

Q. Write as an expression:

A number that is equal to 4 less than c

A. *less than* $\Rightarrow -$

$\Rightarrow c - 4$

a) Write as an expression:

The sum of n and 14

and $\Rightarrow +$

\Rightarrow

b) Write as an expression:

The sum of b and c

\Rightarrow

c) Write as an expression:

The sum of e and f

\Rightarrow

d) Write as an expression:

A number that is equal to 4 more than j

\Rightarrow

e) Write as an expression:

A number that is equal to 3 less than z

\Rightarrow

f) Write as an expression:

A number that is equal to 5 less than v

\Rightarrow

g) Write as an expression:

A number that is equal to three times m

\Rightarrow

h) Write as an expression:

A number that is equal to two times d

\Rightarrow

i) Write as an expression:

A number that is equal to twice as much as h

\Rightarrow

j) Write as an expression:

A number that is equal to three times as much as m

\Rightarrow

k) Write as an expression:

The product of nine and p

\Rightarrow

l) Write as an expression:

The product of seven and z

\Rightarrow

- m) A person grows 2 cm every year for y years. How much did he grow?

..... \Rightarrow

- n) A tree grew 4 cm every year for b years. How much did it grow?

..... \Rightarrow

- o) There are a local and b imported products at the supermarket. How many products are there altogether?

..... \Rightarrow

- p) John earns a weekly wage of n dollars. How much money did he earn in three weeks?

..... \Rightarrow

- q) Elle read m pages from her 300 page novel. How many pages does she have left to read?

..... \Rightarrow

- r) In a store a \$70 shirt is discounted by w dollars. What is the sale price of the shirt?

..... \Rightarrow

- s) Isabelle handed x dollars to the checkout when she purchased a \$70 game. How much change did she receive?

..... \Rightarrow

- t) There are h hours left until the plane's departure from Perth. The trip from Perth to Sydney takes 5 hours. How many hours are left until the plane's arrival to Sydney?

..... \Rightarrow

- u) A shop makes \$15 profit for each school bag sold. Which expression shows the profit for x bags sold?

- A) $15 + x$
B) $15 \times x$
C) $x - 15$

..... \Rightarrow

- v) To hire a taxi you pay a start fee of \$7 and then \$4.50 for each kilometre. If you travel for g km, which expression shows the total taxi fee?

- A) $7 + 4.5 \times g$
B) $4.5 + 7 \times g$
C) $7 \times 4.5 + g$

..... \Rightarrow

- w) An adult aquarium entry ticket is \$40, and a child ticket is \$30. Which expression shows the total cost for c adults and d children?

- A) $30 \times c + 40 \times d$
B) $40 \times c + 30 \times d$
C) $40 \times c + 40 \times d$

..... \Rightarrow

- x) Hannah is x years old, and Tegan is y years old. If Hannah is 2 years older than Tegan, which expression shows this?

- A) $x + y = 2$
B) $x - y = 2$
C) $y - x = 2$

..... \Rightarrow

Skill 20.4 Finding like terms.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Look at the combination of letters in all terms.
- Find the **like terms**, which use the same combination of letters.

Example: $4c$ and c
 gh and $3gh$ like terms

Hint: The order of the letters in a term does not matter.
 $gh = hg$

- Q.** Choose the like terms: $3y, z, 2z$
- A.** $3y$ and z - are terms using different letters
 z and $2z$ - are terms using the same combination of letters
 $\Rightarrow z, 2z$

- a)** Choose the like terms:
 $4f, e, 2f$

$4f, 2f$

- b)** Choose the like terms:
 $c, 3, 3c$

- c)** Choose the like terms:
 $h, 2i, 3h$

- d)** Choose the like terms:
 $b, 3d, 3b$

- e)** Choose the like terms:
 $f, 3e, 3f$

- f)** Choose the like terms:
 $m, n, 4n$

- g)** Choose the like terms:
 $r, 5r, 2s$

- h)** Choose the like terms:
 $l, 2m, 3m$

- i)** Choose the like terms:
 $2w, 2x, 4x$

- j)** Choose the like terms:
 $k, 2jk, 2j, jk$

- k)** Choose the like terms:
 $ab, 2ab, 3b, 2a$

- l)** Choose the like terms:
 $2w, 2x, 4x, wx$

- m)** Choose the like terms:
 $h, 2hi, 4i, hi$

- n)** Choose the like terms:
 $d, 3de, 3d, 3e$

- o)** Choose the like terms:
 $5uv, v, 5v, u$

- p)** Choose the like terms:
 $n, 3o, 2no, no$

- q)** Choose the like terms:
 $a, 2b, 2ab, 2a$

- r)** Choose the like terms:
 $3st, s, 4t, st$

Skill 20.5 Simplifying expressions by first grouping like terms.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Group like terms. (see skill 20.3, page 177)
- Read the sign in front of each term.
- Add and/or subtract only the like terms.

Hint: Unlike terms cannot be added or subtracted.

Q. Simplify
 $p + p + q + p + q$

A. $p + p + q + p + q$
 $= p + p + p + q + q$ ← group like terms
 $= 3p + 2q$

a) Simplify
 $s + r + s$

$= s + s + r = \boxed{2s + r}$

b) Simplify
 $d + e + d$

$= \dots = \boxed{}$

c) Simplify
 $h + i + h$

$= \dots = \boxed{}$

d) Simplify
 $a + b + b + a$

$= \dots = \boxed{}$

e) Simplify
 $l + m + l + m$

$= \dots = \boxed{}$

f) Simplify
 $r + r + r + s$

$= \dots = \boxed{}$

g) Simplify
 $y + x + x + y + y$

$= \dots = \boxed{}$

h) Simplify
 $e + f + e + f + e$

$= \dots = \boxed{}$

i) Simplify
 $m + m + n - m + n$

$= \dots = \boxed{}$

j) Simplify
 $t + u + u - t + t$

$= \dots = \boxed{}$

k) Simplify
 $jk + jk + kl - jk + kl$

$= \dots = \boxed{}$

l) Simplify
 $rs - rs + qr + qr + rs$

$= \dots = \boxed{}$

m) Simplify
 $cd - de + de + de + cd$

$= \dots = \boxed{}$

n) Simplify
 $4h + 3i + h - 2i$

$= \dots = \boxed{}$

o) Simplify
 $5j + 3k - 2j + 2k$

$= \dots = \boxed{}$

p) Simplify
 $6g + 4 - 2g - 1$

$= \dots = \boxed{}$

q) Simplify
 $7l + 5 - 3l - 4$

$= \dots = \boxed{}$

r) Simplify
 $3v + 2w + 5w - v$

$= \dots = \boxed{}$

s) Simplify
 $4q + p + 2q + 4p$

$= \dots = \boxed{}$

t) Simplify
 $5z + 2y + y - 3z$

$= \dots = \boxed{}$

u) Simplify
 $j + 4k + 2j - 2k$

$= \dots = \boxed{}$

21. [Substitution]

Skill 21.1 Substituting one value into expressions involving + and -

MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Replace the letter (variable) with the given value.
- Add (+) and/or subtract (-) from left to right.

Q. If $a = 5$, find the value of $13 - a$

$$\begin{aligned} \text{A. } 13 - a & \text{ — substitute } a = 5 \\ & = 13 - 5 \\ & = 8 \end{aligned}$$

a) If $p = 2$, find the value of $5 + p$

$$= 5 + 2 = \boxed{7}$$

b) If $f = 3$, find the value of $6 + f$

$$= \dots = \boxed{}$$

c) If $c = 4$, find the value of $4 + c$

$$= \dots = \boxed{}$$

d) If $m = 5$, find the value of $m + 3$

$$= \dots = \boxed{}$$

e) If $g = 7$, find the value of $g + 2$

$$= \dots = \boxed{}$$

f) If $z = 6$, find the value of $z + 1$

$$= \dots = \boxed{}$$

g) If $x = 3$, find the value of $x + x$

$$= \dots = \boxed{}$$

h) If $v = 4$, find the value of $v + v$

$$= \dots = \boxed{}$$

i) If $q = 7$, find the value of $q + q$

$$= \dots = \boxed{}$$

j) If $t = 5$, find the value of $t + t + t$

$$= \dots = \boxed{}$$

k) If $e = 6$, find the value of $e + e + e$

$$= \dots = \boxed{}$$

l) If $p = 8$, find the value of $p + p + p$

$$= \dots = \boxed{}$$

m) If $j = 9$, find the value of $j + j - 8$

$$= \dots = \boxed{}$$

n) If $k = 7$, find the value of $k + k + 6$

$$= \dots = \boxed{}$$

o) If $h = 8$, find the value of $4 + h + h$

$$= \dots = \boxed{}$$

p) If $m = 8$, find the value of $m + m - 9$

$$= \dots = \boxed{}$$

q) If $s = 6$, find the value of $9 + s + s$

$$= \dots = \boxed{}$$

r) If $n = 5$, find the value of $8 + n + n$

$$= \dots = \boxed{}$$

Skill 21.2 Substituting one value into expressions involving \times and \div

MM4.2 1 1 22 33 44
MM5.1 1 1 22 33 44

- Replace the letter (variable) with the given value.
- Multiply (\times) and/or divide (\div) from left to right.

Q. If $m = 4$, find the value of $6m$

$$\begin{aligned} \text{A. } 6m & \quad \text{--- substitute } m = 4 \\ & = 6 \times 4 \\ & = 24 \end{aligned}$$

a) If $a = 6$, find the value of $9 \times a$

$$= 9 \times 6 = \boxed{54}$$

b) If $n = 4$, find the value of $3 \times n$

$$= \dots = \boxed{}$$

c) If $y = 5$, find the value of $2 \times y$

$$= \dots = \boxed{}$$

d) If $w = 7$, find the value of $w \times 3$

$$= \dots = \boxed{}$$

e) If $p = 8$, find the value of $4 \times p$

$$= \dots = \boxed{}$$

f) If $z = 6$, find the value of $7 \times z$

$$= \dots = \boxed{}$$

g) If $a = 3$, find the value of $8a$

$$= \dots = \boxed{}$$

h) If $h = 2$, find the value of $9h$

$$= \dots = \boxed{}$$

i) If $n = 5$, find the value of $7n$

$$= \dots = \boxed{}$$

j) If $m = 32$, find the value of $m \div 4$

$$= \dots = \boxed{}$$

k) If $n = 7$, find the value of $42 \div n$

$$= \dots = \boxed{}$$

l) If $k = 3$, find the value of $36 \div k$

$$= \dots = \boxed{}$$

m) If $d = 9$, find the value of $81 \div d$

$$= \dots = \boxed{}$$

n) If $p = 8$, find the value of $64 \div p$

$$= \dots = \boxed{}$$

o) If $i = 6$, find the value of $42 \div i$

$$= \dots = \boxed{}$$

p) If $m = 7$, find the value of $56 \div m$

$$= \dots = \boxed{}$$

q) If $e = 20$, find the value of $\frac{e}{5}$

$$= \dots = \boxed{}$$

r) If $w = 9$, find the value of $\frac{108}{w}$

$$= \dots = \boxed{}$$

Skill 21.3 Substituting one value into expressions involving +, −, × and ÷

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 2 2 3 3 4 4

- Replace the letter (variable) with the given value.
- First multiply (×) and/or divide (÷) from left to right.
- Finally add (+) and/or subtract (−) from left to right.

Q. If $q = 8$, find the value of $4q + 2$

A. $4q + 2$ substitute $q = 8$
 $= 4 \times 8 + 2$
 $= 32 + 2$
 $= 34$

a) If $w = 6$, find the value of $20 - 3w$

$= 20 - 3 \times 6$ Do × first
 $= 20 - 18 = \boxed{2}$

b) If $x = 2$, find the value of $5x + 1$

$=$
 $=$ $\boxed{}$

c) If $m = 3$, find the value of $2 + 3m$

$=$
 $=$ $\boxed{}$

d) If $x = 5$, find the value of $12 + 5x$

$=$
 $=$ $\boxed{}$

e) If $a = 4$, find the value of $6 + 4a$

$=$
 $=$ $\boxed{}$

f) If $b = 7$, find the value of $2b + 9$

$=$
 $=$ $\boxed{}$

g) If $s = 3$, find the value of $7 + 11s$

$=$
 $=$ $\boxed{}$

h) If $v = 4$, find the value of $9v - 8$

$=$
 $=$ $\boxed{}$

i) If $h = 4$, find the value of $3h - 7$

$=$
 $=$ $\boxed{}$

j) If $k = 7$, find the value of $35 - 4k$

$=$
 $=$ $\boxed{}$

k) If $w = 2$, find the value of $8w - 5$

$=$
 $=$ $\boxed{}$

l) If $u = 5$, find the value of $21 - 3u$

$=$
 $=$ $\boxed{}$

m) If $e = 9$, find the value of $\frac{e + 15}{8}$

$=$
 $=$ $\boxed{}$

n) If $s = 3$, find the value of $\frac{s + 4}{7}$

$=$
 $=$ $\boxed{}$

o) If $c = 3$, find the value of $\frac{19 - c}{4}$

$=$
 $=$ $\boxed{}$

Skill 21.4 Substituting negative values into expressions.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Replace the letter (variable) with the given value.
- First multiply (\times) and/or divide (\div) from left to right.
- Finally add ($+$) and/or subtract ($-$) from left to right.
- Determine the sign of the result. (see skills 13.7 to 13.10, pages 104 to 107)

Q. If $z = -5$,
find the value of
 $z - 9$

A. $z - 9$ \leftarrow substitute $z = -5$
 $= -5 - 9$
 $= -14$

a) If $e = -12$, find the
value of $19 + e$

$$= 19 + (-12) = \boxed{7}$$

b) If $y = -3$, find the
value of $9y$

$$= \dots = \boxed{}$$

c) If $r = -2$, find the
value of $6r$

$$= \dots = \boxed{}$$

d) If $n = -7$, find the
value of $n + 8$

$$= \dots = \boxed{}$$

e) If $z = -9$, find the
value of $4 - z$

$$= \dots = \boxed{}$$

f) If $h = -6$, find the
value of $8 + h$

$$= \dots = \boxed{}$$

g) If $j = -2$, find the
value of $8 - j$

$$= \dots = \boxed{}$$

h) If $v = -8$, find the
value of $v - 5$

$$= \dots = \boxed{}$$

i) If $b = -5$, find the
value of $7 + b$

$$= \dots = \boxed{}$$

j) If $b = -9$, find the
value of $4b$

$$= \dots = \boxed{}$$

k) If $f = -3$, find the
value of $-7f$

$$= \dots = \boxed{}$$

l) If $i = -6$, find the
value of $-5i$

$$= \dots = \boxed{}$$

m) If $a = -12$, find the
value of $\frac{a}{4}$

$$= \dots = \boxed{}$$

n) If $e = -21$, find the
value of $\frac{e}{3}$

$$= \dots = \boxed{}$$

o) If $c = -32$, find the
value of $\frac{c}{8}$

$$= \dots = \boxed{}$$

p) If $s = -4$, find the
value of $2 + 3s$

$$= \dots = \boxed{}$$

q) If $q = -3$, find the
value of $7q - 5$

$$= \dots = \boxed{}$$

r) If $x = -9$, find the
value of $5 - 2x$

$$= \dots = \boxed{}$$

Skill 21.5 Substituting two values into expressions involving + and -

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Substitute each letter (variable) with the given value.
- Add (+) and/or subtract (-) from left to right.
- Determine the sign of the result. (see skills 13.7 to 13.10, pages 104 to 107)

Q. If $h = 5$ and $i = -12$,
find the value of $h + i$

A. $h + i$ *substitute $h = 5$ and $i = -12$*
 $= 5 + (-12)$
 $= -7$

a) If $s = 9$ and $t = 8$,
find the value of $s + t$

$= 9 + 8$ $=$

b) If $m = 3$ and $n = 7$,
find the value of $m + n$

$=$ $=$

c) If $i = 10$ and $j = 4$,
find the value of $i + j$

$=$ $=$

d) If $y = 0$ and $z = 12$,
find the value of $y + z$

$=$ $=$

e) If $k = 14$ and $l = 6$,
find the value of $k - l$

$=$ $=$

f) If $g = 13$ and $h = 7$,
find the value of $g - h$

$=$ $=$

g) If $p = 13$ and $q = 11$,
find the value of $p + q$

$=$ $=$

h) If $n = 5$ and $o = 8$,
find the value of $n - o$

$=$ $=$

i) If $a = 6$ and $b = 14$,
find the value of $a - b$

$=$ $=$

j) If $h = 5$ and $i = -12$,
find the value of $h + i$

$=$ $=$

k) If $v = -8$ and $w = 9$,
find the value of $v - w$

$=$ $=$

l) If $f = -7$ and $g = 3$,
find the value of $f - g$

$=$ $=$

m) If $r = 2$ and $s = -11$,
find the value of $r - s$

$=$ $=$

n) If $a = -5$ and $b = 7$,
find the value of $a - b$

$=$ $=$

o) If $q = 6$ and $r = -16$,
find the value of $q + r$

$=$ $=$

p) If $t = 0$ and $u = 6$,
find the value of $t - u$

$=$ $=$

q) If $v = -14$ and $w = 8$,
find the value of $v + w$

$=$ $=$

r) If $w = 7$ and $x = -9$,
find the value of $w - x$

$=$ $=$

Skill 21.6 Substituting two values into expressions involving \times and \div

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Substitute each letter (variable) with the given value.
- Multiply (\times) and/or divide (\div) from left to right.
- Determine the sign of the result. (see skills 13.7 to 13.10, pages 104 to 107)

Q. If $q = 6$ and $r = 8$,
find the value of qr

A. qr substitute $q = 6$ and $r = 8$
 $= 6 \times 8$
 $= 48$

a) If $e = 3$ and $f = 7$,
find the value of $e \times f$

$= 3 \times 7$ $=$ 21

b) If $n = 4$ and $o = 2$,
find the value of $n \times o$

$=$ $=$

c) If $b = 10$ and $c = 3$,
find the value of $b \times c$

$=$ $=$

d) If $y = 2$ and $z = 9$,
find the value of yz

$=$ $=$

e) If $g = 11$ and $h = 4$,
find the value of gh

$=$ $=$

f) If $l = 3$ and $m = 13$,
find the value of lm

$=$ $=$

g) If $s = 5$ and $t = 6$,
find the value of st

$=$ $=$

h) If $w = 5$ and $x = 8$,
find the value of wx

$=$ $=$

i) If $d = 7$ and $e = 0$,
find the value of de

$=$ $=$

j) If $w = 30$ and $x = 5$,
find the value of $w \div x$

$=$ $=$

k) If $v = 45$ and $w = 9$,
find the value of $v \div w$

$=$ $=$

l) If $u = 22$ and $v = -2$,
find the value of $u \div v$

$=$ $=$

m) If $a = 54$ and $b = 6$, find
the value of $\frac{a}{b}$

$=$ $=$

n) If $c = 72$ and $d = 9$, find
the value of $\frac{c}{d}$

$=$ $=$

o) If $k = 63$ and $l = 7$, find
the value of $\frac{k}{l}$

$=$ $=$

p) If $l = 0$ and $m = 14$,
find the value of $9lm$

$=$ $=$

q) If $k = 4$ and $l = -2$,
find the value of $8kl$

$=$ $=$

r) If $d = 5$ and $e = 3$,
find the value of $7de$

$=$ $=$

Skill 21.7 Substituting two values into expressions involving +, −, × and ÷

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Substitute each letter (variable) with the given value.
- First multiply (×) and/or divide (÷) from left to right.
- Finally add (+) and/or subtract (−) from left to right.
- Determine the sign of the result. (see skills 13.7 to 13.10, pages 104 to 107)

Q. If $m = 8$ and $n = 9$,
find the value of
 $m - 5 - n$

A. $m - 5 - n$ ← substitute $m = 8$ and $n = 9$
 $= 8 - 5 - 9$
 $= 3 - 9$
 $= -6$

a) If $t = 6$ and $u = 7$,
find the value of
 $2t + u$

$= 2 \times 6 + 7$
 $= 12 + 7 = \boxed{19}$

b) If $d = 8$ and $e = 3$,
find the value of
 $16 - d + e$

$=$
 $=$ $=$

c) If $h = 3$ and $i = 7$,
find the value of
 $11 + h - i$

$=$
 $=$ $=$

d) If $i = 5$ and $j = 6$,
find the value of
 $3ij$

$=$
 $=$

e) If $a = 3$ and $b = 0$,
find the value of
 $8ab$

$=$
 $=$

f) If $m = 4$ and $n = 1$,
find the value of
 $3m - n$

$=$
 $=$

g) If $m = 3$ and $n = 2$,
find the value of
 $4m - 2n$

$=$
 $=$

h) If $b = 7$ and $c = -5$,
find the value of
 $2bc + 30$

$=$
 $=$

i) If $g = 2$ and $h = 9$,
find the value of
 $-2gh + 2h$

$=$
 $=$

j) If $a = 6$ and $b = 3$,
find the value of
 $-4a + 5b$

$=$
 $=$

k) If $y = 3$ and $z = 2$,
find the value of
 $\frac{9-y}{z}$

$=$
 $=$

l) If $g = -2$ and $h = 15$,
find the value of
 $\frac{h-7}{g}$

$=$
 $=$

Skill 21.8 Substituting into formulae.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Substitute each letter (variable) with the given value.
- First evaluate all powers.
- Then multiply (\times) and/or divide (\div) from left to right.
- Finally add ($+$) and/or subtract ($-$) from left to right.

Q. Use $A = lw$ to find the area (A) of a rectangle where $l = 3$ and $w = 7$

A. $A = lw$ *substitute $l = 3$ and $w = 7$*
 $= 3 \times 7$
 $= 21$

a) Use $F = ma$ to find the force (F) where $m = 5$ and $a = 11$

$$F = 5 \times 11 = \boxed{55}$$

b) Use $P = 5l$ to find the perimeter (P) of a regular pentagon where $l = 12$

$$P = 5 \times 12 = \boxed{}$$

c) Use $V = Bh$ to find the volume (V) of a prism where $B = 12$ and $h = 4$

$$V = 12 \times 4 = \boxed{}$$

d) Use $A = l^2$ to find the area (A) of a square where $l = 9$

$$A = 9^2 = \boxed{}$$

e) Use $A = \frac{ab}{2}$ to find the area (A) of a kite where $a = 8$ and $b = 7$

$$A = \frac{8 \times 7}{2} = \boxed{}$$

f) Use $d = vt$ to find the distance (d) where $v = 95$ and $t = 2$

$$d = 95 \times 2 = \boxed{}$$

g) Use $A = bh$ to find the area (A) of a parallelogram where $b = 4.5$ and $h = 4$

$$A = 4.5 \times 4 = \boxed{}$$

h) Use $P = 8l$ to find the perimeter (P) of an octagon where $l = 2.5$

$$P = 8 \times 2.5 = \boxed{}$$

i) Use $A = \frac{1}{2}h(a + b)$ to find the area (A) of a trapezium where $h = 4$, $a = 7$ and $b = 3$

$$A = \frac{1}{2} \times 4 \times (7 + 3) = \boxed{}$$

j) Use $V = l^2h$ to find the volume (V) of a square prism where $l = 5$ and $h = 4$

$$V = 5^2 \times 4 = \boxed{}$$

k) Use $V = l^3$ to find the volume (V) of a cube where $l = 5$

$$V = 5^3 = \boxed{}$$

l) Use $A = \pi r^2$ to find the area (A) of a circle where $\pi \approx 3.14$ and $r = 10$

$$A = 3.14 \times 10^2 = \boxed{}$$

Skill 21.9 Substituting into expressions involving powers.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Substitute each letter (variable) with the given value.
- First evaluate all powers.
- Then multiply (\times) and/or divide (\div) from left to right.
- Finally add ($+$) and/or subtract ($-$) from left to right.

Q. If $i = 4$,
find the value of
 $2i^2 - i$

A. $2i^2 - i$ *substitute $i = 4$*
 $= 2(4 \times 4) - 4$
 $= 2 \times 16 - 4$
 $= 32 - 4$
 $= 28$

a) If $x = 5$,
find the value of
 $40 - x^2$

$= 40 - 5 \times 5$ *multiply first*
 $= 40 - 25 = 15$

b) If $j = 8$,
find the value of
 j^2

$= \dots = \boxed{}$

c) If $m = 3$,
find the value of
 $8 + m^2$

$= \dots = \boxed{}$

d) If $c = 5$,
find the value of
 $4c^2$

$= \dots = \boxed{}$

e) If $d = 7$,
find the value of
 $d^2 - 9$

$= \dots = \boxed{}$

f) If $k = 4$,
find the value of
 $23 - k^2$

$= \dots = \boxed{}$

g) If $z = 6$,
find the value of
 $2z^2 - 32$

$= \dots = \boxed{}$

h) If $y = 10$,
find the value of
 $2y^2 + y$

$= \dots = \boxed{}$

i) If $b = 4$,
find the value of
 $3b^2 + 7$

$= \dots = \boxed{}$

j) If $t = 3$,
find the value of
 $4t^2 + t$

$= \dots = \boxed{}$

k) If $e = 7$,
find the value of
 $-2e^2$

$= \dots = \boxed{}$

l) If $n = 6$,
find the value of
 $\frac{n^2 - 6}{5}$

$= \dots = \boxed{}$

- Substitute each letter (variable) with the given value.
- First evaluate inside the brackets.
- Then multiply (\times) and/or divide (\div) from left to right.
- Finally add ($+$) and/or subtract ($-$) from left to right.
- Determine the sign of the result. (see skills 13.7 to 13.10, pages 104 to 107)

Q. If $r = 5$, find the value of $4(r - 2)$

$$\begin{aligned} \text{A. } & 4(r - 2) \quad \leftarrow \text{substitute } r = 5 \\ & = 4(5 - 2) \\ & = 4 \times 3 \\ & = 12 \end{aligned}$$

a) If $h = 2$, find the value of $3(5 + h)$

$$\begin{aligned} & = 3(5 + 2) \quad \leftarrow \text{Do } () \text{ first} \\ & = 3 \times 7 = \boxed{21} \end{aligned}$$

b) If $z = 6$, find the value of $4(12 - z)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

c) If $s = 3$, find the value of $s(7 + s)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

d) If $a = 7$, find the value of $5(a + 5)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

e) If $r = 5$, find the value of $4(r - 2)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

f) If $r = 9$, find the value of $r(2 + r)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

g) If $q = 2$, find the value of $9(q + 8)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

h) If $k = 4$, find the value of $k(k - 8)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

i) If $h = -5$, find the value of $4(h - 2)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

j) If $f = 9$, find the value of $6(f + 6)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

k) If $p = 6$, find the value of $p(2 - p)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

l) If $m = 7$, find the value of $m(m - 2)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

m) If $g = -2$, find the value of $2(g + 3)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

n) If $h = -1$, find the value of $h(2 - h)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

o) If $e = -2$, find the value of $e(e - 7)$

$$\begin{aligned} & = \dots\dots\dots \\ & = \dots\dots\dots = \boxed{} \end{aligned}$$

Skill 21.11 Substituting into more complex expressions.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Substitute each letter (variable) with the given value.
- First evaluate all powers.
- Then evaluate inside the brackets.
- Then multiply (\times) and/or divide (\div) from left to right.
- Finally add ($+$) and/or subtract ($-$) from left to right.

Q. If $a = 6$ and $b = 3$, find the value of $a^2 - ab$

A. $a^2 - ab$ *substitute $a = 6$ and $b = 3$*
 $= 6^2 - 6 \times 3$
 $= 36 - 18$
 $= 18$

a) If $x = 4$ and $y = 1$, find the value of $x(x + y)$

Do () first

$= 4(4 + 1)$
 $= 4 \times 5 = \boxed{20}$

b) If $c = 7$ and $d = 4$, find the value of $c(d + c)$

$=$
 $=$ $\boxed{}$

c) If $g = 9$ and $h = 5$, find the value of $h(g + h)$

$=$
 $=$ $\boxed{}$

d) If $p = 8$ and $q = 6$, find the value of $3p(p - q)$

$=$
 $=$ $\boxed{}$

e) If $m = 3$ and $n = 6$, find the value of $2n(n - m)$

$=$
 $=$ $\boxed{}$

f) If $e = 5$ and $f = 1$, find the value of $2e(e - f)$

$=$
 $=$ $\boxed{}$

g) If $j = 2$ and $k = 12$, find the value of $j^2 + jk$

$=$
 $=$ $\boxed{}$

h) If $s = 7$ and $t = 4$, find the value of $s^2 - st$

$=$
 $=$ $\boxed{}$

i) If $u = 3$ and $v = 8$, find the value of $v^2 - uv$

$=$
 $=$ $\boxed{}$

j) If $l = 10$ and $m = 5$, find the value of $3l - m^2$

$=$
 $=$ $\boxed{}$

k) If $r = 6$ and $s = 20$, find the value of $2s - r^2$

$=$
 $=$ $\boxed{}$

l) If $w = 22$ and $x = 4$, find the value of $2w - x^2$

$=$
 $=$ $\boxed{}$

22. [Equations]

Skill 22.1 Finding the missing number in equations involving + and - (1).

MM4.2 11 22 33 44
MM5.1 1 22 33 44

EITHER

Use **trial and error**:

- Guess the value of the missing number that will make the equation true (both sides of the equation are equal).
- Substitute this value in the equation.
- Check if the equation is true.
- Write the guessed value as the solution of the equation.

Example:

$$4 + \boxed{?} = 12$$

$$4 + 8 = 12$$

$$12 = 12 \text{ (true)}$$

The equation is true, so **8** is the solution.

OR

Use **inverse operations**:

- Consider the operation used to construct the sum or the difference.
- Get the missing number alone on one side of the equation, by performing the inverse operation to both sides of the equation.
- Evaluate the other side of the equation.

Hints: Addition and subtraction are inverse operations. Adding 4 and then subtracting 4 leaves a number unchanged.

Example: $4 + \boxed{?} = 12$

$$4 + ? - 4 = 12 - 4$$

$$? = 8$$

Q. $15 - \boxed{} = 9$

A. $15 - ? = 9$ OR

$$15 - 6 = 9$$

$$9 = 9 \text{ (true)}$$

What number subtracted from 15 gives 9?

Guess ? = 6

The solution is **6**.

$$15 - ? = 9$$

$$15 - 15 - ? = 9 - 15$$

$$-? = -6$$

$$? = 6$$

If 15 was added to the missing number, then do the inverse operation and subtract 15 from both sides of the equation. Finally, reverse the signs on both sides.

Use trial and error

a) $16 - \boxed{7} = 9$

$$16 - ? = 9$$

$$? = 7$$

b) $7 + \boxed{} = 15$

$$7 + ? = 15$$

$$? =$$

c) $\boxed{} + 24 = 30$

$$? + 24 = 30$$

$$? =$$

d) $14 - \boxed{} = 6$

$$? =$$

e) $13 - \boxed{} = 3$

$$? =$$

f) $8 + \boxed{} = 21$

$$? =$$

g) $\boxed{} + 8 = 20$

$$? =$$

h) $14 + \boxed{} = 21$

$$? =$$

i) $\boxed{} - 8 = 13$

$$? =$$

Skill 22.1 Finding the missing number in equations involving + and - (2).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

Operation: +18

Use inverse operations

j) $18 + \boxed{9} = 27$

k) $\boxed{} - 14 = 13$

l) $\boxed{} + 20 = 25$

~~18~~ + ? - ~~18~~ = 27 - 18

? - ~~14~~ + ~~14~~ = 13 + 14

? = 9

? =

? =

m) $\boxed{} + 6 = 23$

n) $4 + \boxed{} = 20$

o) $16 + \boxed{} = 27$

p) $15 + \boxed{} = 29$

q) $\boxed{} + 16 = 34$

r) $\boxed{} + 18 = 38$

s) $\boxed{} - 7 = 18$

t) $\boxed{} - 18 = 15$

u) $\boxed{} - 13 = 14$

v) $\boxed{} - 31 = 4$

w) $12 - \boxed{} = 3$

x) $16 - \boxed{} = 9$

y) $24 - \boxed{} = 9$

z) $\boxed{} - 8 = 16$

A) $\boxed{} - 8 = 12$

EITHER

Use **trial and error**:

- Guess the value of the missing number that will make the equation true (both sides of the equation are equal).
- Substitute this value in the equation.
- Check if the equation is true.
- Write the guessed value as the solution of the equation.

Example:

$$4 \times \boxed{?} = 12$$

$$4 \times 3 = 12$$

$$12 = 12 \text{ (true)}$$

The equation is true, so **3** is the solution.

OR

Use **inverse operations**:

- Consider the operation used to construct the multiplication or the division.
- Get the missing number alone on one side of the equation, by performing the inverse operation to both sides of the equation.
- Evaluate the other side of the equation.

Hints: Multiplication and division are inverse operations. Multiplying by 4 and then dividing by 4 leaves a number unchanged.

Example: $4 \times \boxed{?} = 12$

$$4 \times ? \div 4 = 12 \div 4$$

$$? = 3$$

Q.

$$\boxed{} \times 20 = 100$$

A.

$$? \times 20 = 100$$

OR $? \times \cancel{20} = 100$

If 20 was

What number multiplied by 20 gives 100?

$$5 \times 20 = 100$$

$$? \times \cancel{20} \div \cancel{20} = 100 \div 20$$

multiplied

$$100 = 100 \text{ (true)}$$

$$? = 5$$

by the missing

Guess ? = 5

The solution is **5**.

number, then do the inverse operation and divide by 20 both sides of the equation.

Use trial and error

a) $9 \times \boxed{7} = 63$

$$9 \times ? = 63$$

$$? = 7$$

b) $10 \times \boxed{} = 40$

$$10 \times ? = 40$$

$$? =$$

c) $\boxed{} \times 8 = 64$

$$? =$$

d) $\boxed{} \times 4 = 24$

$$? =$$

e) $4 \times \boxed{} = 20$

$$? =$$

f) $7 \times \boxed{} = 56$

$$? =$$

g) $6 \times \boxed{} = 12$

$$? =$$

h) $\boxed{} \times 7 = 42$

$$? =$$

i) $\boxed{} \times 8 = 72$

$$? =$$

Skill 22.2 Finding the missing number in equations involving \times (2).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

Operation: $\times 6$

Use inverse operations

j) $6 \times \boxed{5} = 30$

k) $\boxed{} \times 5 = 60$

l) $\boxed{} \times 12 = 72$

~~$6 \times ?$~~ $\div \cancel{6} = 30 \div 6$

$? \times \cancel{5} \div \cancel{5} = 60 \div 5$

$? = 5$

$? =$

$? =$

m) $\boxed{} \times 5 = 55$

n) $13 \times \boxed{} = 39$

o) $9 \times \boxed{} = 360$

p) $\boxed{} \times 14 = -28$

q) $-8 \times \boxed{} = -24$

r) $-4 \times \boxed{} = -28$

s) $\boxed{} \times 10 = -30$

t) $-9 \times \boxed{} = -81$

u) $-7 \times \boxed{} = 63$

v) $-9 \times \boxed{} = 18$

w) $\boxed{} \times 5 = -35$

x) $-8 \times \boxed{} = -88$

y) $\boxed{} \times (-3) = -75$

z) $\boxed{} \times (-8) = 16$

A) $-7 \times \boxed{} = 49$

EITHER

Use **trial and error**:

- Guess the value of the missing number that will make the equation true (both sides of the equation are equal).
- Substitute this value in the equation.
- Check if the equation is true.
- Write the guessed value as the solution of the equation.

Example:

$$\frac{1}{4} \text{ of } \boxed{?} = 3$$

$$\frac{1}{\cancel{4}} \times \overset{3}{\mathbf{12}} = 3$$

$$3 = 3 \text{ (true)}$$

The equation is true, so **12** is the solution.

'OF' is another way of saying 'x'

OR

Use **inverse operations**:

- Consider the operation used to construct the division.
- Get the missing number alone on one side of the equation, by performing the inverse operation to both sides of the equation.
- Evaluate the other side of the equation.

Hints: Multiplication and division are inverse operations. Multiplying by $\frac{1}{4}$ (which is the same as dividing by 4) and then multiplying by 4 leaves a number unchanged.

Example: $\frac{1}{4} \times \boxed{?} = 3$

$$\frac{1}{\cancel{4}} \times ? \times \cancel{4} = 3 \times 4$$

$$? = 12$$

Q. $\frac{3}{5}$ of $\boxed{} = 21$

A. $\frac{3}{5}$ of ? = 21

OR $\left(\frac{3}{5}\right)$ of ? = 21

What number multiplied by $\frac{3}{5}$ gives 21?

$$\frac{3}{\cancel{5}} \times \overset{6}{\cancel{30}} = 21$$

$$\frac{3}{1} \times 18 = 21 \text{ (false)}$$

Guess ? = 30

$$\frac{3}{\cancel{5}} \times \overset{7}{\cancel{35}} = 21$$

Guess ? = 35

$$\frac{3}{1} \times 21 = 21 \text{ (true)}$$

The solution is **35**.

$$\frac{3}{5} \times ? = 21$$

$$\frac{3}{\cancel{5}} \times ? \times \cancel{5} = 21 \times 5$$

$$3 \times ? = 105$$

$$3 \times ? \div 3 = 105 \div 3$$

$$? = \mathbf{35}$$

If the missing number has been divided by 5 and then multiplied by 3, then do the inverse operations and multiply by 5 and then divide by 3 both sides of the equation.

Use trial and error

a) $\frac{1}{6}$ of $\boxed{48} = 8$

$$\frac{1}{6} \times ? = 8$$

Guess ? = 48

$$\frac{1}{\cancel{6}} \times \overset{8}{\cancel{48}} = 8 \Rightarrow 8 = 8$$

$$? = 48$$

b) $\frac{1}{2}$ of $\boxed{} = 17$

$$\frac{1}{2} \times ? = 17$$

$$\frac{1}{2} \times 34 = 17 \Rightarrow 17 = 17$$

$$? =$$

c) $\frac{1}{7}$ of $\boxed{} = 9$

$$\frac{1}{7} \times ? = 9$$

$$? =$$

d) $\frac{1}{5} \times \boxed{} = 9$

$$? =$$

e) $\frac{1}{9} \times \boxed{} = 10$

$$? =$$

f) $\frac{1}{10} \times \boxed{} = 5$

$$? =$$

Skill 22.3 Finding the missing number in equations involving fractions (2).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

Operation: $\div 8$

Use inverse operations

g) $\frac{1}{8} \times \boxed{64} = 8$

h) $\frac{1}{4} \times \boxed{} = 48$

i) $\frac{1}{3} \times \boxed{} = 60$

$\frac{1}{8} \times ? \times 8 = 8 \times 8$

Inverse of $\div 8$ is $\times 8$

$? = 64$

$? =$

$? =$

j) $\frac{2}{3}$ of $\boxed{} = 10$

k) $\frac{3}{4}$ of $\boxed{} = 15$

l) $\frac{2}{5}$ of $\boxed{} = 12$

m) $\frac{4}{5} \times \boxed{} = 20$

n) $\frac{5}{6} \times \boxed{} = 50$

o) $\frac{2}{7} \times \boxed{} = 12$

p) $\frac{1}{3} \times \boxed{} = -21$

q) $\frac{1}{4} \times \boxed{} = -11$

r) $\frac{1}{5} \times \boxed{} = -12$

s) $\frac{1}{6} \times \boxed{} = -5$

t) $\frac{1}{8} \times \boxed{} = -7$

u) $\frac{1}{9} \times \boxed{} = -3$

EITHER

Use **trial and error**:

- Guess the value of the missing number that will make the equation true (both sides of the equation are equal).
- Substitute this value in the equation.
- Check if the equation is true.
- Write the guessed value as the solution of the equation.

Example:

$$4 \times \boxed{?} - 13 = 15$$

What number minus 13 gives 15?

$$4 \times ? = 28$$

$$4 \times 7 = 28$$

$$28 = 28 \text{ (true)}$$

The equation is true, so **7** is the solution.

OR

Use **inverse operations**:

- Consider the operation used to construct the equation.
 - Get the missing number alone on one side of the equation, by performing the inverse operation to both sides of the equation.
 - Evaluate the other side of the equation.
- Hints: For simplicity consider the equation inside the brackets, as one number.

Example:

$$4 \times \boxed{?} - 13 = 15$$

$$4 \times ? - \cancel{13} + \cancel{13} = 15 + 13$$

$$4 \times ? \div 4 = 28 \div 4$$

$$? = 7$$

Q. $4 \times (17 - \boxed{}) = 20$ **A.** $4 \times (17 - ?) = 20$ OR $4 \times (17 - ?) \div 4 = 20 \div 4$

What number multiplied by 4 gives 20?

What number minus 13 gives 15?

Guess ? = 12

The solution is **12**.

$$17 - ? = 5$$

$$17 - 12 = 5$$

$$5 = 5 \text{ (true)}$$

$$17 - ? = 5$$

$$17 - ? - 17 = 5 - 17$$

$$-? = -12$$

$$? = 12$$

If the bracket has been multiplied by 4, then do the inverse operation and divide by 4 both sides of the equation. Then subtract 17 from both sides. Finally reverse the signs.

Use trial and error

- a)** $8 + 4 \times \boxed{10} = 48$
 $8 + 4 \times ? = 48$
 $4 \times ? = 40$
 $? = 10$
- b)** $5 + 6 \times \boxed{} = 47$
 $5 + 6 \times ? = 47$
 $6 \times ? = 42$
 $? =$
- c)** $12 + 4 \times \boxed{} = 44$
 $? =$
- d)** $4 \times (9 - \boxed{}) = 16$
 $4 \times (9 - ?) = 16$
 $9 - ? = 4$
 $? =$
- e)** $3 \times (8 - \boxed{}) = 15$
 $? =$
- f)** $7 \times (9 - \boxed{}) = 21$
 $? =$

Skill 22.4 Finding the missing number in equations involving +, −, × and/or brackets (2).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

Operation: +15

Use inverse operations

g) $15 + 6 \times \boxed{5} = 45$

h) $16 + 2 \times \boxed{} = 40$

i) $21 + 5 \times \boxed{} = 61$

~~15~~ + 6 × ? − ~~15~~ = 45 − 15

$6 \times ? \div 6 = 30 \div 6$

$? = 5$

$? =$

$? =$

j) $8 \times (16 - \boxed{}) = 24$

k) $4 \times (13 - \boxed{}) = 16$

l) $8 \times (20 - \boxed{}) = 32$

m) $5 \times \boxed{} - 20 = 25$

n) $6 \times \boxed{} - 36 = 12$

o) $4 \times \boxed{} - 16 = 12$

p) $5 \times \boxed{} + 6 = 51$

q) $7 \times \boxed{} + 12 = 82$

r) $\boxed{} \times 7 + 8 = 50$

s) $36 - 6 \times \boxed{} = 12$

t) $50 - 7 \times \boxed{} = 15$

u) $42 - 10 \times \boxed{} = 22$

Skill 22.5 Finding the missing number in equations involving decimals.

- Use trial and error or inverse operation to find the missing number. (see skill 22.1, page 193 and skill 22.2, page 195)

Q. $\square + 2.7 = 3.4$ **A.** $? + 2.7 = 3.4$ OR $? + \overset{\text{2.7}}{\cancel{2.7}} = 3.4$ If 2.7 was added to the missing number, then do the inverse operation and subtract 2.7 from both sides of the equation.

What number added to 2.7 gives 3.4? $0.7 + 2.7 = 3.1$ $? + \cancel{2.7} - \cancel{2.7} = 3.4 - 2.7$

Guess ? = 0.7 $3.4 = 3.4$ (true) $? = 0.7$

The solution is **0.7**

a) $\square \times 1.6 = 6.4$ Use trial and error

Guess ? = 4 $? \times 1.6 = 6.4$

$? = 4$

b) $1.4 + \square = 2.6$ $1.4 + ? = 2.6$

$? =$

c) $2.8 + \square = 4.4$ $? =$

d) $3.8 - \square = 3$ $? =$

e) $2.9 - \square = 0.7$ $? =$

f) $\square \times 1.3 = 3.9$ $? =$

g) $4.2 - \square = 2.7$ Operation: + 4.2 Use inverse operations

$\cancel{4.2} - ? - \cancel{4.2} = 2.7 - 4.2$ Inverse of + 4.2 is - 4.2

$-? = -1.5$

$? = 1.5$

h) $3.5 - \square = 1.2$

i) $2.8 - \square = 0.6$

j) $\square + 2.5 = 4$

k) $3.6 + \square = 5$

l) $\square + 1.2 = 2.1$

m) $1.2 \times \square = 7.2$

n) $1.7 \times \square = 3.4$

o) $1.4 \times \square = 7$

Skill 22.6 Solving one-step equations by using the inverse operations of + and - (1).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Consider the operation used to construct the sum or the difference involving the variable.
 - Get the variable alone on one side of the equation, by performing the inverse operation to both sides of the equation.
 - Evaluate the other side of the equation.
- Hint: Remember that you must do the same operation to both sides of the equation.*

| Operation | Inverse Operation | Operation | Inverse Operation |
|---|-------------------|---|-------------------|
| + | - | - | + |
| $x + 3 = 6$ $x + 3 - 3 = 6 - 3$ $x = 3$ | | $x - 3 = 6$ $x - 3 + 3 = 6 + 3$ $x = 9$ | |

Q. Solve for p : $17 - p = 13$ **A.** $+17 - p = 13$ *Operation: +17*

$\cancel{17} - p - \cancel{17} = 13 - 17$ *Inverse of +17 is -17*

Simplify: $17 - 17 = 0$ $-p = -4$ *Reverse sign both sides*

$p = 4$

a) Solve for t : $t + 6 = 15$ **b)** Solve for y : $y + 5 = 12$ **c)** Solve for r : $3 + r = 11$

Operation: +6

Inverse of +6 is -6

$t + \cancel{6} - \cancel{6} = 15 - 6$ $y + 5 - 5 = 12 - 5$

$t = 9$ $y =$ $r =$

d) Solve for a : $a + 10 = 30$ **e)** Solve for x : $8 + x = 17$ **f)** Solve for m : $5 + m = 12$

$a =$ $x =$ $m =$

g) Solve for e : $e + 9 = 12$ **h)** Solve for g : $g + 7 = 11$ **i)** Solve for s : $13 + s = 22$

$e =$ $g =$ $s =$

j) Solve for t : $t - 3 = 6$ **k)** Solve for y : $y - 4 = 9$ **l)** Solve for z : $z - 5 = 2$

$t =$ $y =$ $z =$

m) Solve for x : $x - 12 = 20$

$x =$

n) Solve for b : $b - 15 = 8$

$b =$

o) Solve for s : $s - 13 = 27$

$s =$

p) Solve for a : $14 - a = 6$

$14 - a - 14 = 6 - 14$

$-a = -8$

$a = 8$

q) Solve for z : $24 - z = 10$

$z =$

r) Solve for s : $18 - s = 7$

$s =$

s) Solve for j : $10 - j = 2$

$j =$

t) Solve for c : $22 - c = 7$

$c =$

u) Solve for e : $16 - e = 9$

$e =$

v) Solve for d : $-3 + d = 9$

$d =$

w) Solve for v : $-6 + v = 12$

$v =$

x) Solve for n : $-8 + n = 7$

$n =$

y) Solve for h : $-9 + h = 12$

$h =$

z) Solve for k : $-7 + k = 25$

$k =$

A) Solve for m : $-5 + m = 16$

$m =$

Skill 22.7 Solving one-step equations by using the inverse operations of \times and \div (1).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Consider the operation used to construct the expression involving the variable.
 - Get the variable alone on one side of the equation, by performing the inverse operation on both sides of the equation.
 - Evaluate the other side of the equation.
- Hint: Remember that you must do the same operation to both sides of the equation.*

| Operation | Inverse Operation | Operation | Inverse Operation |
|------------------------------|-------------------|-------------------------------------|-------------------|
| \times | \div | \div | \times |
| $3x = 6$ | | $\frac{x}{3} = 6$ | |
| $\frac{3x}{3} = \frac{6}{3}$ | | $\frac{x}{3} \times 3 = 6 \times 3$ | |
| $x = 2$ | | $x = 18$ | |

Q. Solve for x : $\frac{x}{8} = 6$

A. $\frac{x}{8} = 6$ *Operation: $\div 8$*

Simplify: $8 \div 8 = 1$ $\frac{x}{\cancel{8}} \times \frac{1}{\cancel{8}} = 6 \times 8$ *Inverse of $\div 8$ is $\times 8$*

$x = 48$

Operation: $\times 5$

- a)** Solve for a : $5 \times a = 45$ **b)** Solve for m : $4 \times m = 40$ **c)** Solve for c : $6 \times c = 72$

Inverse of $\times 5$ is $\div 5$ $\frac{5a}{\cancel{5}} = \frac{45}{\cancel{5}}$ *Simplify: $\div 5$*

$a = 9$

$m =$

$c =$

- d)** Solve for h : $7 \times h = 77$ **e)** Solve for n : $9 \times n = 81$ **f)** Solve for p : $8 \times p = 64$

$h =$

$n =$

$p =$

- g)** Solve for b : $8b = 24$ **h)** Solve for z : $7z = 28$ **i)** Solve for l : $9l = 54$

$b =$

$z =$

$l =$

- j)** Solve for r : $10r = 120$ **k)** Solve for y : $5y = 75$ **l)** Solve for u : $4u = 36$

$r =$

$y =$

$u =$

Skill 22.7 Solving one-step equations by using the inverse operations of \times and \div (2).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

m) Solve for g : $15g = -30$

$$15 \times g \div 15 = -30 \div 15$$

$$g = -2$$

n) Solve for a : $20a = -100$

$$a =$$

o) Solve for s : $3s = -21$

$$s =$$

p) Solve for m : $5m = 60$

$$m =$$

q) Solve for n : $14n = -28$

$$n =$$

r) Solve for g : $7g = 49$

$$g =$$

s) Solve for d : $10d = -80$

$$d =$$

t) Solve for p : $12p = -36$

$$p =$$

u) Solve for h : $9h = -90$

$$h =$$

Operation: $\div 4$

v) Solve for x : $\frac{x}{4} = 9$

w) Solve for c : $\frac{c}{5} = 6$

x) Solve for q : $\frac{q}{3} = 8$

Inverse of $\div 4$ is $\times 4$

$$\frac{x}{4} \times 4 = 9 \times 4$$

$$x =$$

$$c =$$

$$q =$$

y) Solve for n : $\frac{n}{7} = 3$

$$n =$$

z) Solve for r : $\frac{r}{8} = 12$

$$r =$$

A) Solve for j : $\frac{j}{4} = 15$

$$j =$$

B) Solve for b : $\frac{b}{6} = 12$

$$b =$$

C) Solve for e : $\frac{e}{9} = 10$

$$e =$$

D) Solve for k : $\frac{k}{2} = 35$

$$k =$$

Skill 22.8 Solving two-step equations by using the inverse operations of +, -, × and ÷ (1).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Get the variable alone on one side of the equation, by performing the inverse operations, in order, to both sides of the equation. (see skill 22.6, page 202 and skill 22.7, page 204).
- Evaluate the other side of the equation.

Hint: Remember that you must do the same operation to both sides of the equation.

Q. Solve for v : $9v - 2 = -20$ **A.**

$$\begin{aligned}
 9v - 2 &= -20 && \text{Operation: } -2 \\
 9v - \cancel{2} + \cancel{2} &= -20 + 2 && \text{Inverse of } -2 \text{ is } +2 \\
 9v &= -18 && \text{Operation: } \times 9 \\
 \frac{1\cancel{9}v}{1\cancel{9}} &= \frac{-18}{\cancel{9}1} && \text{Inverse of } \times 9 \text{ is } \div 9 \\
 v &= -2
 \end{aligned}$$

Operation: + 8

a) Solve for x : $7x + 8 = 50$ **b)** Solve for y : $6y - 9 = 21$ **c)** Solve for a : $3a + 8 = 29$

Inverse of + 8 is - 8

$$7x + \cancel{8} - \cancel{8} = 50 - 8$$

Inverse of $\times 7$ is $\div 7$

$$7x = 42$$

$$\frac{1\cancel{7}x}{1\cancel{7}} = \frac{42}{\cancel{7}1} \quad \text{Simplify: } \div 7$$

$$x = 6$$

$$y =$$

$$a =$$

d) Solve for d : $4d + 5 = 29$ **e)** Solve for e : $3e - 5 = 25$ **f)** Solve for u : $8u - 10 = 22$

$$d =$$

$$e =$$

$$u =$$

g) Solve for x : $2x - 26 = -2$ **h)** Solve for t : $7t - 3 = -24$ **i)** Solve for h : $5h - 6 = -6$

$$x =$$

$$t =$$

$$h =$$

Skill 22.8 Solving two-step equations by using the inverse operations of $+$, $-$, \times and \div (2).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- j)** Solve for i : $6i - 9 = -21$ **k)** Solve for q : $5q - 7 = -32$ **l)** Solve for s : $8s - 20 = -4$

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$i =$

$q =$

$s =$

- m)** Solve for i : $4i + 12 = -20$ **n)** Solve for j : $3j + 5 = -10$ **o)** Solve for l : $10l + 4 = -26$

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$i =$

$j =$

$l =$

- p)** Solve for x : $9x + 10 = 1$ **q)** Solve for z : $4z + 19 = 3$ **r)** Solve for c : $6c + 17 = 5$

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$x =$

$z =$

$c =$

- s)** Solve for g : $7g + 8 = 1$ **t)** Solve for m : $9m + 40 = 4$ **u)** Solve for p : $2p + 18 = 6$

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$g =$

$m =$

$p =$

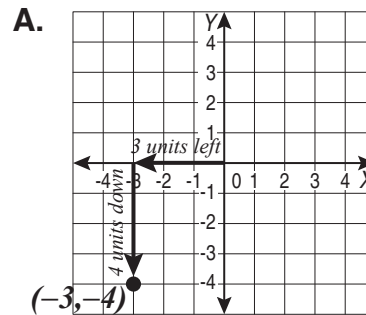
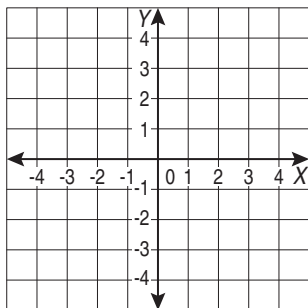
23. [Coordinates]

Skill 23.1 Describing the position of ordered pairs on a Cartesian plane.

MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

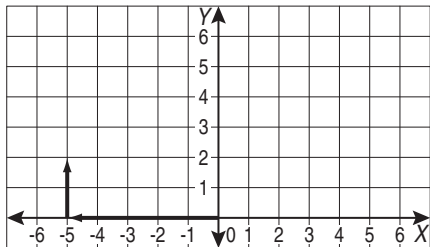
- Start at the origin (0,0).
- Move left or right by the number of given units. This first number becomes the x-coordinate. Use a “+” sign if you moved to the right and use a “-” if you moved to the left.
- From that point, move up or down by the number of given units. This second number becomes the y-coordinate. Use a “+” sign if you moved up and use a “-” if you moved down.
- Plot the final point on the Cartesian plane.

Q. Start at the origin. Move 3 units to the left along the x -axis and then down 4 units. Plot a point. What are the coordinates of the point?



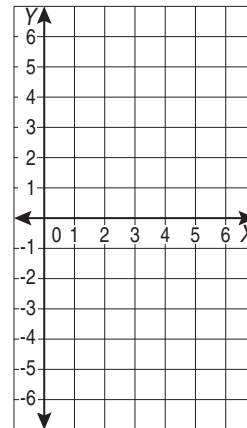
The first coordinate is -3 (3 units left)
The second coordinate is -4 (4 units down)
The answer is $(-3,-4)$

a) Start at the origin. Move 5 units to the left along the x -axis and then up 2 units. Plot a point. What are the coordinates of the point?



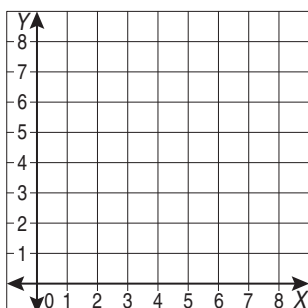
(,)

b) Start at the origin. Move 6 units to the right along the x -axis and then down 5 units. Plot a point. What are the coordinates of the point?



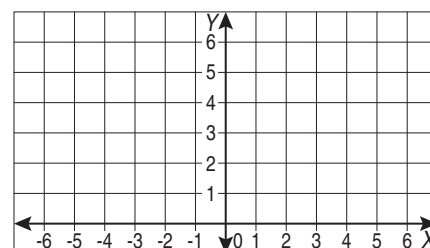
(,)

c) Start at the origin. Move 8 units to the right along the x -axis and then up 3 units. Plot a point. What are the coordinates of the point?



(,)

d) Start at the origin. Move 4 units to the left along the x -axis and then up 6 units. Plot a point. What are the coordinates of the point?



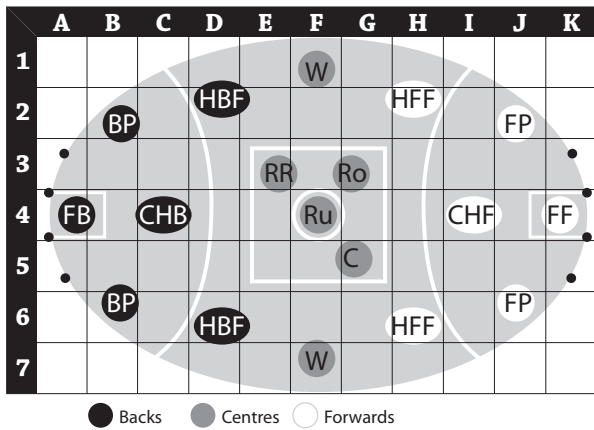
(,)

Skill 23.2 Using grid references to describe location on a map (1).

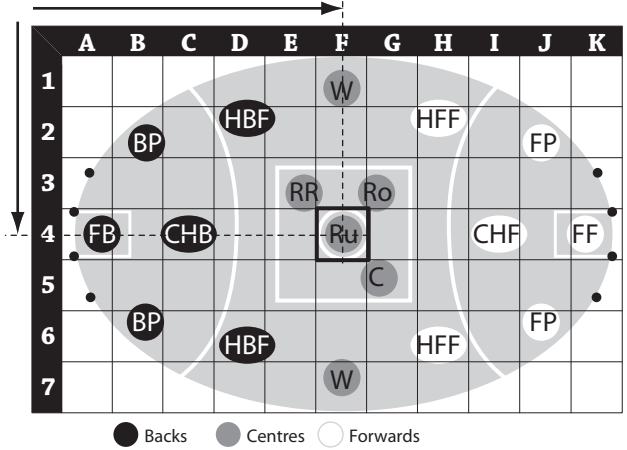
MM4.2 1 1 22 33 44
MM5.1 1 1 22 33 44

- Locate the object on the grid.
- Starting from the left, first read across the horizontal axis to find the letter that matches the column of the object.
- Then read along the vertical axis to find the number that matches the row of the object.
- Write the letter followed by the number to specify the grid reference.

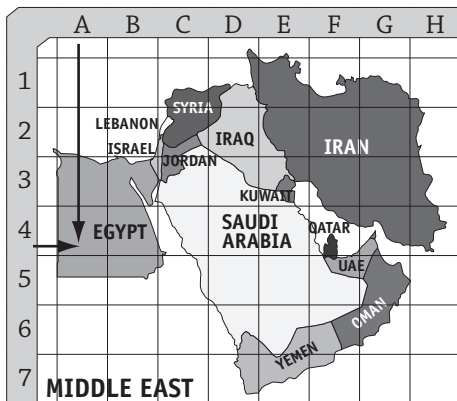
Q. In this AFL starting line up, what is the grid reference of the Ruck (Ru)?



A. The grid reference is **F4**.



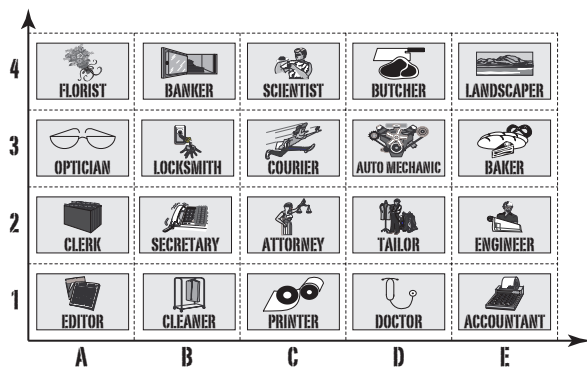
a) In which country would you be if you were located at A4?



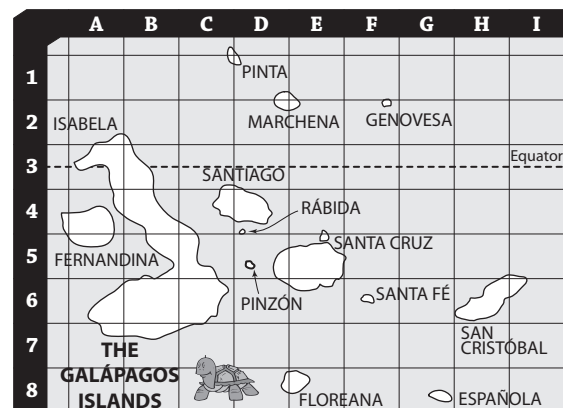
b) Above which continent would you be if your airplane is flying at O6?



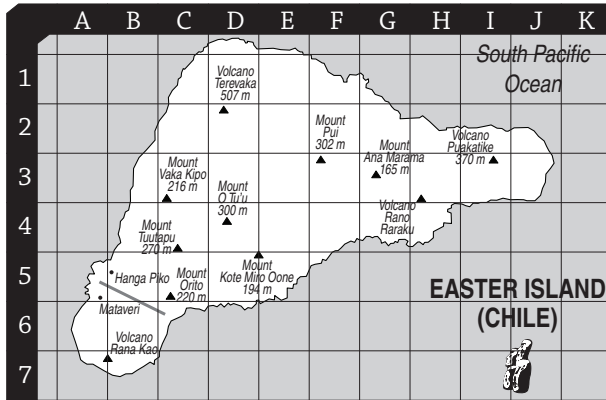
c) Which occupation is listed at C4?



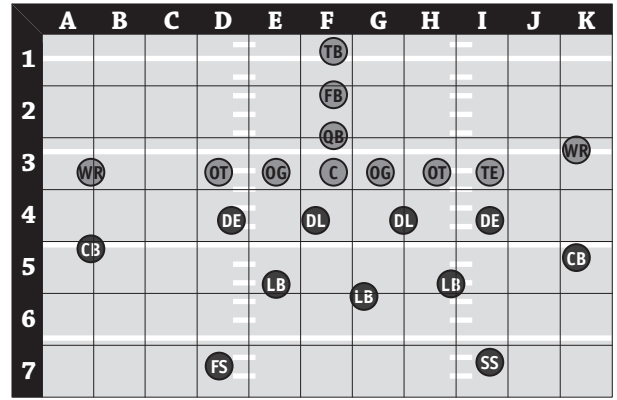
d) On which island would you be if you were located at G8?



e) On which mountain would you be located at C5?

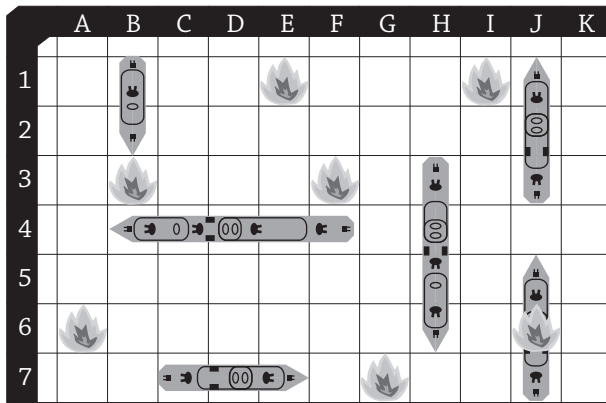


f) In this gridiron starting line up, what is the grid reference of the Tight End (TE)?



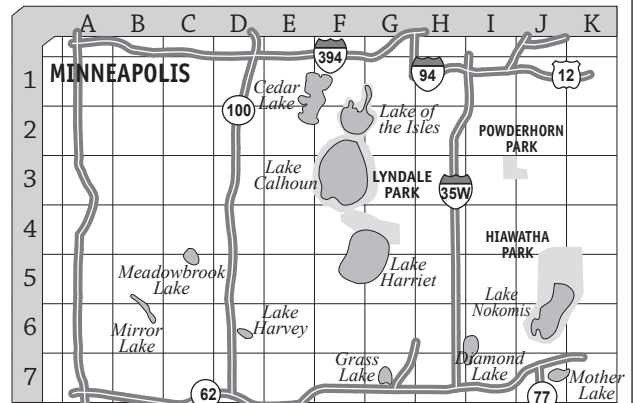
● Offense
● Defense

g) What is the grid reference of an enemy hit on a battleship?

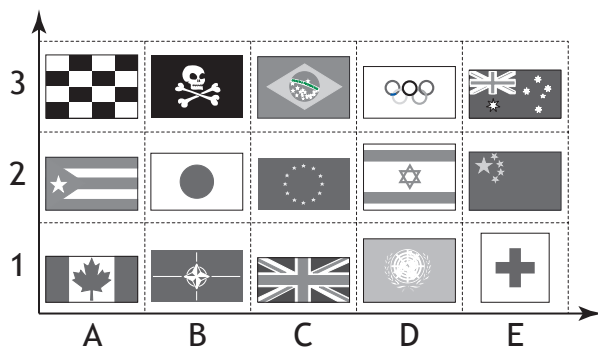


☀ Enemy hit
🚢 Battleship

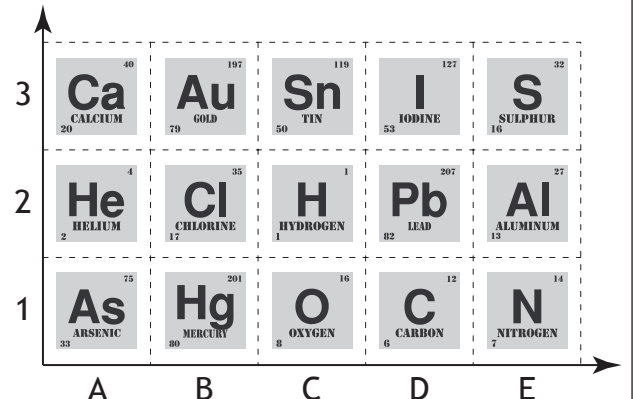
h) What is the grid reference of Grass Lake?



i) What is the grid reference of the Red Cross flag?



j) What is the grid reference of Hydrogen (H)?

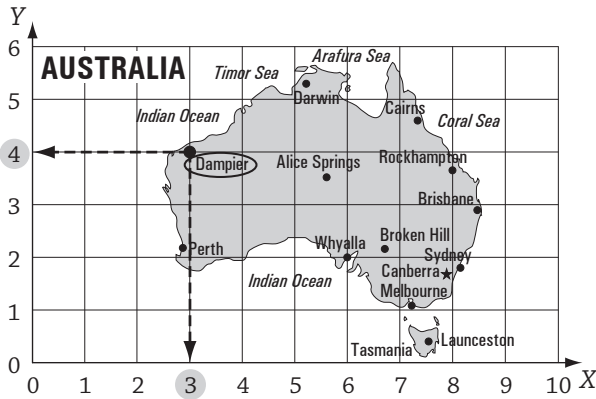


Skill 23.3 Using coordinates to describe location on a map.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Locate the object on the coordinate plane.
 - Move vertically from the object until you intersect the horizontal axis (x -axis).
 - Write the number you find on the horizontal axis as the x -coordinate of the point (x ,).
 - Move horizontally from the object until you intersect the vertical axis (y -axis).
 - Write the number you find on the vertical axis as the y -coordinate of the point (, y).
 - Read the coordinate on the horizontal axis first, then on the vertical axis.
- Hint: x before y in the alphabet is one way to remember this order.*

Q. What are the coordinates of Dampier?



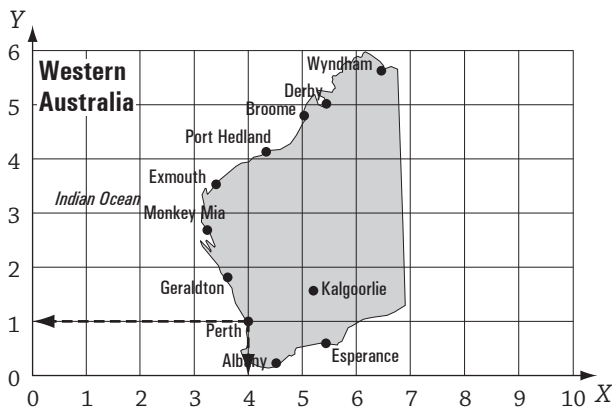
A. Locate Dampier on the map.

Follow the vertical line that Dampier is on, down to where it meets the horizontal axis. The x -coordinate is 3.

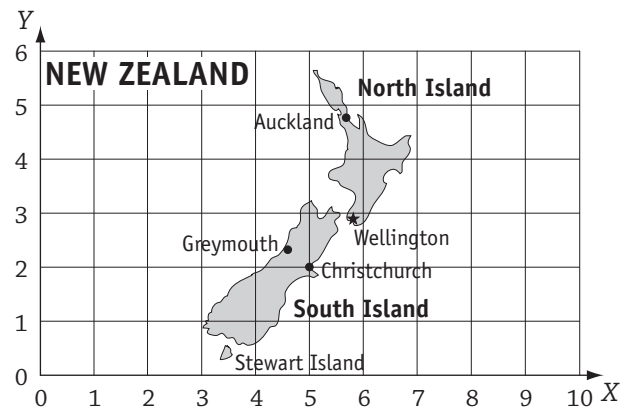
Follow the horizontal line that Dampier is on, back to where it meets the vertical axis. The y -coordinate is 4.

The coordinates that describe the location of Dampier are **(3,4)**.

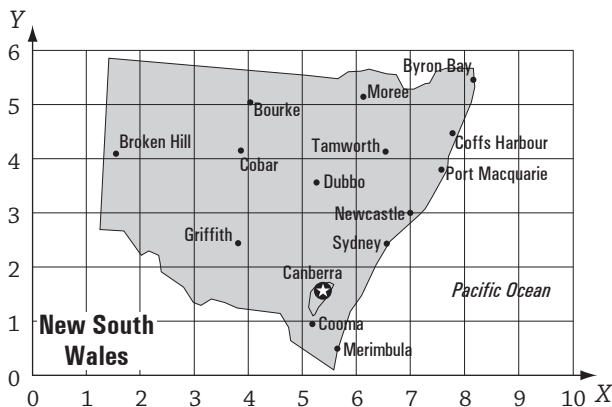
a) What are the coordinates of Perth?



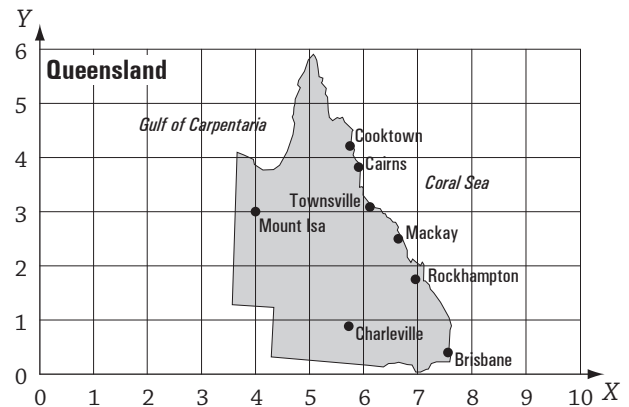
b) Which city is located at the coordinates (5,2)?



c) What are the coordinates of Newcastle?

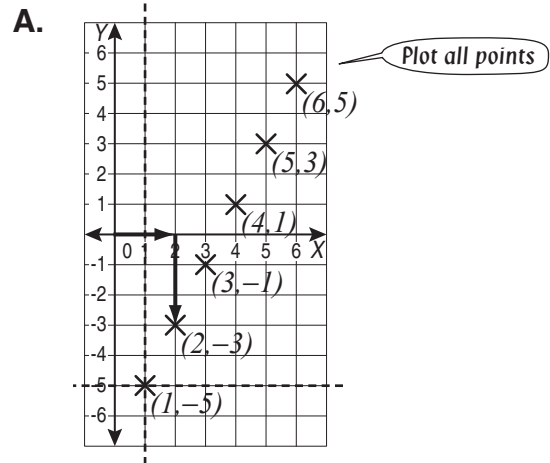
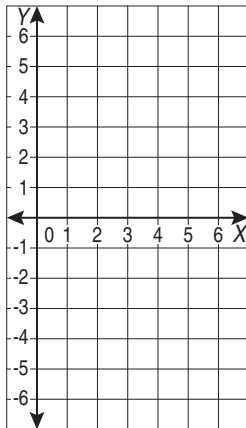


d) What are the coordinates of Mount Isa?

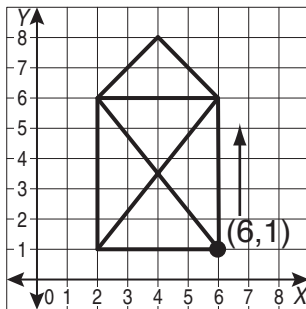


- Start at the origin (0,0) of the Cartesian plane.
- Move across the x -axis by the number of units equal to the first coordinate (move to the right if the coordinate is positive and to the left if the coordinate is negative).
- Draw a vertical line passing through this point.
- From the origin, move along the y -axis by the number of units equal to the second coordinate (move up if the coordinate is positive and down if the coordinate is negative).
- Draw a horizontal line passing through this point.
- Plot the point at the intersection of these two lines.

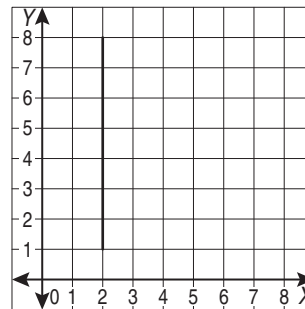
Q. Draw crosses at the following points:
(1,-5), (2,-3), (3,-1), (4,1), (5,3), (6,5)



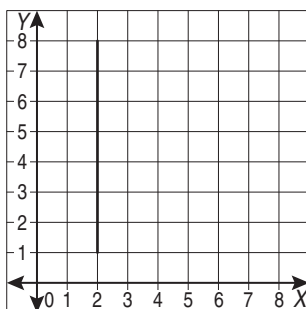
a) Starting at (6,1), draw a line to (6,6) then continue to (2,6), (2,1), (6,1), (2,6), (4,8), (6,6) and (2,1). What shape have you drawn?



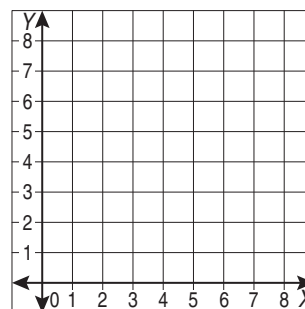
b) Starting at (2,8), draw a line to (3,8) then continue to (3,5), (6,5), (6,8), (7,8), (7,1), (6,1), (6,4), (3,4), (3,1) and (2,1). What letter have you drawn?



c) Starting at (2,8), draw a line to (7,8) then continue to (7,7), (3,7), (3,5), (6,5), (6,4), (3,4), (3,1) and (2,1). What letter have you drawn?

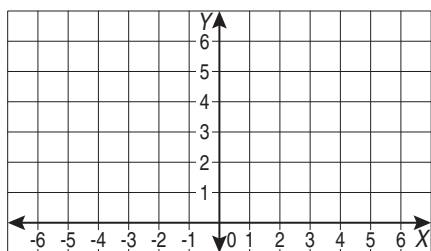


d) Plot point G at coordinates (4,7) on this Cartesian plane.



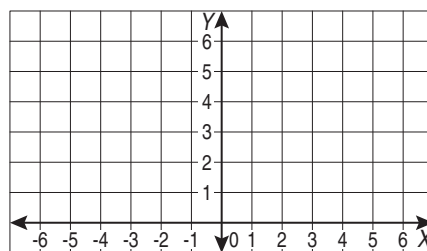
- e) Plot the following points on this Cartesian plane:

M at coordinates $(-6,0)$
N at coordinates $(3,5)$



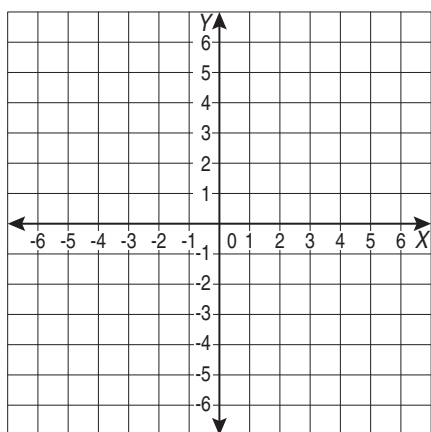
- f) Plot the following points on this Cartesian plane:

D at coordinates $(0,4)$
E at coordinates $(-4,6)$



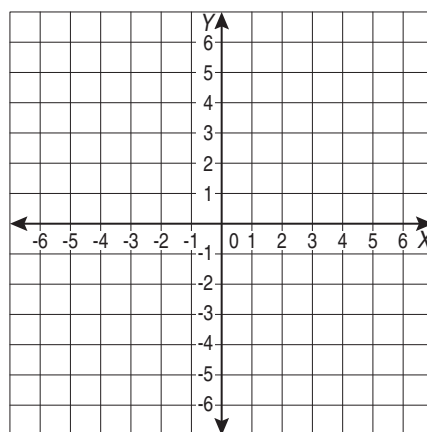
- g) Plot the following points on this Cartesian plane:

P at coordinates $(-5,3)$
Q at coordinates $(-4,-1)$
R at coordinates $(3,-2)$

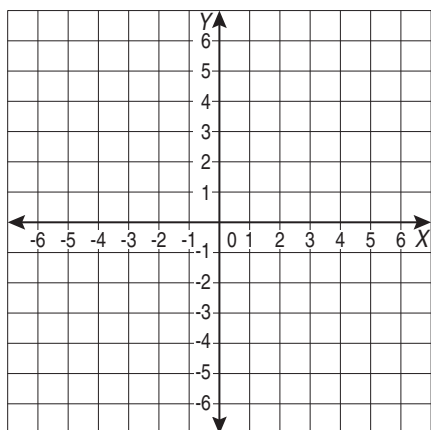


- h) Plot the following points on this Cartesian plane:

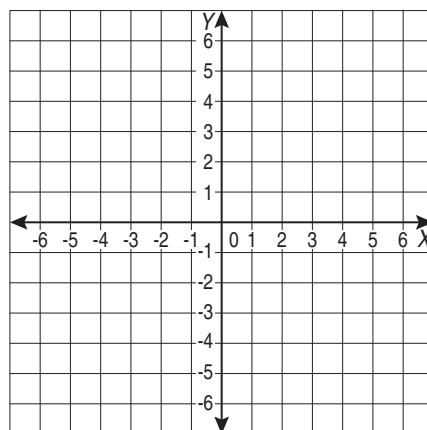
E at coordinates $(-6,4)$
F at coordinates $(0,1)$
G at coordinates $(-3,-3)$



- i) Draw circles at the following points:
 $(-6,-3)$, $(-4,-1)$, $(-2,1)$, $(0,3)$, $(2,5)$



- j) Draw circles at the following points:
 $(-6,5)$, $(-3,4)$, $(0,3)$, $(3,2)$, $(6,1)$

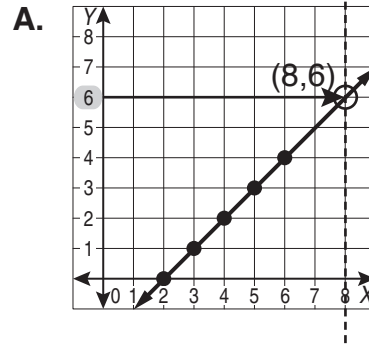
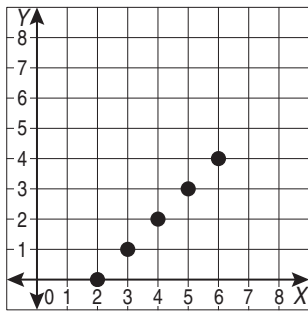


- Locate the point on the coordinate plane.
- Move vertically from the object until you intersect the horizontal axis (x -axis).
- Write the number you find on the horizontal axis as the x -coordinate of the point (x ,).
- Move horizontally from the object until you intersect the vertical axis (y -axis).
- Write the number you find on the vertical axis as the y -coordinate of the point (, y).

Hints: Always write the x -coordinate first.

The coordinates of the origin O are $(0,0)$.

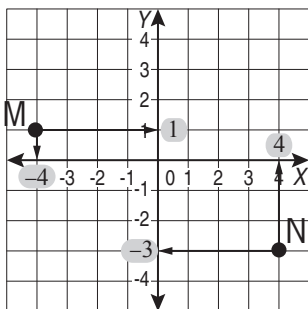
Q. These dots, if joined, would form a line. A point on this line has an x -coordinate of 8. What is the y -coordinate of this point?



Join the given dots. Draw a vertical line through the x -coordinate 8. Plot the point where the vertical line intersects the other line. Read the y -coordinate of this point.

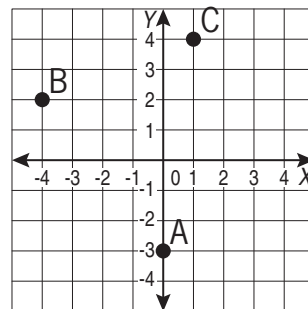
The y -coordinate is 6

a) What are the coordinates of the points M and N on this Cartesian plane?



$M(-4, 1)$ $N(\quad , \quad)$

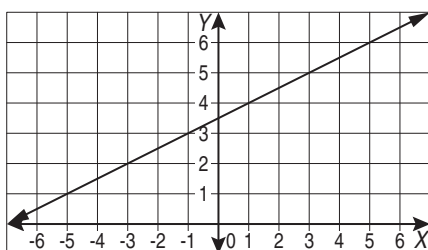
b) What are the coordinates of the points A , B and C on this Cartesian plane?



$A(\quad , \quad)$ $B(\quad , \quad)$ $C(\quad , \quad)$

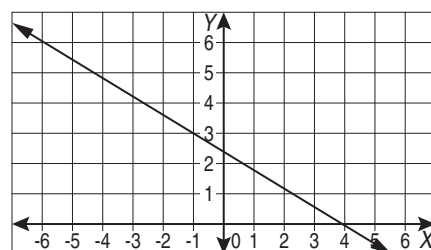
c) Which point lies on the line graphed below?

$M(-5,1)$ $N(0,5)$ $P(6,6)$



d) Which point lies on the line graphed below?

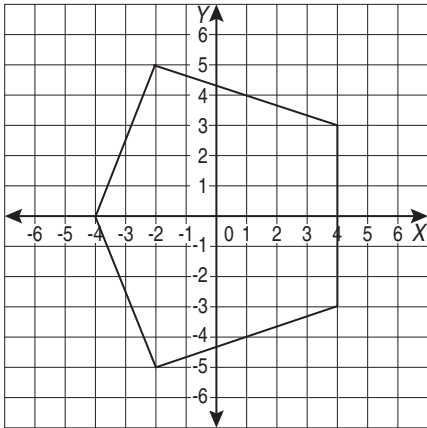
$E(-4,0)$ $F(3,3)$ $G(-1,3)$



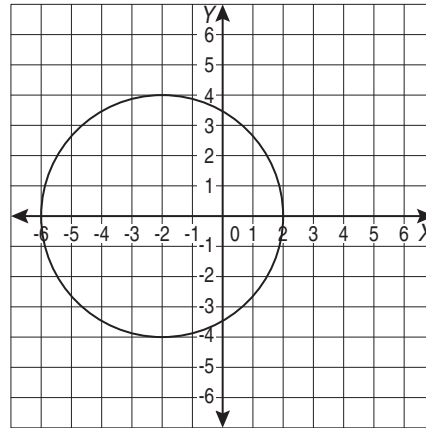
Skill 23.5 Finding the coordinates of a point on a Cartesian plane (2).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

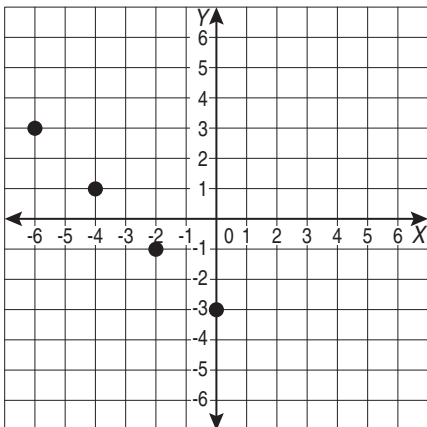
- e) Which ordered pair lies within this pentagon?
A) $(-6, -2)$ B) $(-3, 4)$ C) $(3, -2)$



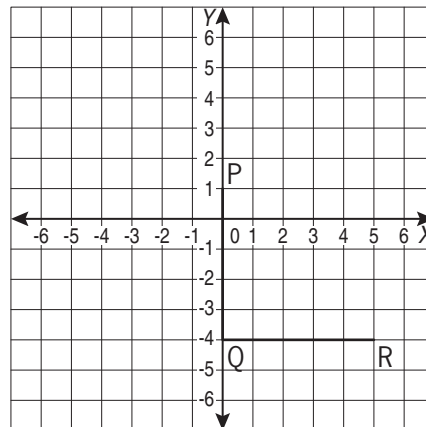
- f) Which ordered pair lies within this circle?
A) $(-4, 5)$ B) $(-5, -2)$ C) $(3, -6)$



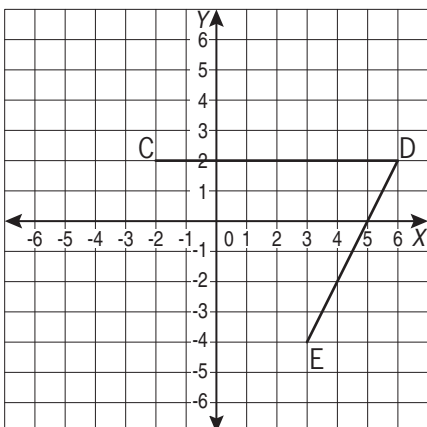
- g) These dots, if joined, would form a line. A point on this line has an x -coordinate of 3. What is the y -coordinate of this point?



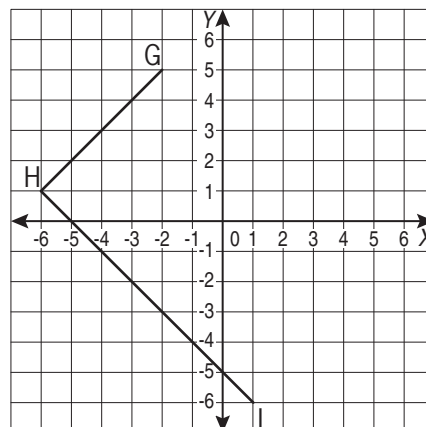
- h) What are the coordinates of point S that will make PQRS a square?



- i) What are the coordinates of point F that will make CDEF a parallelogram?



- j) What are the coordinates of point J that will make GHIJ a rectangle?



Skill 23.6 Completing a table of values for a linear rule (1).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Substitute the variable x with the given values.
- Calculate the values of y .

Q. Complete the table of values for the linear rule $y = -2 + x$

| x | $y = -2 + x$ | y |
|-----|-------------------|-----|
| 0 | $y = -2 + 0 = -2$ | -2 |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

A. $y = -2 + x$ Substitute $x = 1$
 $x = 1 \Rightarrow y = -2 + 1 = -1$
 $x = 2 \Rightarrow y = -2 + 2 = 0$
 $x = 3 \Rightarrow y = -2 + 3 = 1$
 $x = 4 \Rightarrow y = -2 + 4 = 2$
 $x = 5 \Rightarrow y = -2 + 5 = 3$

\Rightarrow

| x | $y = -2 + x$ | y |
|-----|-------------------|-----|
| 0 | $y = -2 + 0 = -2$ | -2 |
| 1 | $y = -2 + 1 = -1$ | -1 |
| 2 | $y = -2 + 2 = 0$ | 0 |
| 3 | $y = -2 + 3 = 1$ | 1 |
| 4 | $y = -2 + 4 = 2$ | 2 |
| 5 | $y = -2 + 5 = 3$ | 3 |

a) Complete the table for this rule:

| Houses sold (x) | Earnings ($2000x$) |
|---------------------|------------------------|
| 1 | $2000 \times 1 = 2000$ |
| 2 | $2000 \times 2 = 4000$ |
| 3 | $2000 \times 3 = 6000$ |
| 4 | |
| 5 | |
| 6 | |

b) Complete the table for this rule:

| Number of guests (x) | Dinner cost in dollars ($15x$) |
|--------------------------|----------------------------------|
| 4 | $15 \times 4 = 60$ |
| 8 | |
| 12 | |
| 16 | |
| 20 | |
| 24 | |

c) Complete the table for this rule:

| No. of days (x) | Records entered ($90x$) |
|---------------------|---------------------------|
| 1 | $90 \times 1 = 90$ |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |

d) Complete the table for this rule:

| No. of days (x) | Number of T-shirts sold ($16x$) |
|---------------------|-----------------------------------|
| 1 | $16 \times 1 = 16$ |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |

e) Complete the table for this rule:

| No. of hours worked (x) | Pay in dollars ($8x$) |
|-----------------------------|-------------------------|
| 2 | $8 \times 2 = 16$ |
| 4 | |
| 6 | |
| 8 | |
| 10 | |
| 12 | |

f) Complete the table for this rule:

| No. of seconds (x) | Distance travelled in metres ($18x$) |
|------------------------|--|
| 10 | $18 \times 10 = 180$ |
| 20 | |
| 30 | |
| 40 | |
| 50 | |
| 60 | |

- g) Complete the table of values for the linear rule
- $y = x + 5$

| x | $y = x + 5$ | y |
|-----|-----------------|-----|
| 0 | $y = 0 + 5 = 5$ | 5 |
| 1 | $y = 1 + 5 = 6$ | 6 |
| 2 | $y = 2 + 5 = 7$ | 7 |
| 3 | | |
| 4 | | |
| 5 | | |

- h) Complete the table of values for the linear rule
- $y = 8 - x$

| x | $y = 8 - x$ | y |
|-----|-----------------|-----|
| 3 | $y = 8 - 3 = 5$ | 5 |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |

- i) Complete the table of values for the linear function
- $y = 7 + x$

| x | $y = 7 + x$ | y |
|-----|-----------------|-----|
| 0 | $y = 7 + 0 = 7$ | 7 |
| 2 | | |
| 4 | | |
| 6 | | |
| 8 | | |
| 10 | | |

- j) Complete the table of values for the linear function
- $y = x - 4$

| x | $y = x - 4$ | y |
|-----|------------------|-----|
| 0 | $y = 0 - 4 = -4$ | -4 |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

- k) Complete the table of values for the linear function
- $y = 3x$

| x | $y = 3x$ | y |
|-----|----------------------|-----|
| 0 | $y = 3 \times 0 = 0$ | 0 |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

- l) Complete the table of values for the linear function
- $y = x - 6$

| x | $y = x - 6$ | y |
|-----|------------------|-----|
| 1 | $y = 1 - 6 = -5$ | -5 |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |

- m) Complete the table of values for the linear function
- $y = 100 \div x$

| x | $y = 100 \div x$ | y |
|-----|-----------------------|-----|
| 5 | $y = 100 \div 5 = 20$ | 20 |
| 10 | | |
| 20 | | |
| 25 | | |
| 50 | | |
| 100 | | |

- n) Complete the table of values for the linear function
- $y = 2 - x$

| x | $y = 2 - x$ | y |
|-----|-----------------|-----|
| 0 | $y = 2 - 0 = 2$ | 2 |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

To determine the correct equation of a given line

EITHER

- Choose two points lying on the linear graph.
- Substitute the coordinates of these points in the equation of the line.
- Check if they are both true statements.

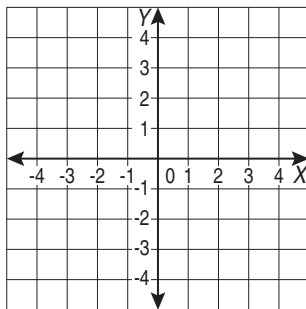
OR

- Check for special properties of the x-coordinates or the y-coordinates.
Example: All the points where $x = 4$ means that all points are lying on a vertical line passing through the point $(4,0)$.

To draw the graph of a given equation

- Choose two different pairs of numbers (x,y) which satisfy the equation.
- Plot these two pairs of coordinates.
- Join the points.

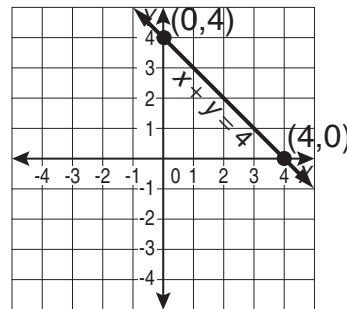
Q. Draw a line connecting all the points where the x -coordinate and the y -coordinate add to 4 (line of equation $x + y = 4$).



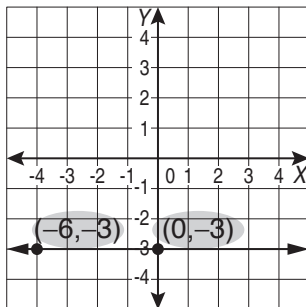
A. $x + y = 4$

Choose $x = 4$ and $y = 0 \Rightarrow$ the point $(4,0)$

Choose $x = 0$ and $y = 4 \Rightarrow$ the point $(0,4)$



a)



The line above shows:

- A) All points where $x - y = 3$
- B) All points where $x = -3$
- C) All points where $y = -3$

$x - y = 3$ A) $0 - (-3) = 3$ or $3 = 3$ (true) $x = 0$ and $y = -3$

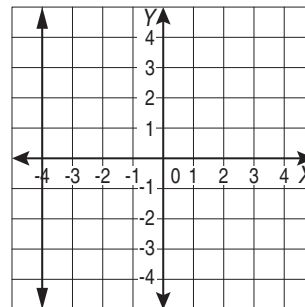
$-6 - (-3) = 3$ or $-3 = 3$ (false) $x = -6$ and $y = -3$

$x = -3$ B) $0 = -3$ (false) and $-6 = -3$ (false)

$y = -3$ C) $-3 = -3$ (true)

$-3 = -3$ (true) \Rightarrow

b)



The line above shows:

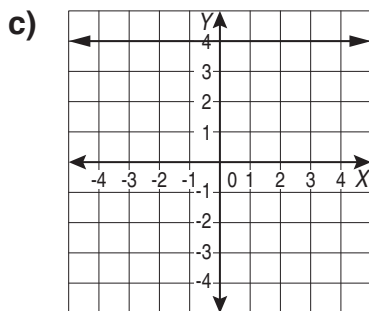
- A) All points where $y - x = 4$
- B) All points where $x = -4$
- C) All points where $y = -4$

A)

B)

C)

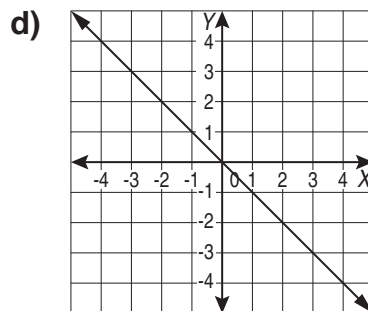
\Rightarrow



The line above shows:

- A) All points where $y = 4$
- B) All points where $x = 4$
- C) All points where $x + y = 4$

..... \Rightarrow

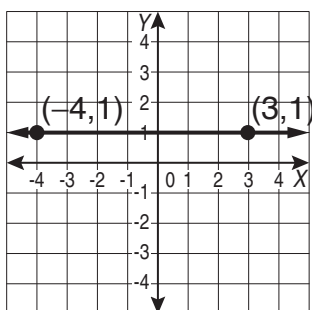


The line above shows:

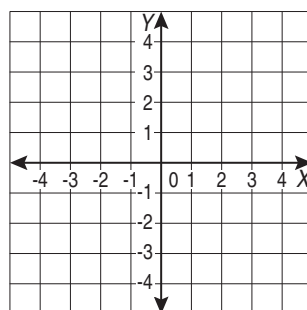
- A) All points where $x = 0$
- B) All points where $y = -x$
- C) All points where $y = 0$

..... \Rightarrow

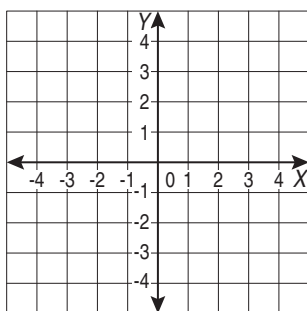
e) Draw a line through all the points where the y-coordinate is 1.



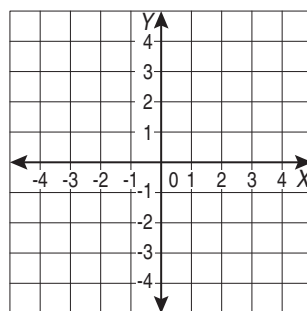
f) Draw a line connecting all the points which have an x-coordinate of -3.



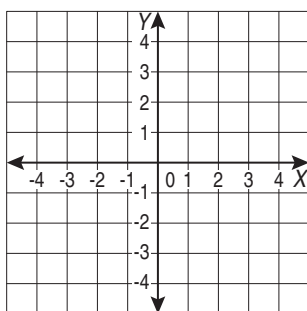
g) Draw a line through all the points where the y-coordinate is 3 more than the x-coordinate (line of equation $y = x + 3$).



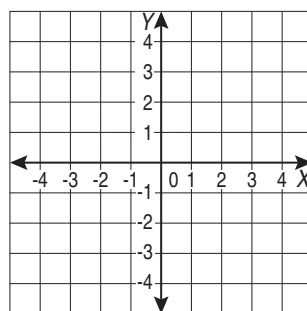
h) Draw a line through all the points where the x-coordinate is 3 more than the y-coordinate (line of equation $y = x - 3$).



i) Draw a line through all the points where the x-coordinate and the y-coordinate add to 3 (line of equation $x + y = 3$).



j) Draw a line through all the points where the x-coordinate and the y-coordinate add to 1 (line of equation $x + y = 1$).



To find the time taken to travel when the distance is given

- Locate the point on the vertical axis, marking the given distance.
- Draw a horizontal line through that point.
- Locate the intersection between this horizontal line and the graph.
- Draw a vertical line through the intersection point until it intersects the horizontal axis.
- Mark and read the value of the time on the horizontal axis at the intersection point.

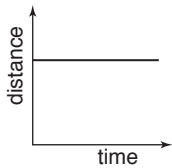
To find the distance travelled

- Measure the value on the vertical axis, starting from the origin of the axes.

To interpret distance-time graphs

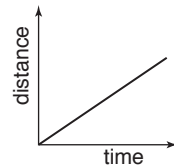
Object not moving

Time increasing, but distance not changing - **flat line**



Object moving at a constant rate

It covers the same distance in the same time interval - **oblique line**



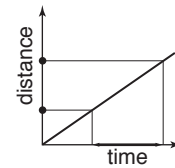
Object moving fast

It covers the distance in a shorter time interval - **line with big inclination**

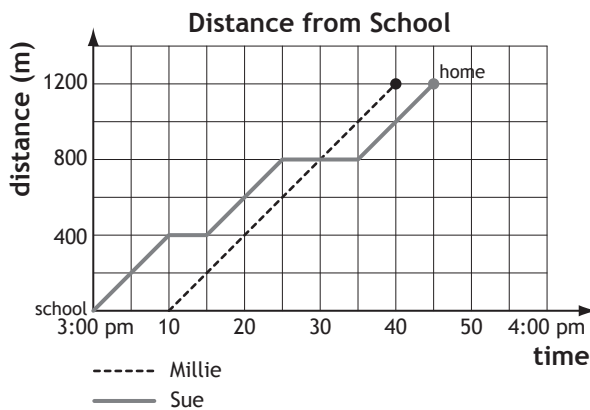


Object moving slow

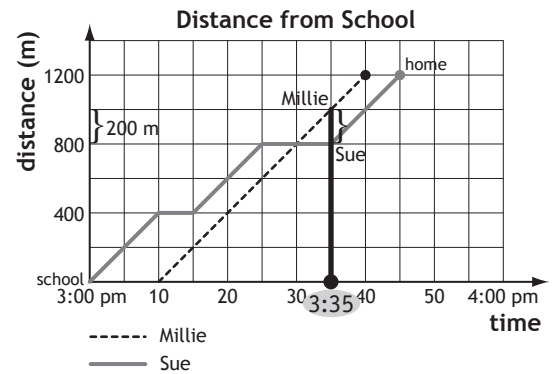
It covers the distance in a longer time interval - **line with small inclination**



Q. Millie and Sue walk home, leaving school 10 minutes apart. What is the distance between them at 3:35 pm?

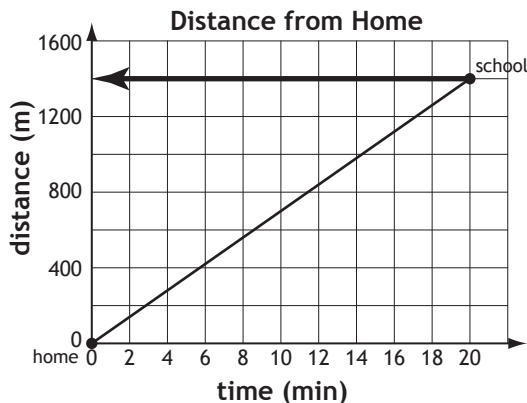


A.



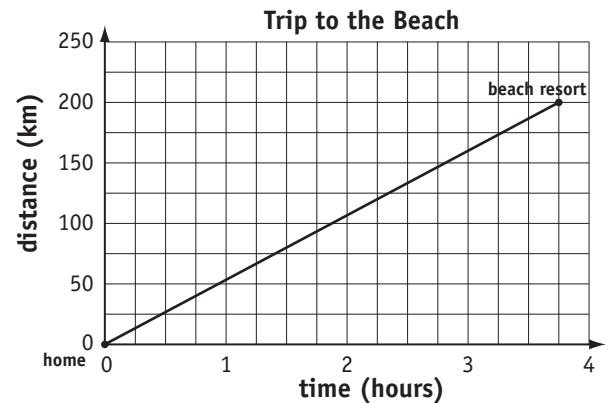
Sue reached 800 metres at 3:35 pm
 Millie reached 1000 metres at 3:35 pm
 distance between girls = 1000 m – 800 m
 = **200 m**

a) This graph shows Grace's distance from home as she walks to school. How far is the school from home?



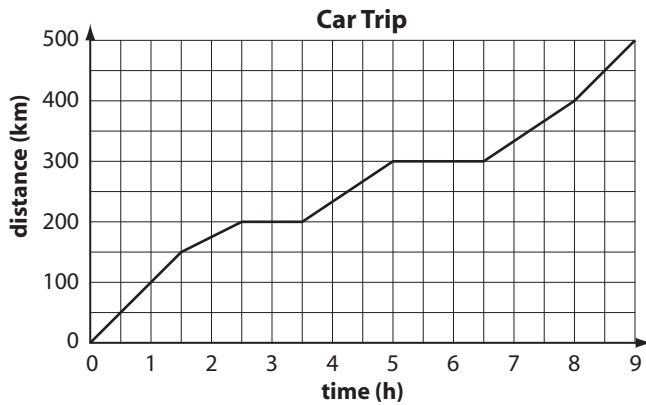
1400 m

b) Chloe leaves home at 1:00 pm. At what time does she arrive at the beach resort?



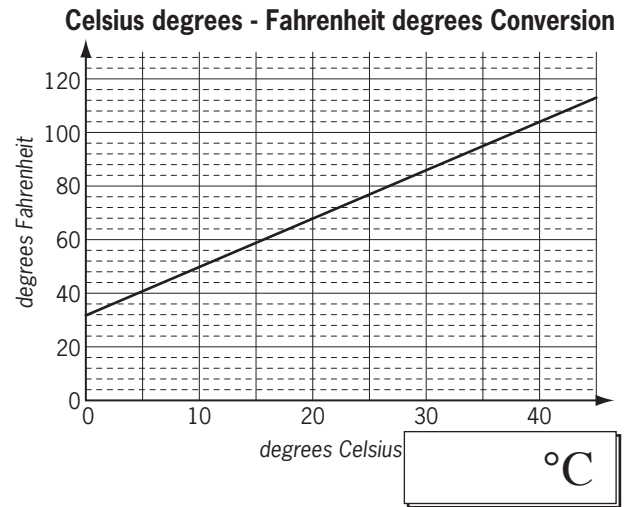
1:40 pm

c) This graph shows the distance travelled by a car over a 9-hour period. For how long does the car stop in total?



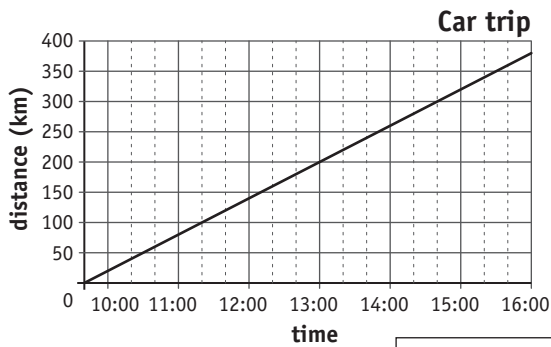
h

d) Approximately how many degrees Celsius are equivalent to 104 degrees Fahrenheit?



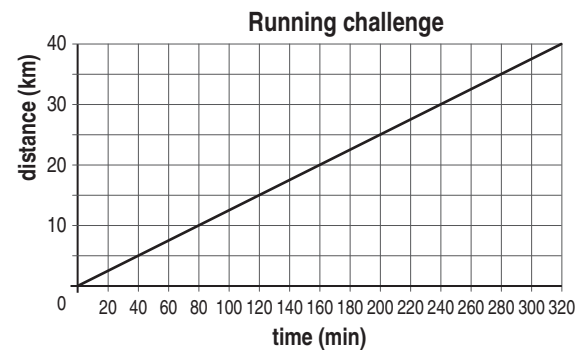
°C

e) This graph shows the distance Felix travelled between 9:40 am and 4:00 pm. How many minutes did the car take to travel 200 kilometres?



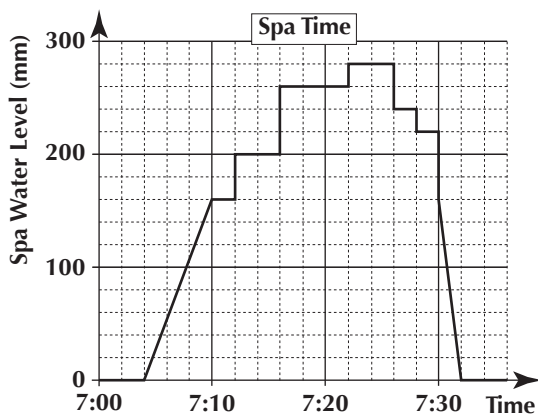
min

f) This graph shows the distance run by Josh at constant speed. How many kilometres did he cover in 4 hours?



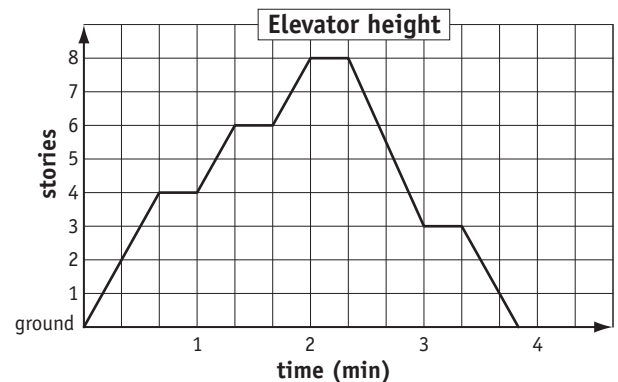
km

g) At 7:12 Caitlin got into the spa, followed later by Emma and then her younger sister. For how long was Emma in the spa?

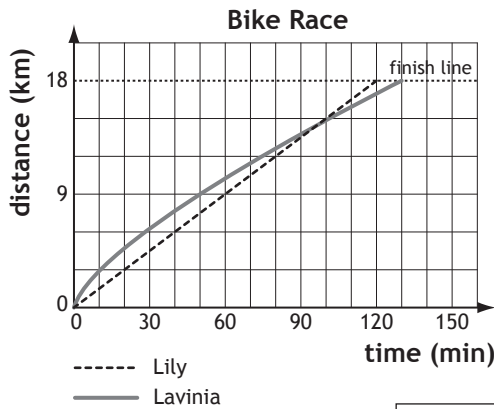


min

h) This graph shows the height of an elevator in an eight-story building. How many times does the elevator stop on its way to the top?

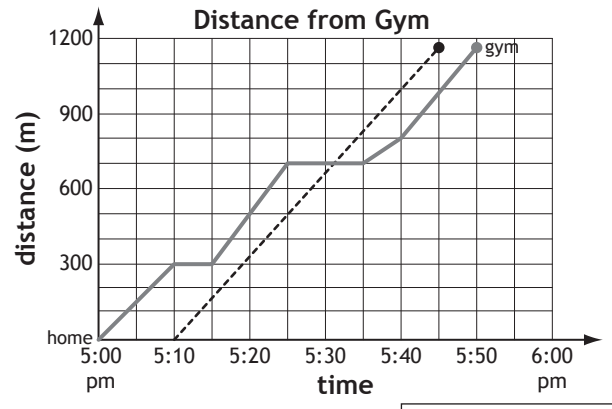


i) Lily and Lavinia had an 18-kilometre bike race. Who was winning at the half way point?



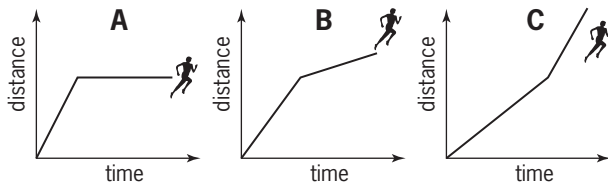
----- Lily
——— Lavinia

j) Bella and Leah walk to the gym, leaving home 10 minutes apart. What is the distance between them at 5:40 pm?

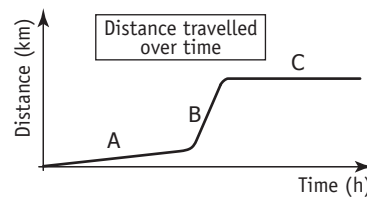


----- Bella
——— Leah

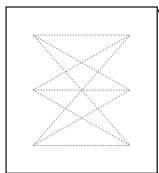
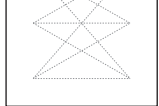

k) Jo runs at a constant speed, and then she decides to walk. Which graph shows this?



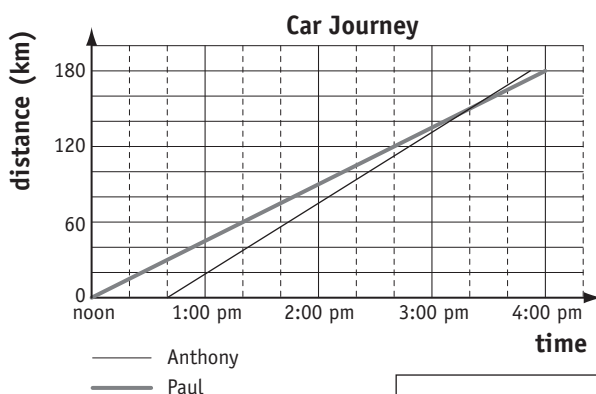
l) The graph of a trip is shown below. It is divided into 3 parts.



Match each part with its best description.

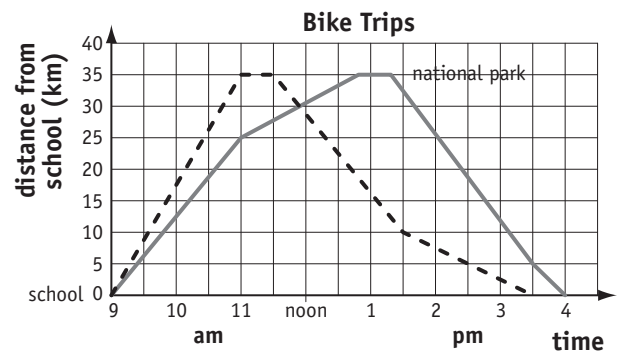
- A  Stopped for lunch
- B  Driving on a dirt road
- C  Driving on a freeway

m) The graph shows the distance travelled by Paul and Anthony by car, on the same journey. At what time does Anthony's car overtake Paul's?



——— Anthony
----- Paul

n) Anna and Maria ride their bikes from school to the national park and back. How far from the park do they meet?



——— Anna
----- Maria

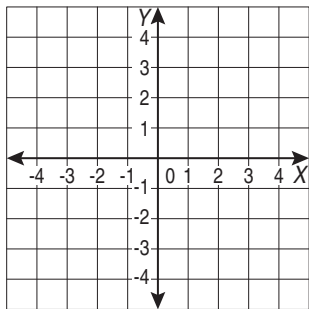
Skill 23.9 Plotting points from a table of values on a Cartesian plane.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- For each point read the x-coordinate and the y-coordinate from the table of values.
- Plot and label each point on the Cartesian plane.

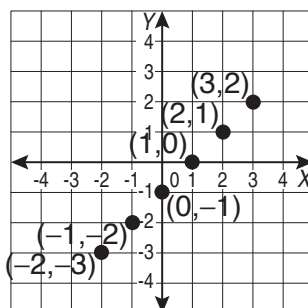
Q. Using the table of values, plot the points on the Cartesian plane.

| | | | | | | |
|----------|----|----|----|---|---|---|
| <i>x</i> | -2 | -1 | 0 | 1 | 2 | 3 |
| <i>y</i> | -3 | -2 | -1 | 0 | 1 | 2 |



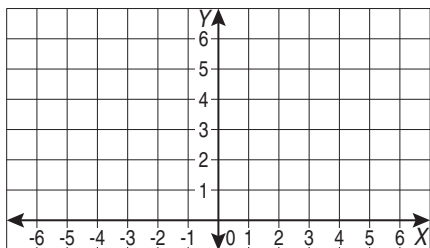
A. *x*-coordinate -2 , *y*-coordinate -3
 \Rightarrow point $(-2, -3)$

Continue reading the ordered pairs:
 \Rightarrow points $(-1, -2)$ $(0, -1)$ $(1, 0)$ $(2, 1)$ $(3, 2)$



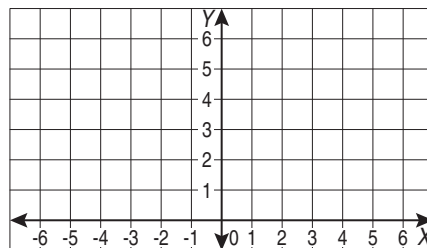
a) Using the table of values, plot the points on the Cartesian plane.

| | | | | | | |
|----------|----|----|---|---|---|---|
| <i>x</i> | -4 | -2 | 0 | 2 | 4 | 6 |
| <i>y</i> | 1 | 2 | 3 | 4 | 5 | 6 |



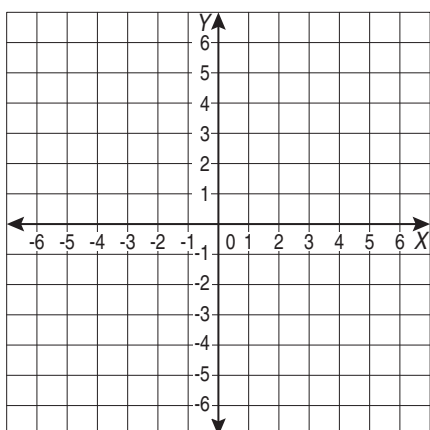
b) Using the table of values, plot the points on the Cartesian plane.

| | | | | | | |
|----------|----|----|----|---|---|---|
| <i>x</i> | -6 | -4 | -2 | 0 | 2 | 4 |
| <i>y</i> | 5 | 4 | 3 | 2 | 1 | 0 |



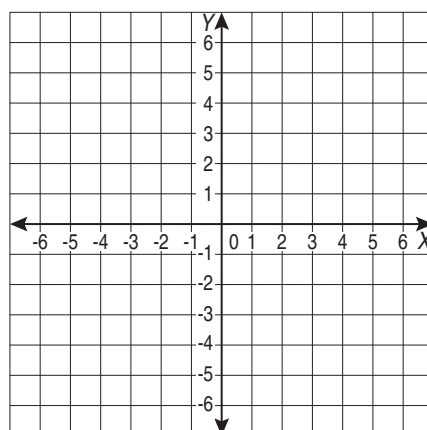
c) Using the table of values, plot the points on the Cartesian plane.

| | | | | | | |
|----------|----|----|----|---|----|----|
| <i>x</i> | -3 | -2 | -1 | 0 | 1 | 2 |
| <i>y</i> | 6 | 4 | 2 | 0 | -2 | -4 |



d) Using the table of values, plot the points on the Cartesian plane.

| | | | | | | |
|----------|----|----|----|---|---|---|
| <i>x</i> | -5 | -3 | -1 | 1 | 3 | 5 |
| <i>y</i> | -5 | -3 | -1 | 1 | 3 | 5 |



Skill 23.10 Plotting linear graphs from a table of values on a Cartesian plane (1).

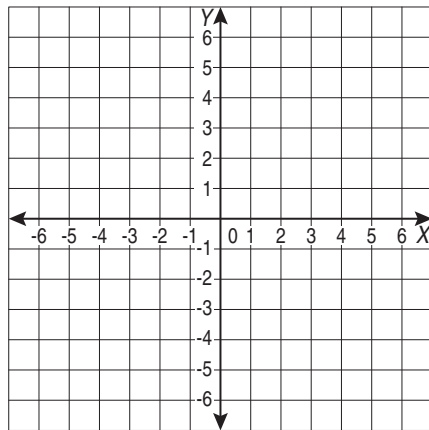
MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Complete the table of values for the rule. (see skill 21.3, page 183 and skill 23.6, page 217)
- Plot each point on the Cartesian plane. (see skill 23.4, page 213)
- Draw the line that joins these points.
- Label the line with the rule.

Q. Graph the line of equation $y = -2x - 1$ on the Cartesian plane below, by first completing this table of values.

[Label the graph with the equation.]

| | | | | | |
|---------|----------|------------------|------------------|------------------|------------------|
| x | -2 | -1 | 0 | 1 | 2 |
| y | 3 | | | | |
| (x,y) | $(-2,3)$ | (\quad, \quad) | (\quad, \quad) | (\quad, \quad) | (\quad, \quad) |



A. $y = -2x - 1 = -2 \times x - 1$ $2x = 2 \times x$

$x = -1 \Rightarrow y = -2 \times -1 - 1 = 1 \Rightarrow (-1, 1)$

$x = 0 \Rightarrow y = -2 \times 0 - 1 = -1 \Rightarrow (0, -1)$

$x = 1 \Rightarrow y = -2 \times 1 - 1 = -3 \Rightarrow (1, -3)$

$x = 2 \Rightarrow y = -2 \times 2 - 1 = -5 \Rightarrow (2, -5)$

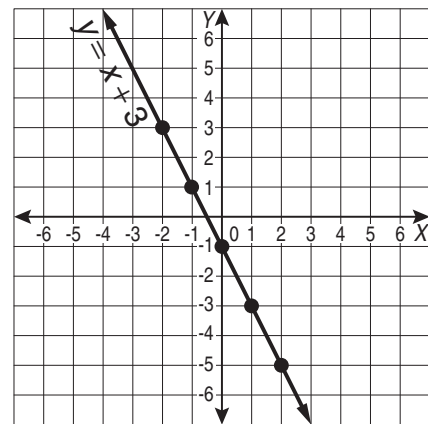
| | | | | | |
|---------|----------|-----------|-----------|-----------|-----------|
| x | -2 | -1 | 0 | 1 | 2 |
| y | 3 | 1 | -1 | -3 | -5 |
| (x,y) | $(-2,3)$ | $(-1, 1)$ | $(0, -1)$ | $(1, -3)$ | $(2, -5)$ |

Complete the table of values.

Plot the points.

Join the points with a line.

Label the line with the rule $y = -2x - 1$



a) Graph the line of equation $y = -x$ on the Cartesian plane below, by first completing this table of values.

[Label the graph with the equation.]

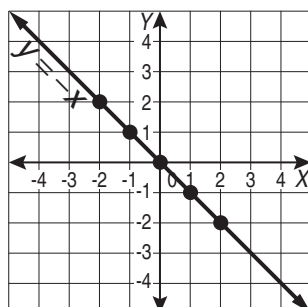
$x = -1 \Rightarrow y = -(-1) = 1 \Rightarrow (-1, 1)$

$x = 0 \Rightarrow y = -0 = 0 \Rightarrow (0, 0)$

$x = 1 \Rightarrow y = -1 \Rightarrow (1, -1)$

$x = 2 \Rightarrow y = -2 \Rightarrow (2, -2)$

| | | | | | |
|---------|----------|-----------|----------|-----------|-----------|
| x | -2 | -1 | 0 | 1 | 2 |
| y | 2 | 1 | 0 | -1 | -2 |
| (x,y) | $(-2,2)$ | $(-1, 1)$ | $(0, 0)$ | $(1, -1)$ | $(2, -2)$ |



b) Graph the line of equation $y = x - 4$ on the Cartesian plane below, by first completing this table of values.

[Label the graph with the equation.]

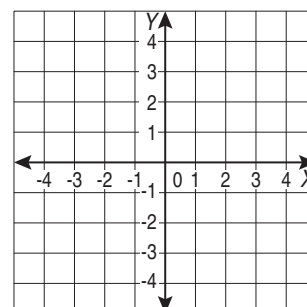
$x = 1 \Rightarrow y = 1 - 4 = -3 \Rightarrow (1, -3)$

$x = 2 \Rightarrow y = \quad \Rightarrow$

$x = 3 \Rightarrow y = \quad \Rightarrow$

$x = 4 \Rightarrow y = \quad \Rightarrow$

| | | | | | |
|---------|-----------|------------------|------------------|------------------|------------------|
| x | 0 | 1 | 2 | 3 | 4 |
| y | -4 | | | | |
| (x,y) | $(0, -4)$ | (\quad, \quad) | (\quad, \quad) | (\quad, \quad) | (\quad, \quad) |



- c)** Graph the line of equation $y = 2x$ on the Cartesian plane below, by first completing this table of values.

[Label the graph with the equation.]

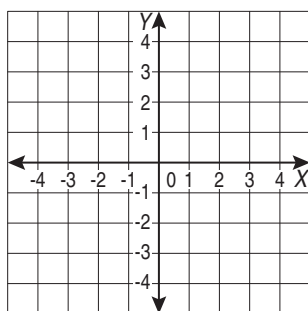
$x = -1 \Rightarrow y = 2 \times -1 = -2 \Rightarrow$

$x = 0 \Rightarrow y = \quad \Rightarrow$

$x = 1 \Rightarrow y = \quad \Rightarrow$

$x = 2 \Rightarrow y = \quad \Rightarrow$

| | | | | | |
|---------|-----------|---------------------|---------------------|---------------------|---------------------|
| x | -2 | -1 | 0 | 1 | 2 |
| y | -4 | | | | |
| (x,y) | $(-2,-4)$ | (\quad , \quad) | (\quad , \quad) | (\quad , \quad) | (\quad , \quad) |



- d)** Graph the line of equation $y = -x + 4$ on the Cartesian plane below, by first completing this table of values.

[Label the graph with the equation.]

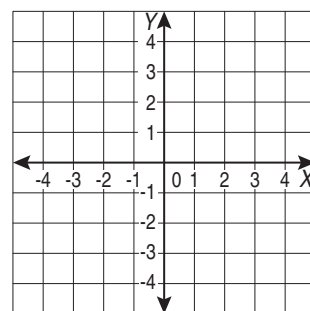
$x = 2 \Rightarrow y = \quad \Rightarrow$

$x = 3 \Rightarrow y = \quad \Rightarrow$

$x = 4 \Rightarrow y = \quad \Rightarrow$

$x = 5 \Rightarrow y = \quad \Rightarrow$

| | | | | | |
|---------|---------|---------------------|---------------------|---------------------|---------------------|
| x | 0 | 1 | 2 | 3 | 4 |
| y | 4 | | | | |
| (x,y) | $(0,4)$ | (\quad , \quad) | (\quad , \quad) | (\quad , \quad) | (\quad , \quad) |



- e)** Graph the line of equation $y = 3x - 1$ on the Cartesian plane below, by first completing this table of values.

[Label the graph with the equation.]

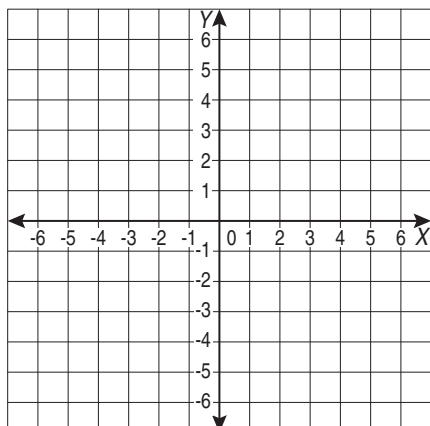
$x = -1 \Rightarrow y = \quad \Rightarrow$

$x = 0 \Rightarrow y = \quad \Rightarrow$

$x = 1 \Rightarrow y = \quad \Rightarrow$

$x = 2 \Rightarrow y = \quad \Rightarrow$

| | | | | | |
|---------|-----------|---------------------|---------------------|---------------------|---------------------|
| x | -2 | -1 | 0 | 1 | 2 |
| y | -7 | | | | |
| (x,y) | $(-2,-7)$ | (\quad , \quad) | (\quad , \quad) | (\quad , \quad) | (\quad , \quad) |



- f)** Graph the line of equation $y = -2x - 3$ on the Cartesian plane below, by first completing this table of values.

[Label the graph with the equation.]

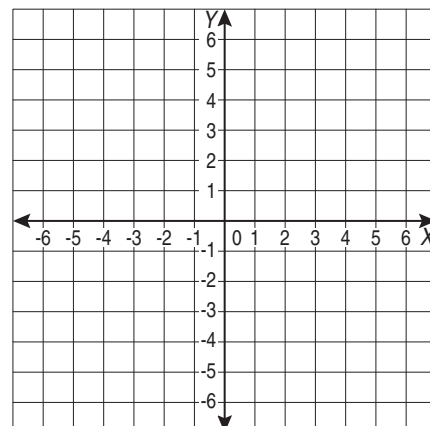
$x = -1 \Rightarrow y = \quad \Rightarrow$

$x = 0 \Rightarrow y = \quad \Rightarrow$

$x = 1 \Rightarrow y = \quad \Rightarrow$

$x = 2 \Rightarrow y = \quad \Rightarrow$

| | | | | | |
|---------|----------|---------------------|---------------------|---------------------|---------------------|
| x | -2 | -1 | 0 | 1 | 2 |
| y | 1 | | | | |
| (x,y) | $(-2,1)$ | (\quad , \quad) | (\quad , \quad) | (\quad , \quad) | (\quad , \quad) |



24. [Units of Measurement / Time]

Skill 24.1 Converting units of time (1).

MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

Conversion Facts - TIME

$$\begin{aligned}
 1 \text{ week} &= 7 \text{ days} = 168 \text{ h} = 10\,080 \text{ min} = 604\,800 \text{ s} \\
 1 \text{ day} &= 24 \text{ h} = 1\,440 \text{ min} = 86\,400 \text{ s} \\
 1 \text{ h} &= 60 \text{ min} = 3\,600 \text{ s} \\
 1 \text{ min} &= 60 \text{ s}
 \end{aligned}$$

To change from **smaller** units to **larger** units:

- Divide by the conversion factor (because you need less).

Example: To change s to min \div by 60

To change from **larger** units to **smaller** units:

- Multiply by the conversion factor (because you need more).

Example: To change h to min \times by 60

Q. 4 min 40 s = s

A. $4 \text{ min } 40 \text{ s} = 4 \times 60 \text{ s} + 40 \text{ s}$ min to s: $\times 60$
 $= 240 \text{ s} + 40 \text{ s}$
 $= \mathbf{280 \text{ s}}$

a) 600 seconds = minutes

s to min: $\div 60$

$600 \text{ s} = 600 \div 60 \text{ min} = 10 \text{ min}$

b) 5 hours = minutes

h to min: $\times 60$

c) 4 minutes = seconds

d) 180 s = min

e) 10 h = min

f) 240 min = h

g) 300 min = h

h) 5 min = s

i) 4 days = h

j) 4 weeks = days

Skill 24.1 Converting units of time (2).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

k) 10 years = months

.....

l) 5 days = h

.....

m) 90 min = h

.....

n) 270 min = h

.....

o) 3 h 35 min = min

.....

p) 5 min 30 s = s

.....

q) 3 weeks, 5 days = days

.....

r) 2 h 50 min = min

.....

s) 2 min 25 s = s

.....

t) 6 h 10 min = min

.....

u) $2\frac{1}{3}$ days = h

$2 \times 24 + \frac{1}{3} \times 24 = 48 + 8 = 56$

.....

v) $1\frac{1}{4}$ h = min

.....

w) $\frac{3}{4}$ day = h

.....

x) $2\frac{1}{2}$ h = min

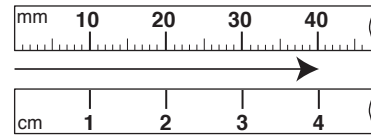
.....

Conversion Facts - LENGTH

$$1 \text{ km} = 1000 \text{ m} = 100\,000 \text{ cm} = 1\,000\,000 \text{ mm}$$

$$1 \text{ m} = 100 \text{ cm} = 1000 \text{ mm}$$

$$= 1 \text{ cm} = 10 \text{ mm}$$



To change from **smaller** units to **larger** units:

- Divide by the conversion factor (because you need less).

Example: To change
mm to cm
÷ by 10

To change from **larger** units to **smaller** units:

- Multiply by the conversion factor (because you need more).

Example: To change
cm to mm
× by 10

Q. $3800 \text{ cm} = \boxed{} \text{ m}$

A. $3800 \text{ cm} = 3800 \div 100 \text{ m}$ *cm to m: ÷ 100*
 $= 38 \text{ m}$

a) $24 \text{ cm} = \boxed{240} \text{ mm}$
cm to mm: × 10

$24 \times 10 = 240$

b) $120 \text{ mm} = \boxed{} \text{ cm}$
mm to cm: ÷ 10

c) $130 \text{ cm} = \boxed{} \text{ mm}$

d) $8 \text{ km} = \boxed{} \text{ m}$

e) $7000 \text{ m} = \boxed{} \text{ km}$

f) $6 \text{ m} = \boxed{} \text{ cm}$

g) $19 \text{ m} = \boxed{} \text{ mm}$

h) $50 \text{ mm} = \boxed{} \text{ cm}$

i) $12 \text{ km} = \boxed{} \text{ m}$

j) $11\,000 \text{ m} = \boxed{} \text{ km}$

Skill 24.2 Converting units of length (2).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

k) 15 m = mm

.....

l) 16 m = cm

.....

m) 7000 m = km

.....

n) 4000 cm = m

.....

o) 140 m = cm

.....

p) 19 cm = mm

.....

q) 270 cm = m

.....

r) 30 m = cm

.....

s) 500 mm = m

.....

t) 4.1 km = m

.....

u) 2.8 m = mm

.....

v) 600 m = km

.....

w) 0.2 km = m

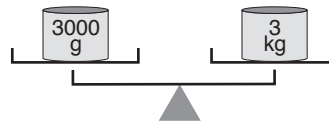
.....

x) 3.7 m = mm

.....

Conversion Facts - MASS

1 tonne = 1000 kg = 1 000 000 g
1 kg = 1000 g



To change from **smaller** units to **larger** units:

- Divide by the conversion factor (because you need less).

Example: To change g to kg ÷ by 1000

To change from **larger** units to **smaller** units:

- Multiply by the conversion factor (because you need more).

Example: To change tonnes (t) to kg × by 1000

Q. 2.5 kg = g

A. $2.5 \text{ kg} = 2.5 \times 1000 \text{ g}$ *kg to g: × 1000*
 $= 2.500$ *3 zeros, 3 places to the right*
 $= 2500 \text{ g}$

a) $6 \text{ t} = \text{ kg}$ *t to kg: × 1000*
3 zeros, 3 places to the right
 $6 \times 1000 = 6000$

b) $9000 \text{ g} = \text{ kg}$ *g to kg: ÷ 1000*

c) $2000 \text{ kg} = \text{ tonnes}$

d) $3.4 \text{ kg} = \text{ g}$

e) $5000 \text{ g} = \text{ kg}$

f) $70000 \text{ g} = \text{ kg}$

g) $8 \text{ tonnes} = \text{ kg}$

h) $1.9 \text{ kg} = \text{ g}$

i) $20000 \text{ g} = \text{ kg}$

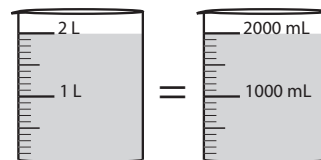
j) $10000 \text{ kg} = \text{ t}$

Conversion Facts - CAPACITY

1 ML (megalitre) = 1 000 kL = 1 000 000 L

1 kL = 1000 L

1 L = 1000 mL (millilitre)



To change from **smaller** units to **larger** units:

- Divide by the conversion factor (because you need less).

Example: To change mL to L \div by 1000

To change from **larger** units to **smaller** units:

- Multiply by the conversion factor (because you need more).

Example: To change kL to L \times by 1000

Q. 7500 mL = L

A. $7500 \text{ mL} = 7500 \div 1000 \text{ L}$ *mL to L: \div 1000*
 $= 7500.0$ *3 zeros, 3 places to the left*
 $= 7.5 \text{ L}$

a) $3.7 \text{ L} =$ mL
L to mL: \times 1000
 $3.7 \times 1000 = 3700$

b) $6 \text{ L} =$ mL
L to mL: \times 1000

c) $22 \text{ L} =$ mL

d) $8000 \text{ mL} =$ L

e) $40 \text{ L} =$ mL

f) $9.4 \text{ L} =$ mL

g) $0.5 \text{ L} =$ mL

h) $1.2 \text{ L} =$ mL

i) $30000 \text{ mL} =$ L

j) $15.3 \text{ L} =$ mL

k) $200 \text{ mL} =$ L

l) $500 \text{ mL} =$ L

Skill 24.5 Converting units of time, length, mass and capacity by using real-life facts.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Use the conversion factors to convert the units of time, length, mass and capacity. (see skills 24.1 to 24.4, pages 227 to 232)

Q. The ruby throated hummingbird can beat its wings at a rate of 4200 beats per minute. Is this more or less than 200 000 beats per hour?

A. 4200 beats in a minute
 $1\text{ h} = 60\text{ min}$
 $\Rightarrow 4200 \times 60\text{ min} = 252\,000\text{ beats in an hour}$
 $252\,000 > 200\,000$
 \Rightarrow The answer is **more**.

a) The longest river in the world is the Nile (North-East Africa). It is 6655 km long. Express this in metres.

km to m: $\times 1000$

$$6655 \times 1000\text{ m} = 6\,655\,000\text{ m}$$

m

b) While brushing your teeth, a running tap wastes 5 litres of water. Express this in millilitres.

mL

c) The average weight of an adult blue whale is 120 tonnes. Express this in kilograms.

kg

d) Bamboo can grow up to 1 metre in a day. How many centimetres is this?

cm

e) The first athlete to run a mile in under four minutes was Australian distance champion John Landy, who ran it in 3 minutes and 58 seconds. Express this in seconds.

s

f) The newborns' average respiratory rate is 45 breaths per minute. Is this more than or less than 3000 breaths per hour?

g) An astronaut weighs 12 kg on the moon. Express this weight in grams.

g

h) Our bodies lose on average 2.5 litres of water a day. Express this in millilitres.

mL

i) The average weight of an elephant at birth is about 105 kilograms. Express this in grams.

g

j) Your heart pumps about 6000 mL of blood every minute. How many litres will it pump in a day?

L

Skill 24.6 Finding the elapsed time between two events.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Calculate the time until the next closest hour.
am to pm
- Add the time to midday.
- Then add the remaining time.

- **pm to am**
- Add the time to midnight.
- Then add the remaining time.

Q. School starts at 8:50 am and ends at 2:30 pm. How long is a school day in hours and minutes?

A. $8:50$ to $9:00 = 10$ min
 $9:00$ to $12:00 = 3$ h
 $12:00$ to $2:30 = 2$ h 30 min
 10 min + 3 h + 2 h + 30 min
 = **5 h 40 min**

a) Find the time in hours and minutes between 8:30 am and 3:00 pm the same day.

$8:30$ to $9:00 = 30$ min, $9:00$ to $12:00 = 3$ h

$12:00$ to $3:00 = 3$ h

30 min + 3 h + 3 h \Rightarrow

b) The movie begins at 3:15 pm and ends at 5:00 pm. How long is the movie in hours and minutes?

\Rightarrow

c) Mum started cooking at 6:20 pm and finished at 7:35 pm. How long did she cook in hours and minutes?

\Rightarrow

d) Find the time in hours and minutes between 6:30 pm and 2:10 am the next day.

\Rightarrow

e) Find the time in hours and minutes between 4:00 am and 2:25 pm on the same day.

\Rightarrow

f) Find the time in hours and minutes between 09:10 and 16:20 on the same day.

\Rightarrow

To calculate the time ahead

- Add the time difference to the given time (count forward on the clock).

To calculate the time behind

- Subtract the time difference from the given time (count backward on the clock).

To calculate the time difference

- Subtract the two given times.

Q. A Virgin Australia flight departs Gold Coast at 12:05 pm and arrives in Auckland the same day at 5:30 pm. If Auckland time is 2 hours ahead Gold Coast time how long was the flight?

A. Gold Coast departure time = 12:05 pm
 (Auckland time = 12:05 plus 2 h = 2:05 pm)
 Auckland arrival time = 5:30 pm
 Flight time (using Auckland time) =
 2:05 pm to 5:30 pm
 = **3 h 25 min**

a) It is 10:15 pm in Tokyo. If London time is 9 hours behind Tokyo time, what time is it in London?

[Give your answer using 12-hour time.]

subtract the time difference

London time = 10:15 pm less 9 h

⇒

b) You live in Melbourne and want to call Grandma in Wellington, at noon, on Christmas day, Wellington time. If Wellington time is 2 h ahead Melbourne time, at what time should you call?

[Give your answer using 12-hour time.]

⇒

c) Roger is in Rotorua and wants to ring Alina in Los Angeles (LA) at midnight on New Year, LA time. If LA time is 21 hours behind Rotorua time, at what time in Rotorua should he call?

[Give your answer using 12-hour time.]

⇒

d) Sven is in Auckland and wants to ring Oscar in Paris at 10:00 am Paris time. If Paris time is 12 h behind Auckland time, at what time in Auckland should he call? [Give your answer using 12-hour time.]

⇒

e) A Qantas flight departs Sydney on Friday at 5:40 pm and arrives in Singapore on Friday at 10:30 pm. If Singapore time is 3 hours behind Sydney time, how long is the flight?

[Give your answer using 12-hour time.]

⇒

f) It is Sunday, 1825 hours in Shanghai, China, and Sunday, 2325 hours in Wellington. By how many hours is Shanghai time behind Wellington time?

⇒

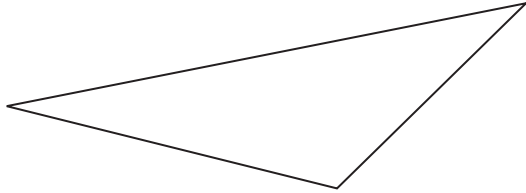
25. [Perimeter]

Skill 25.1 Finding the perimeter of polygons by measuring their side lengths.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

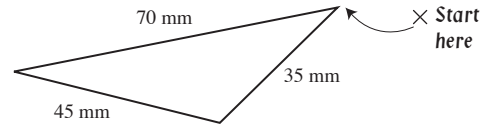
- Measure each side length of the shape.
- Add together the side lengths.

Q. Use a ruler to find the perimeter of the scalene triangle in millimetres.

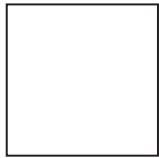


A. $35\text{ mm} + 45\text{ mm} + 70\text{ mm}$
= **150 mm**

Measure the side lengths.
Write down the lengths
next to each side.

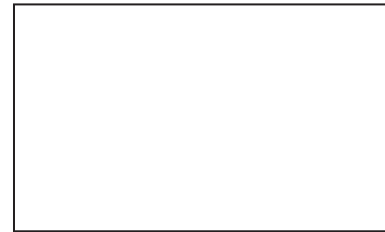


a) Use a ruler to find the perimeter of the square in centimetres.



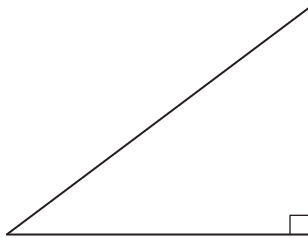
4×2 =

b) Use a ruler to find the perimeter of the rectangle in millimetres



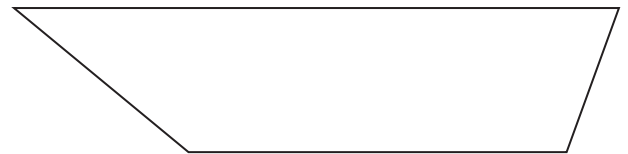
..... =

c) Use a ruler to find the perimeter of the right-angled triangle in centimetres.



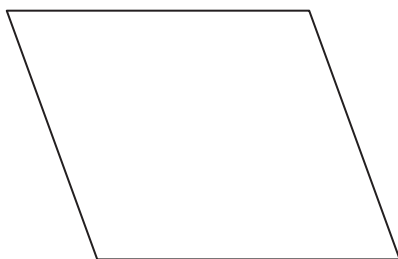
..... =

d) Use a ruler to find the perimeter of the trapezium in centimetres.



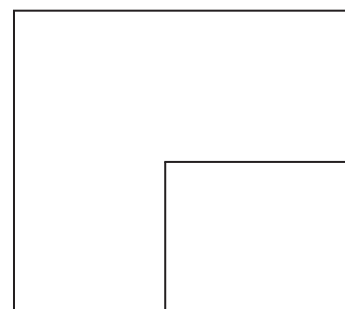
..... =

e) Use a ruler to find the perimeter of the parallelogram in millimetres.



..... =

f) Use a ruler to find the perimeter of the polygon in millimetres.



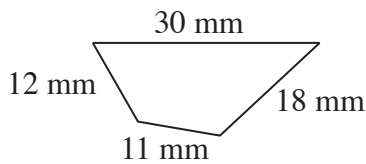
..... =

Skill 25.2 Calculating the perimeter of polygons when all side lengths are given (1).

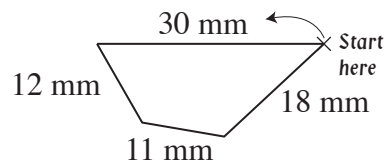
MM4.2 1 1 2 2 3 4 4
MM5.1 1 1 2 3 3 4 4

- Add together the side lengths.

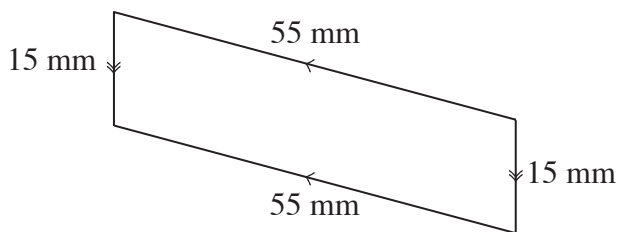
Q. Calculate the perimeter of the quadrilateral.



A. $30\text{ mm} + 12\text{ mm} + 11\text{ mm} + 18\text{ mm}$
 $= 71\text{ mm}$

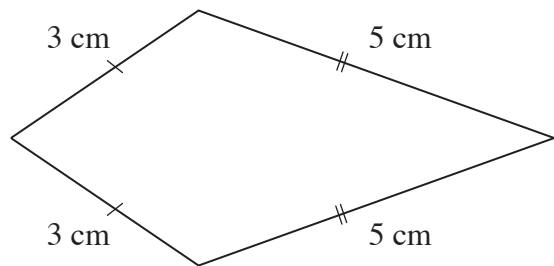


a) Calculate the perimeter of the parallelogram.



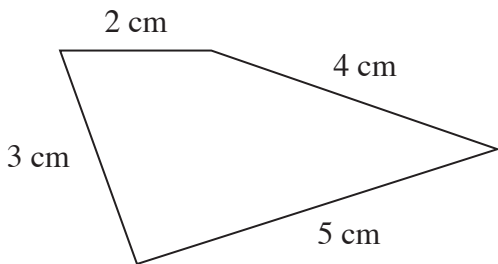
$15 + 15 + 55 + 55 = \boxed{140\text{ mm}}$

b) Calculate the perimeter of the kite.



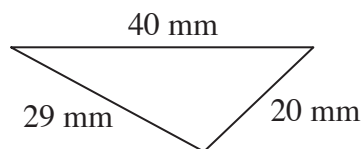
..... =

c) Calculate the perimeter of the quadrilateral.



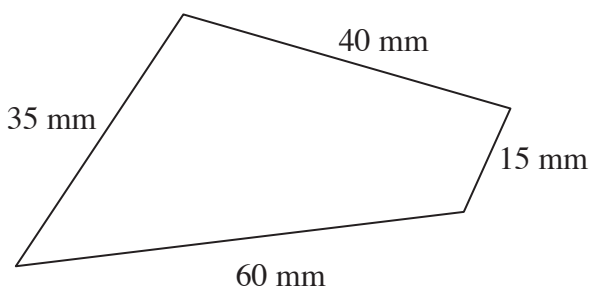
..... =

d) Calculate the perimeter of the scalene triangle.



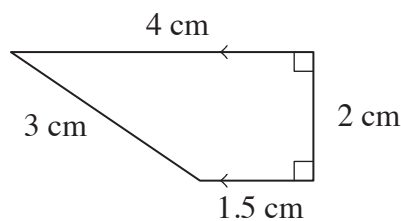
..... =

e) Calculate the perimeter of the quadrilateral.



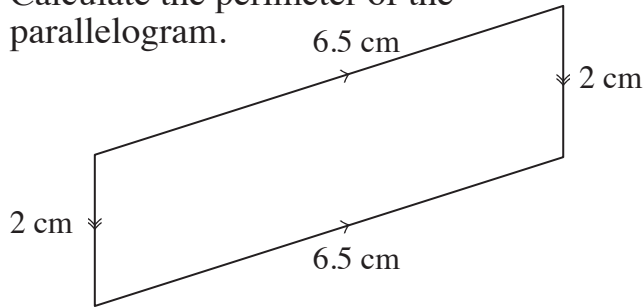
..... =

f) Calculate the perimeter of the trapezium.



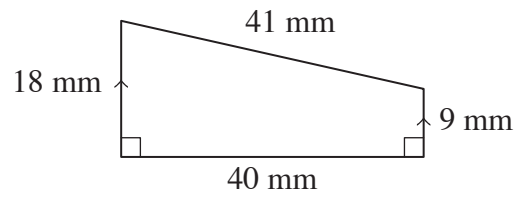
..... =

g) Calculate the perimeter of the parallelogram.



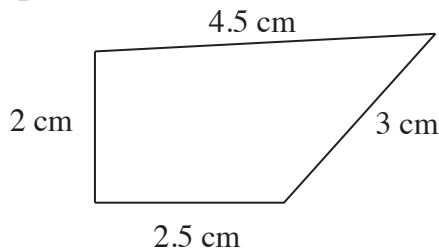
$6.5 + 2 + 6.5 + 2 = \boxed{\text{cm}}$

h) Calculate the perimeter of the trapezium.



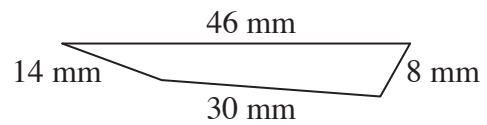
$\dots\dots\dots = \boxed{\text{mm}}$

i) Calculate the perimeter of the quadrilateral.



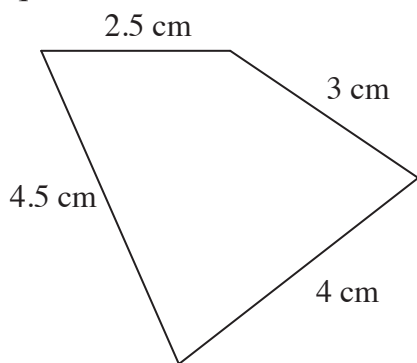
$\dots\dots\dots = \boxed{\text{cm}}$

j) Calculate the perimeter of the quadrilateral.



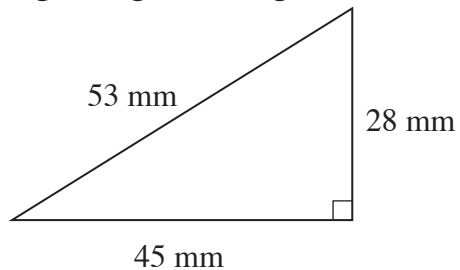
$\dots\dots\dots = \boxed{\text{mm}}$

k) Calculate the perimeter of the quadrilateral.



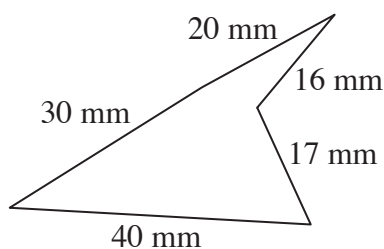
$\dots\dots\dots = \boxed{\text{cm}}$

l) Calculate the perimeter of the right-angled triangle.



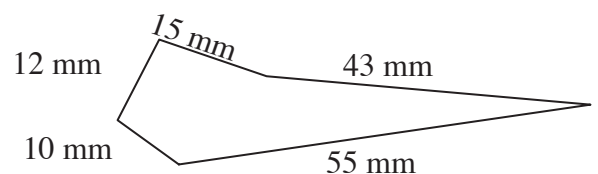
$\dots\dots\dots = \boxed{\text{mm}}$

m) Calculate the perimeter of the polygon.



$\dots\dots\dots = \boxed{\text{mm}}$

n) Calculate the perimeter of the polygon.



$\dots\dots\dots = \boxed{\text{mm}}$

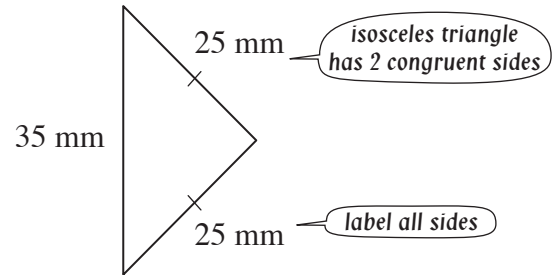
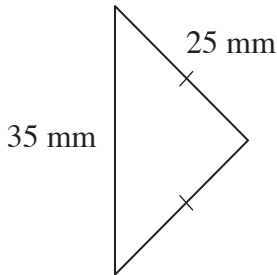
Skill 25.3 Calculating the perimeter of polygons by recognising congruent sides.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

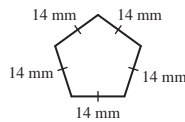
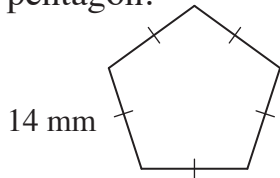
- Determine and label all side lengths.
Hint: Sides marked with a dash (|) are of equal length. Sides marked with two dashes (||) are of equal length etc.
- Add together the side lengths.

Q. Calculate the perimeter of the isosceles triangle.

A. $25\text{ mm} + 25\text{ mm} + 35\text{ mm}$
 $= 85\text{ mm}$

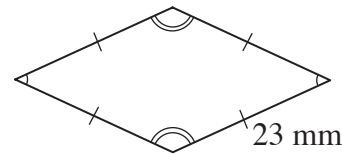


a) Calculate the perimeter of the regular pentagon.



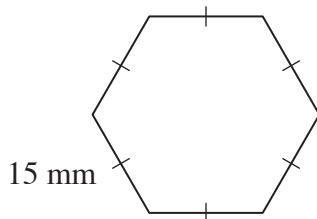
5×14 *pentagon - 5 sides* =

b) Calculate the perimeter of the rhombus.



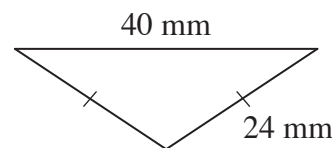
$\dots =$

c) Calculate the perimeter of the regular hexagon.



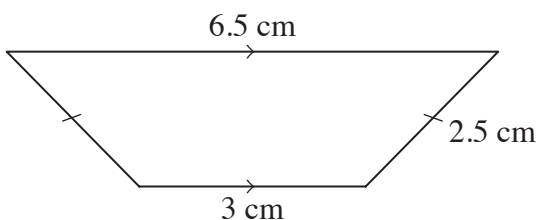
$\dots =$

d) Calculate the perimeter of the isosceles triangle.



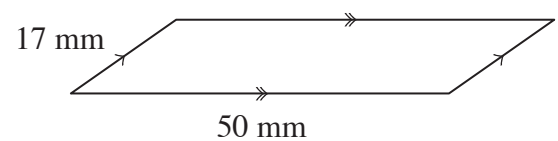
$\dots =$

e) Calculate the perimeter of the trapezium.



$\dots =$

f) Calculate the perimeter of the parallelogram.



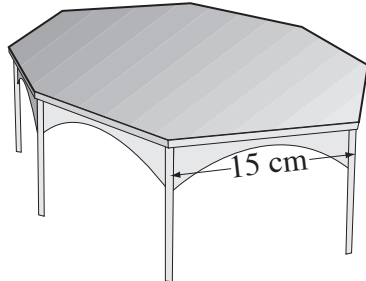
$\dots =$

Skill 25.4 Calculating the perimeter of polygons using real-life examples.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

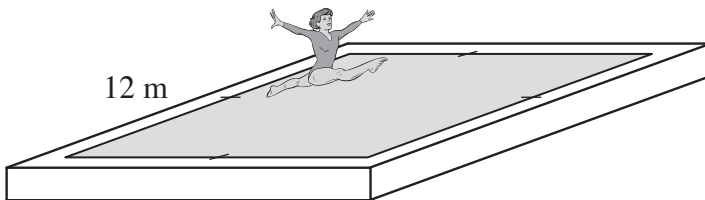
- Determine and label all side lengths.
Hint: Sides marked with a dash (|) are of equal length. Sides marked with two dashes (||) are of equal length etc.
- Add together the side lengths.

Q. Calculate the perimeter of the regular octagonal table top.



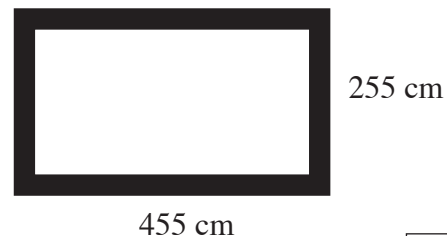
A. $15 + 15 + 15 + 15 + 15 + 15 + 15 + 15$
 $= 15 \times 8$
 $= 120 \text{ cm}$

a) What is the perimeter of the gymnastics floor?



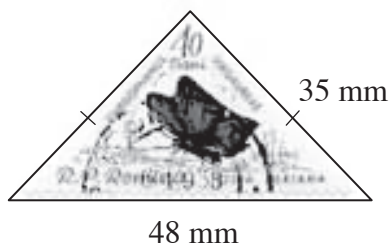
$4 \times 12 = \boxed{48 \text{ m}}$

b) What is the perimeter of the rectangular Luxio TV screen?



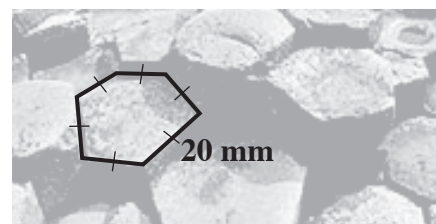
$\dots = \boxed{\text{cm}}$

c) What is the perimeter of this Romanian stamp valued at 40 bani?



$\dots = \boxed{\text{mm}}$

d) What is the perimeter of the upper surface of this regular hexagonal column of basalt seen at the Giant's Causeway in Ireland?



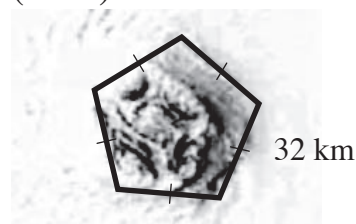
$\dots = \boxed{\text{mm}}$

e) What is the perimeter of the rectangular ceiling of the Sistine Chapel?



$\dots = \boxed{\text{m}}$

f) What is the perimeter of the eye of the pentagonal vortex of hurricane Isabel (2003)?



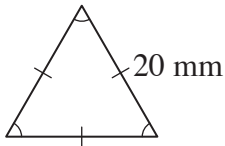
$\dots = \boxed{\text{km}}$

Skill 25.5 Calculating the perimeter of polygons using unit conversions.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Convert all measurements to the same unit. (see skill 24.2, page 229)
- Determine and label all side lengths.
*Hint: Sides marked with a dash (|) are of equal length.
Sides marked with two dashes (||) are of equal length etc.*
- Add together the side lengths.

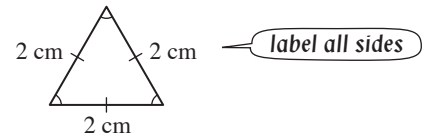
Q. Calculate the perimeter of the equilateral triangle in centimetres.



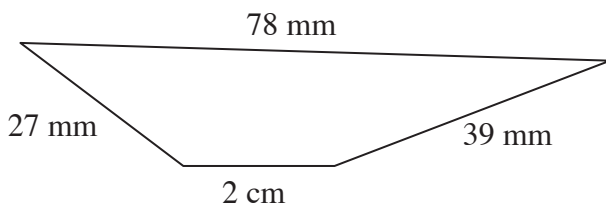
A. $20 \text{ mm} = 20 \div 10 \text{ cm} = 2 \text{ cm}$ mm to cm: $\div 10$

$$P = 3 \times 2$$

$$= 6 \text{ cm}$$

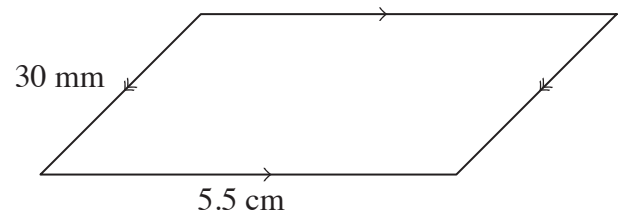


a) Calculate the perimeter of the trapezoid in millimetres.



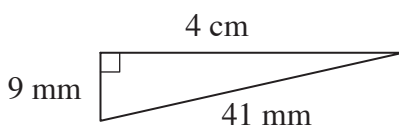
$P =$ mm

b) Express all measurements in centimetres and then find the perimeter of the parallelogram.



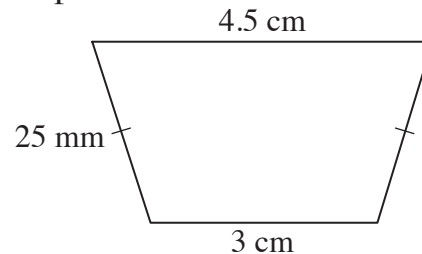
$P =$ cm

c) Express all measurements in millimetres and then find the perimeter of the right-angled triangle.



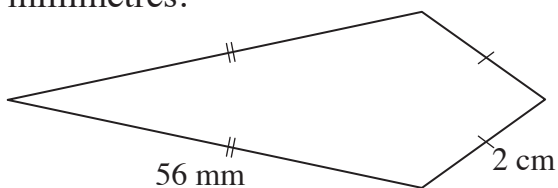
$P =$ mm

d) Calculate the perimeter of the trapezium in centimetres.



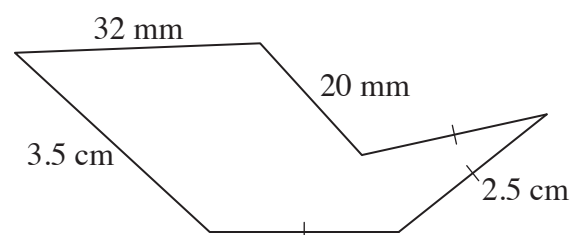
$P =$ cm

e) Calculate the perimeter of the kite in millimetres.



$P =$ mm

f) Calculate the perimeter of this polygon in centimetres.



$P =$ cm

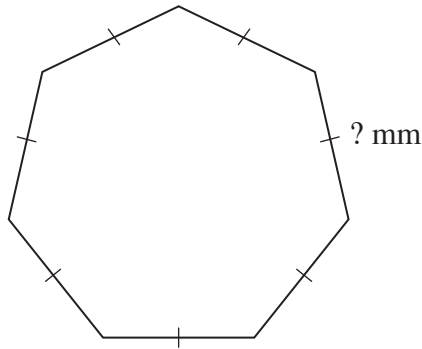
EITHER

- Add together all the given side lengths.
- Subtract the total from the perimeter to find the unknown side length.

OR

- Use algebra.

Q. The perimeter of this regular heptagon is 140 mm. What is the length of a side?



A. If ? represents the length of a side:

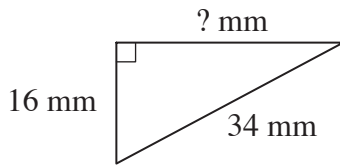
$$P = 140 \text{ mm}$$

$$P = 7 \times ?$$

$$140 = 7 \times ?$$

$$? = \mathbf{20 \text{ mm}}$$

a) The perimeter of this right-angled triangle is 80 mm. Find the missing side length.

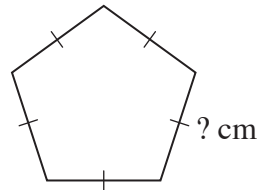


$$P = 16 + 34 + ?$$

Guess ? = 30

$$80 = 50 + ? \quad \text{so } ? = \boxed{\text{mm}}$$

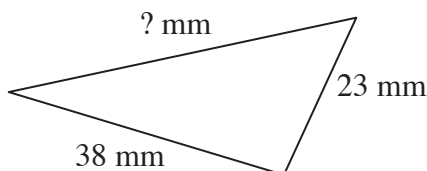
b) The perimeter of this regular pentagon is 7.5 cm. What is the length of a side?



$$P =$$

$$= \quad \text{so } ? = \boxed{\text{cm}}$$

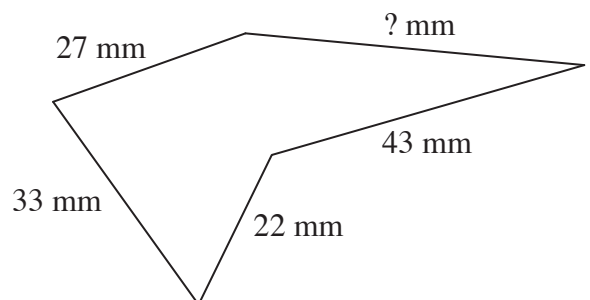
c) The perimeter of this scalene triangle is 108 mm. Find the missing side length.



$$P =$$

$$= \quad \text{so } ? = \boxed{\text{mm}}$$

d) The perimeter of this polygon is 170 mm. Find the missing side length.

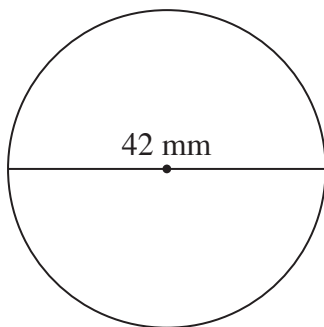


$$P =$$

$$= \quad \text{so } ? = \boxed{\text{mm}}$$

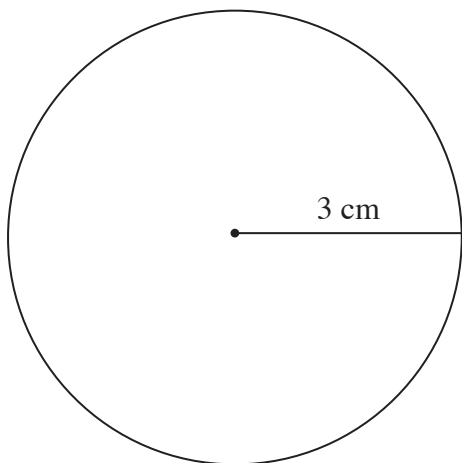
- Substitute the known values into the formula for the circumference of a circle.
Hint: You need the radius which is half the diameter.

Q. Using $C = 2\pi r$ where $\pi \approx \frac{22}{7}$, calculate the circumference of the circle.



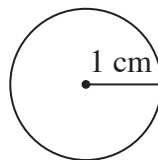
A. $C = 2\pi r$ where $d = 42$ and $r = 21$ $\left(r = \frac{d}{2} \right)$
 $= 2 \times \frac{22}{7} \times 21$ $\left(\text{Simplify: } \div 7 \right)$
 $= 44 \times 3$
 $= 132 \text{ mm}$

a) Using $C = 2\pi r$ where $\pi \approx 3.14$, calculate the circumference of the circle.



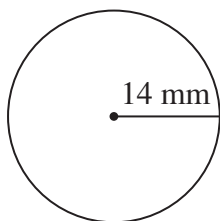
$C = 2\pi r = 2 \times 3.14 \times 3$
 $= 6 \times 3.14 = \boxed{\text{cm}}$

b) Using $C = 2\pi r$ where $\pi \approx 3.14$, calculate the circumference of the circle.



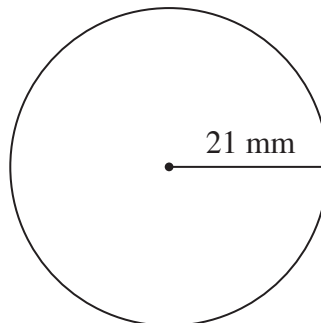
$C =$
 $=$ $=$ $\boxed{\text{cm}}$

c) Using $C = 2\pi r$ where $\pi \approx \frac{22}{7}$, calculate the circumference of the circle.



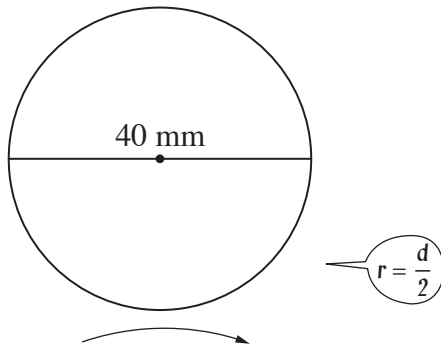
$C =$
 $=$ $=$ $\boxed{\text{mm}}$

d) Using $C = 2\pi r$ where $\pi \approx \frac{22}{7}$, calculate the circumference of the circle.



$C =$
 $=$ $=$ $\boxed{\text{mm}}$

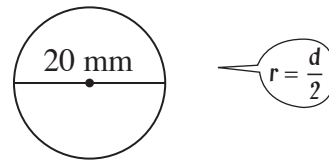
- e) Using $C = 2\pi r$ where $\pi \approx 3.14$, calculate the circumference of the circle.



$$C = 2 \times 3.14 \times 20 \text{ where } d = 40 \text{ and } r = 20$$

$$= 40 \times 3.14 = \boxed{125.6 \text{ mm}}$$

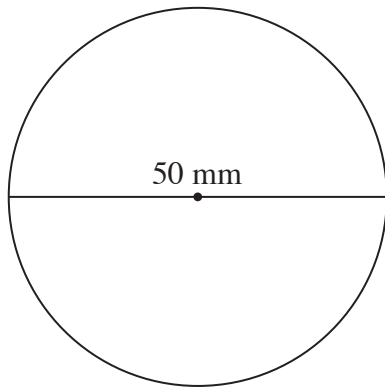
- f) Using $C = 2\pi r$ where $\pi \approx 3.14$, calculate the circumference of the circle.



$$C =$$

$$= \quad = \boxed{\text{mm}}$$

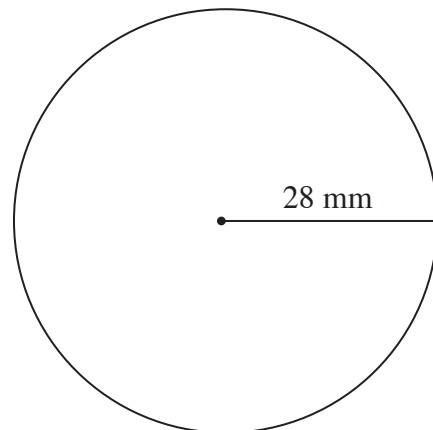
- g) Using $C = 2\pi r$ where $\pi \approx 3.14$, calculate the circumference of the circle.



$$C =$$

$$= \quad = \boxed{\text{mm}}$$

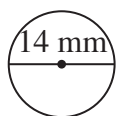
- h) Using $C = 2\pi r$ where $\pi \approx \frac{22}{7}$, calculate the circumference of the circle.



$$C =$$

$$= \quad = \boxed{\text{mm}}$$

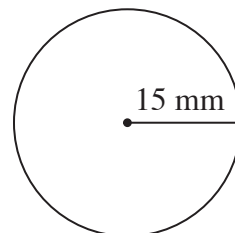
- i) Using $C = 2\pi r$ where $\pi \approx \frac{22}{7}$, calculate the circumference of the circle.



$$C =$$

$$= \quad = \boxed{\text{mm}}$$

- j) Using $C = 2\pi r$ where $\pi \approx 3.14$, calculate the circumference of the circle.



$$C =$$

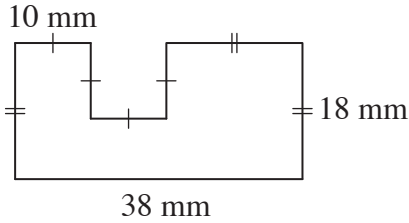
$$= \quad = \boxed{\text{mm}}$$

Skill 25.8 Calculating the perimeter of composite shapes.

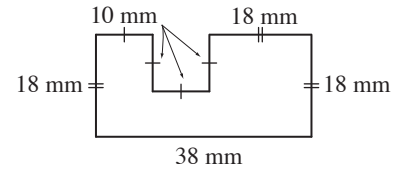
MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Determine and label all side lengths.
Hint: Sides marked with a dash (|) are of equal length. Sides marked with two dashes (||) are of equal length etc.
- Add together the side lengths.

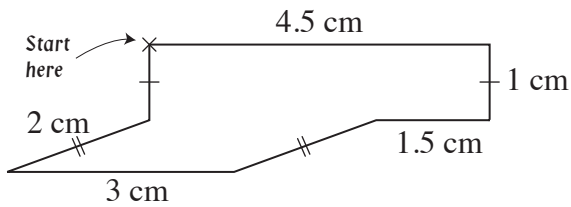
Q. Calculate the perimeter of the polygon.



A. $10 + 10 + 10 + 10 + 18 + 18 + 38 + 18$
 $= 40 + 36 + 56$
 $= \mathbf{132 \text{ mm}}$
 OR $(10 \times 4) + (18 \times 3) + 38$
 $= 40 + 54 + 38$
 $= \mathbf{132 \text{ mm}}$



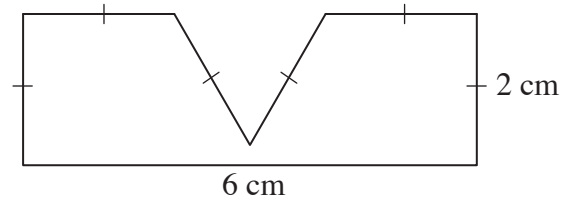
a) Calculate the perimeter of the polygon.



$$4.5 + 1 + 1.5 + 2 + 3 + 2 + 1$$

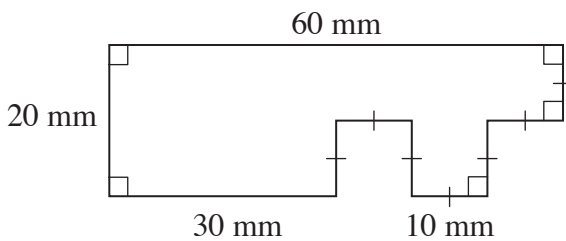
$$= 5.5 + 3.5 + 6 = \boxed{\text{cm}}$$

b) Calculate the perimeter of the polygon.



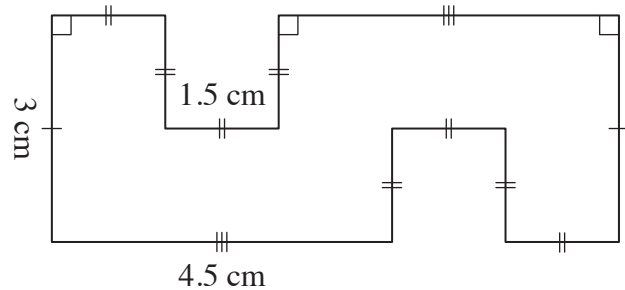
$$= \boxed{\text{cm}}$$

c) Calculate the perimeter of the polygon.



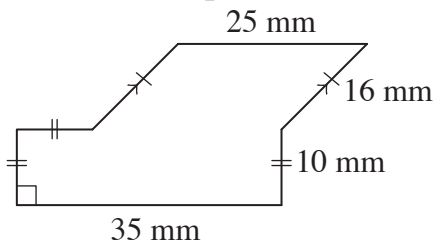
$$= \boxed{\text{mm}}$$

d) Calculate the perimeter of the polygon.



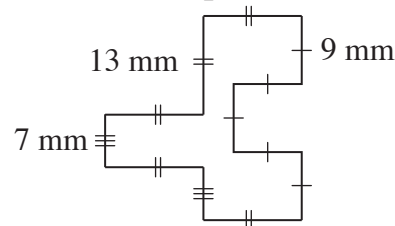
$$= \boxed{\text{cm}}$$

e) Calculate the perimeter of the polygon.



$$= \boxed{\text{mm}}$$

f) Calculate the perimeter of the polygon.



$$= \boxed{\text{mm}}$$

26. [Area / Volume]

Skill 26.1 Calculating the area of polygons by counting squares and triangles on a square grid (1).

MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Count the number of fully shaded squares on the grid.
- If necessary add on the number of half shaded squares (or triangles).
- Look for shortcuts in your counting.

Hint: To calculate the area of a rectangular shape it is possible to count the number of squares in a row and then multiply by the number of squares in a column.

Q. Find the area of the rectangle.



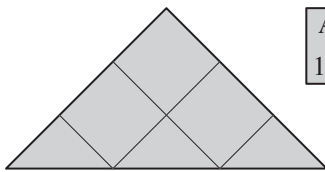
Area = 1 cm²

A. 6×2 There are 6 squares in a row and 2 squares in a column.
= **12 cm²**

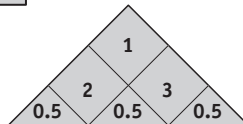


Area = 1 cm²

a) Find the area of the triangle.



Area = 1 cm²



$3 + 0.5 + 0.5 + 0.5 =$

cm²

b) Find the area of the rectangle.

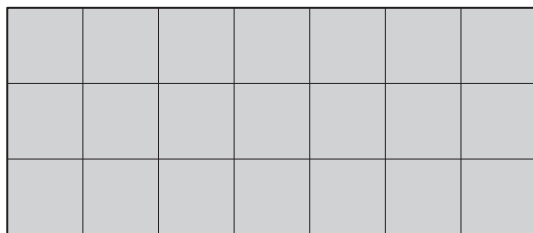


Area = 1 cm²

1×6

cm²

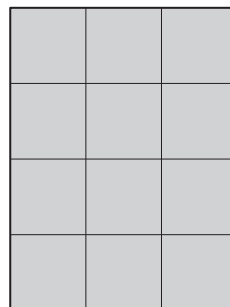
c) Find the area of the rectangle.



Area = 1 cm²

cm²

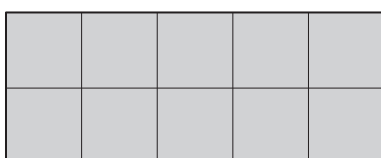
d) Find the area of the rectangle.



Area = 1 cm²

cm²

e) Find the area of the rectangle.



Area = 1 cm²

cm²

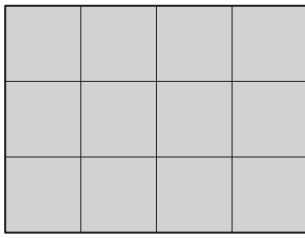
f) Find the area of the rectangle.



Area = 1 cm²

cm²

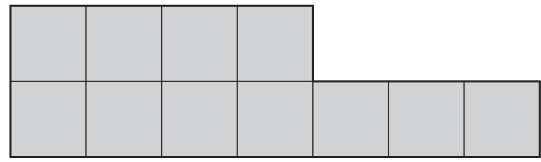
g) Find the area of the rectangle.



Area
= 1 cm²

..... = cm²

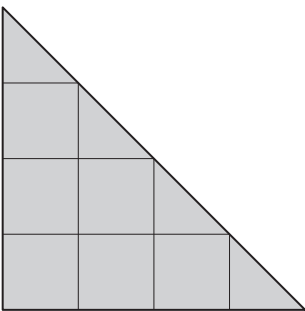
h) Find the area of the polygon.



Area
= 1 cm²

..... = cm²

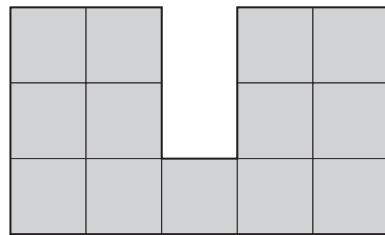
i) Find the area of the triangle.



Area
= 1 cm²

..... = cm²

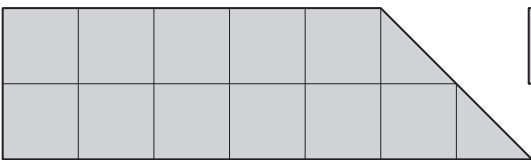
j) Find the area of the polygon.



Area
= 1 cm²

..... = cm²

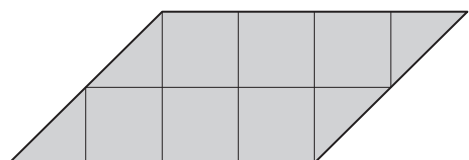
k) Find the area of the trapezium.



Area
= 1 cm²

..... = cm²

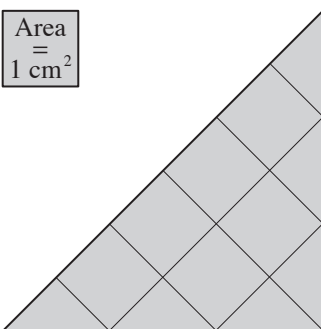
l) Find the area of the parallelogram.



Area
= 1 cm²

..... = cm²

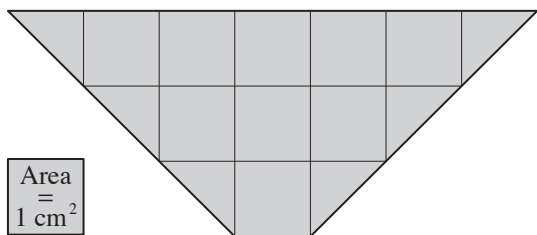
m) Find the area of the triangle.



Area
= 1 cm²

..... = cm²

n) Find the area of the trapezium.

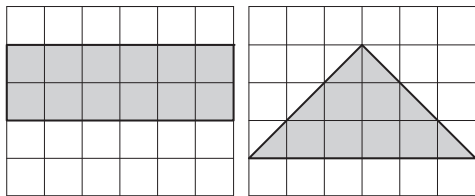


Area
= 1 cm²

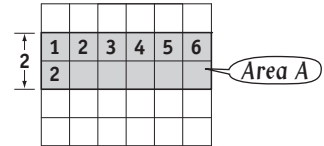
..... = cm²

- Break the shape up into rectangles and triangles if necessary.
- Calculate the area of any rectangle by:
 - Counting the squares
 - OR
 - Multiplying the number of squares in a row by the number of squares in a column.
- Calculate the area of any triangle by halving the area of the rectangle that would enclose it.
- Compare your results.

Q. Do the rectangle and the triangle have the same area?



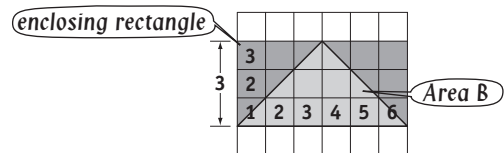
A. $Area A \neq Area B$ $Area A = 6 \times 3 = 18$ sq. units
 \Rightarrow **No**



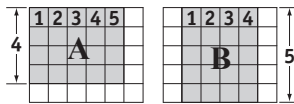
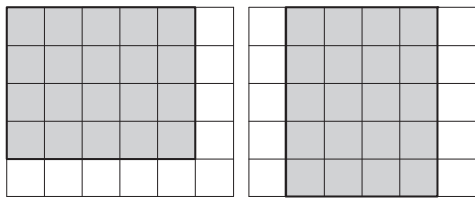
$$Area B = \frac{1}{2} \times 6 \times 3$$

$$= \frac{1}{2} \times 18$$

$$= 9 \text{ sq. units}$$



a) Do these rectangles have the same area?

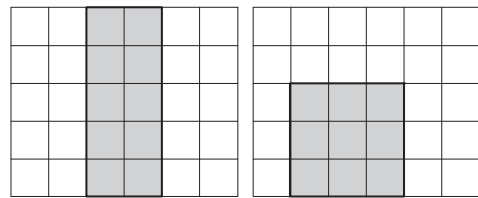


$Area A = 5 \times 4 = 20$

$Area B = 4 \times 5 = 20$

\Rightarrow **yes**

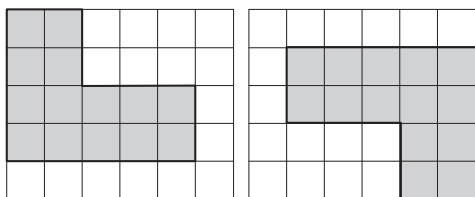
b) Do these rectangles have the same area?



$Area A =$

$Area B =$

c) Do these polygons have the same area?

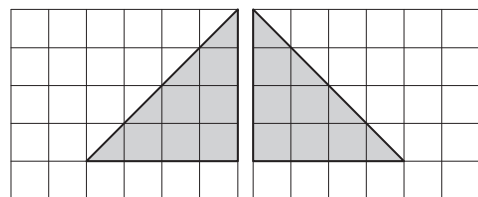


$Area A =$

$Area B =$

\Rightarrow

d) Do these triangles have the same area?

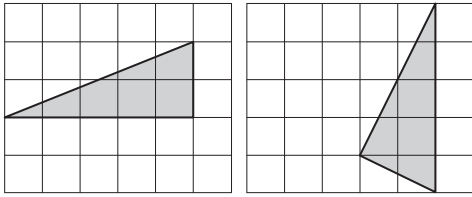


$Area A =$

$Area B =$

\Rightarrow

e) Do these triangles have the same area?

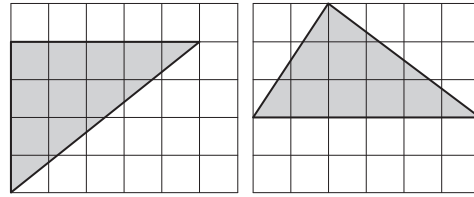


Area A =

Area B =

⇒

f) Do these triangles have the same area?

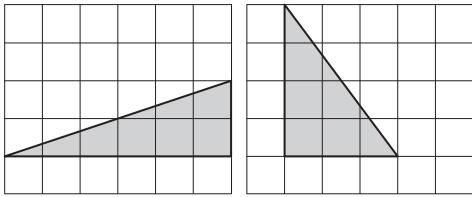


Area A =

Area B =

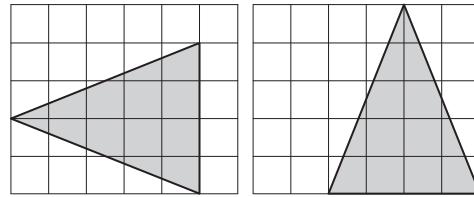
⇒

g) Do these triangles have the same area?



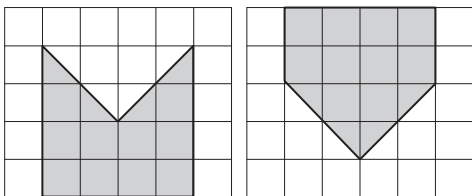
.....
.....
..... ⇒

h) Do these triangles have the same area?



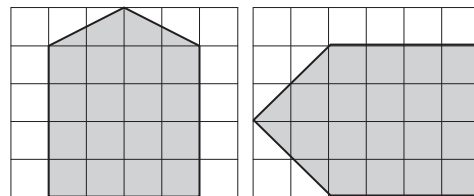
.....
.....
..... ⇒

i) Do these polygons have the same area?



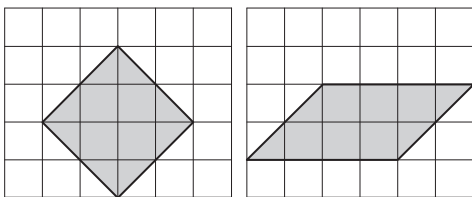
.....
.....
..... ⇒

j) Do these polygons have the same area?



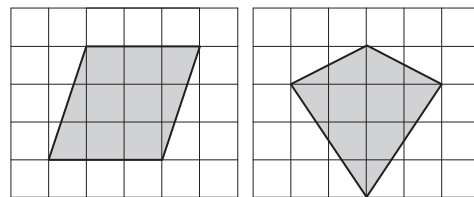
.....
.....
..... ⇒

k) Do the square and the parallelogram have the same area?



.....
.....
..... ⇒

l) Do the parallelogram and the kite have the same area?



.....
.....
..... ⇒

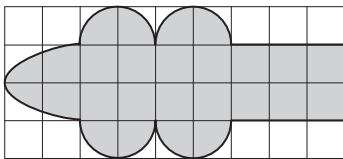
Skill 26.3 Estimating the area of irregular shapes on a square grid.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Break the shape up into workable parts (rectangles/triangles/curved shapes).
- Calculate the area of any rectangle by:
 - Counting the squares
 - OR
 - Multiplying the number of squares in a row by the number of squares in a column.
- Calculate the area of any triangle by halving the area of the rectangle that would enclose it.
- Estimate the area of any partly curved shape by making up whole squares from the shaded region.
- Add the results.

Q. Find the area of the shaded shape.

[Round to the nearest whole number.]

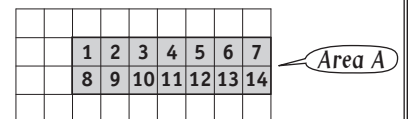


A. $Area A + Area B$

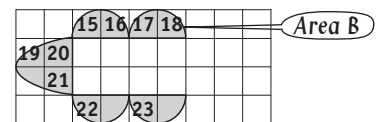
$$= 14 + 9$$

$$= 23 \text{ sq. units}$$

Area A = 14 whole units

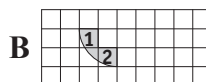
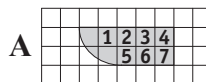
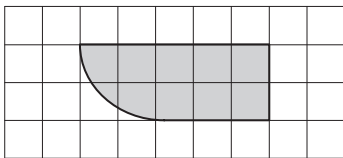


Area B = 9 units
(made up from 12 part units)



a) Find the area of the shaded shape.

[Round to the nearest whole number.]

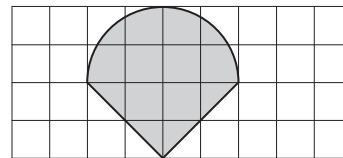


$$Area A = 7 \text{ and } Area B = 2$$

$$Area A + B = 7 + 2 = \boxed{9} \text{ sq. units}$$

b) Find the area of the shaded shape.

[Round to the nearest whole number.]

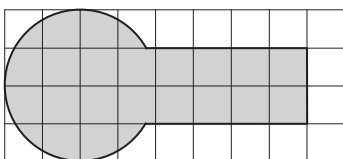


$$Area A = \quad \text{ and } Area B =$$

$$Area A + B = \quad = \boxed{\quad} \text{ sq. units}$$

c) Find the area of the shaded shape.

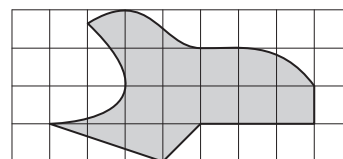
[Round to the nearest whole number.]



$$= \boxed{\quad} \text{ sq. units}$$

d) Find the area of the shaded shape.

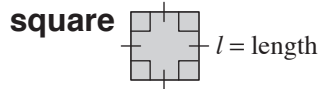
[Round to the nearest whole number.]



$$= \boxed{\quad} \text{ sq. units}$$

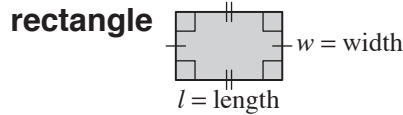
Skill 26.4 Calculating the area of squares, rectangles and parallelograms (1).

MM4.2 1 1 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4



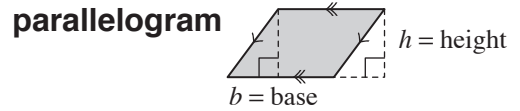
$$A = l \times l$$

$$= l^2$$



$$A = l \times w$$

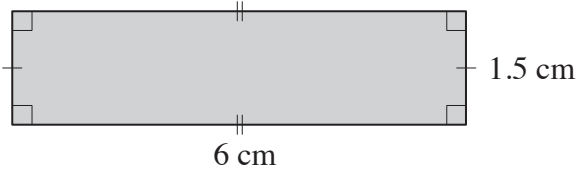
$$= lw$$



$$A = b \times h$$

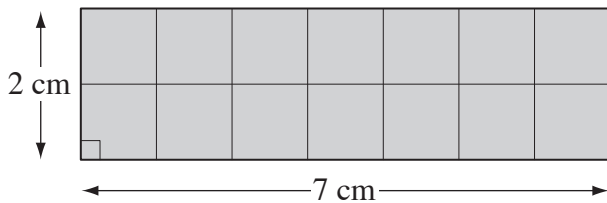
$$= bh$$

Q. Using $A = lw$ find the area of the rectangle.



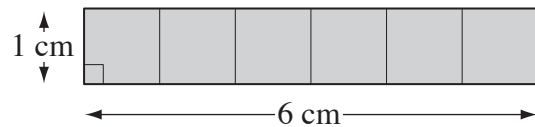
A. $A = lw$ where $l = 6$ and $w = 1.5$
 $= 6 \times 1.5$
 $= 9 \text{ cm}^2$

a) Using Area = length \times width find the area of this rectangle.



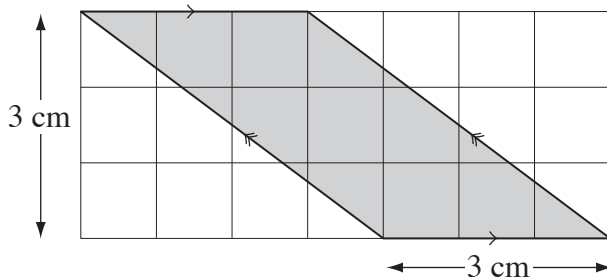
$$A = 7 \times 2 = \boxed{\text{cm}^2}$$

b) Using Area = length \times width find the area of this rectangle.



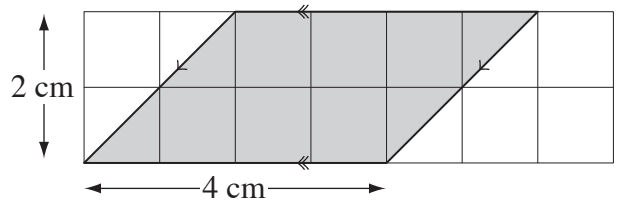
$$A = \boxed{\text{cm}^2}$$

c) Using Area = base \times height find the area of this parallelogram.



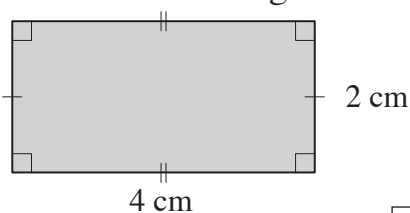
$$A = \boxed{\text{cm}^2}$$

d) Using Area = base \times height find the area of this parallelogram.



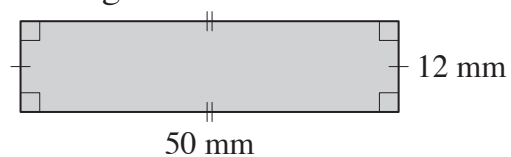
$$A = \boxed{\text{cm}^2}$$

e) Using Area = length \times width find the area of this rectangle.



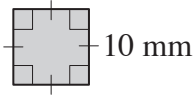
$$A = \boxed{\text{cm}^2}$$

f) Using $A = lw$ find the area of the rectangle.



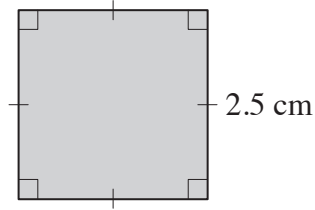
$$A = \boxed{\text{mm}^2}$$

- g)** Using $\text{Area} = \text{length} \times \text{length}$ find the area of the square.



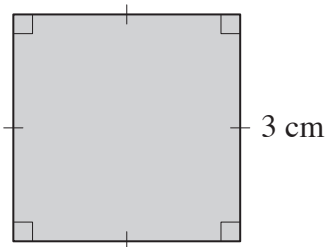
$A = \dots = \boxed{\text{mm}^2}$

- h)** Using $\text{Area} = l^2$ find the area of the square.



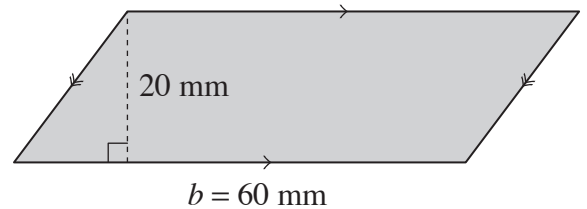
$A = \dots = \boxed{\text{cm}^2}$

- i)** Find the area of the square.



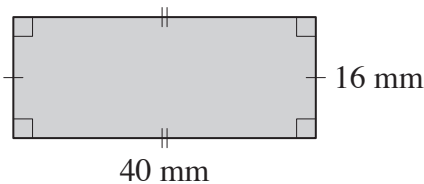
$A = \dots = \boxed{\text{cm}^2}$

- j)** Using $\text{Area} = \text{base} \times \text{height}$ find the area of the parallelogram.



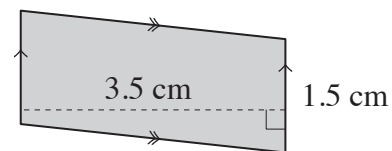
$A = \dots = \boxed{\text{mm}^2}$

- k)** Using $A = lw$ find the area of the rectangle.



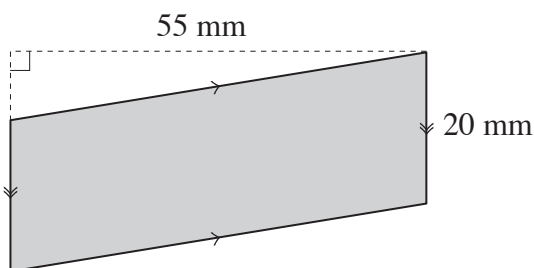
$A = \dots = \boxed{\text{mm}^2}$

- l)** Using $\text{Area} = \text{base} \times \text{height}$ find the area of the parallelogram.



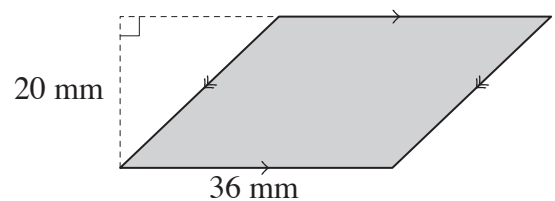
$A = \dots = \boxed{\text{cm}^2}$

- m)** Using $A = bh$ find the area of the parallelogram.



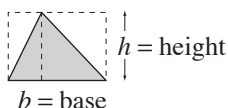
$A = \dots = \boxed{\text{mm}^2}$

- n)** Find the area of the parallelogram.



$A = \dots = \boxed{\text{mm}^2}$

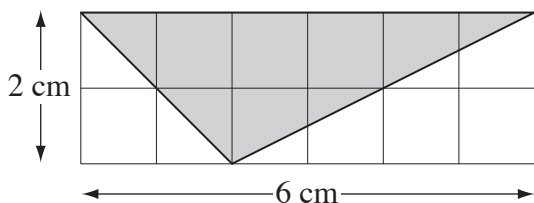
Area of a triangle



$$A = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} bh$$

Q. Using Area = $\frac{1}{2} \times$ base \times height find the area of the triangle.



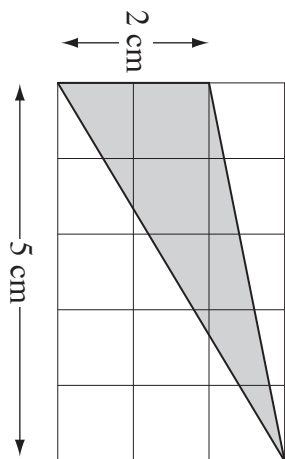
A. $A = \frac{1}{2} bh$ where $b = 6$ and $h = 2$

$$= \frac{1}{2} \times 6 \times 2$$

$$= \frac{1}{2} \times 12$$

$$= \mathbf{6 \text{ cm}^2}$$

a) Using Area = $\frac{1}{2} \times$ base \times height find the area of the triangle.

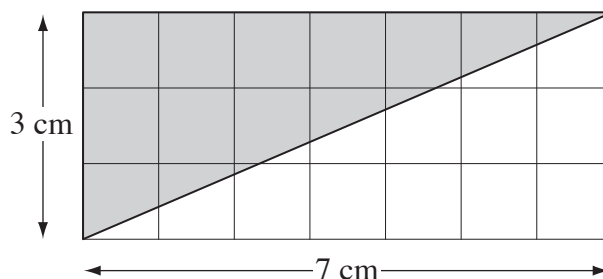


$$A = \frac{1}{2} \times 2 \times 5$$

.....

$$= \frac{1}{2} \times 10 = \boxed{\text{cm}^2}$$

b) Using Area = $\frac{1}{2} \times$ base \times height find the area of the triangle.

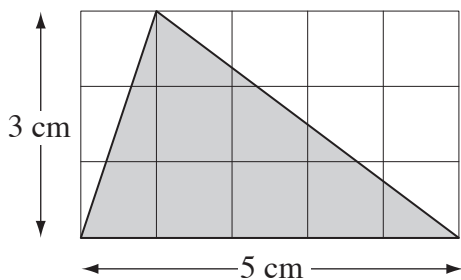


$$A =$$

.....

$$= \boxed{\text{cm}^2}$$

c) Using Area = $\frac{1}{2} \times$ base \times height find the area of the triangle.

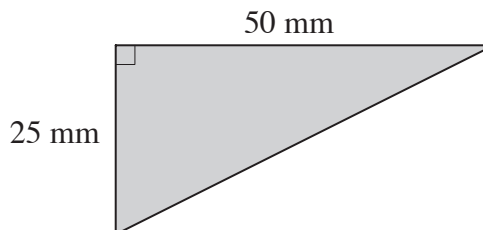


$$A =$$

.....

$$= \boxed{\text{cm}^2}$$

d) Using $A = \frac{1}{2} bh$ find the area of the right-angled triangle.

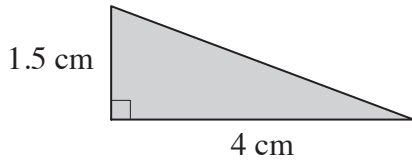


$$A =$$

.....

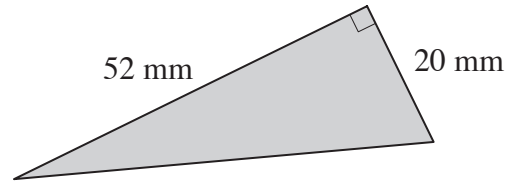
$$= \boxed{\text{mm}^2}$$

e) Using Area = $\frac{1}{2} \times \text{base} \times \text{height}$ find the area of the triangle.



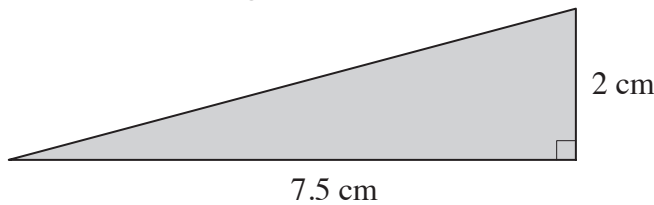
$A =$
.....
= = cm^2

f) Using Area = $\frac{1}{2} bh$ find the area of the triangle.



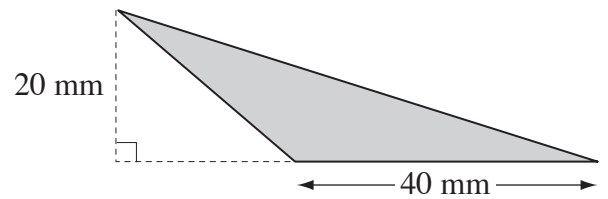
$A =$
.....
= = mm^2

g) Using Area = $\frac{1}{2} \times \text{base} \times \text{height}$ find the area of the triangle.



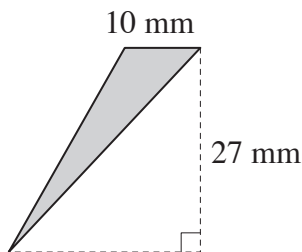
$A =$
.....
= = cm^2

h) Using Area = $\frac{1}{2} bh$ find the area of the triangle.



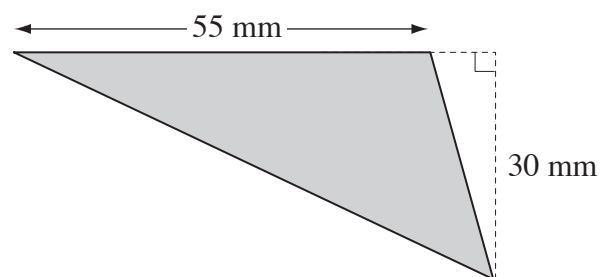
$A =$
.....
= = mm^2

i) Using Area = $\frac{1}{2} bh$ find the area of the triangle.



$A =$
.....
= = mm^2

j) Using Area = $\frac{1}{2} bh$ find the area of the triangle.



$A =$
.....
= = mm^2

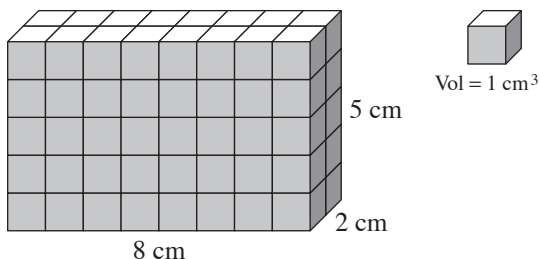
Skill 26.6 Calculating the volume of rectangular prisms by counting cubes (1).

MM4.2 11 22 3 4 4
MM5.1 11 2 3 3 4 4

- Count the cubes.

Hint: Count the cubes in one layer and then multiply the result by the total number of layers.

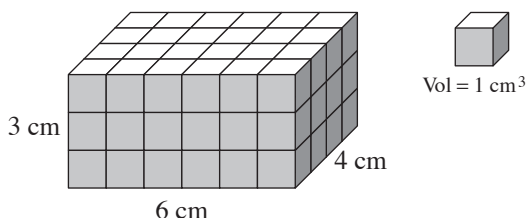
Q. Find the volume of the rectangular prism.



A. $V = 16 \times 5$
 $= 80 \text{ cm}^3$

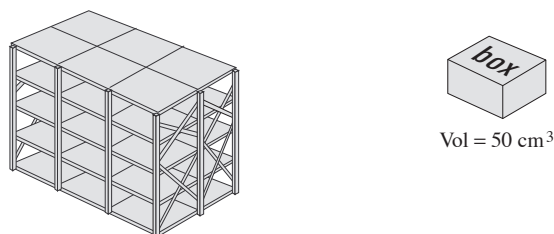
16 cubes in top layer
5 layers all together

a) Using Volume = length \times width \times height, find the volume of the rectangular prism.



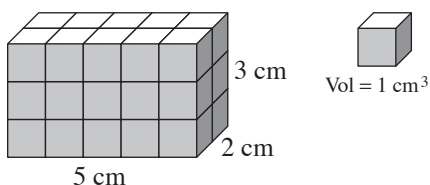
$V = 24 \times 3 = \boxed{\text{cm}^3}$

b) If 24 boxes can fit inside these shelves, find the total volume of the boxes.



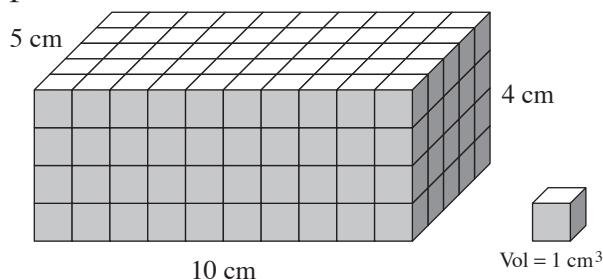
$V = \boxed{\text{cm}^3}$

c) Using Volume = length \times width \times height, find the volume of the rectangular prism.



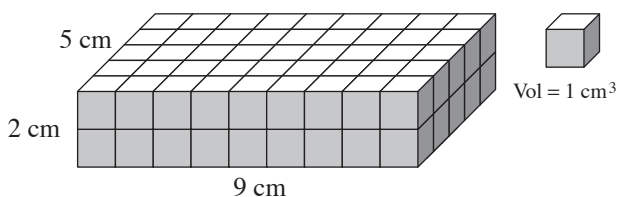
$V = \boxed{\text{cm}^3}$

d) Using Volume = length \times width \times height, find the volume of the rectangular prism.



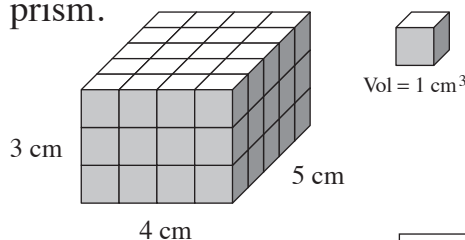
$V = \boxed{\text{cm}^3}$

e) Using Volume = length \times width \times height, find the volume of the rectangular prism.



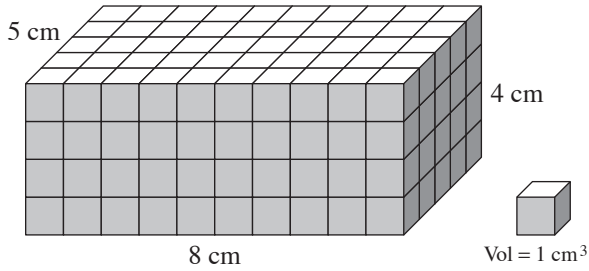
$V = \boxed{\text{cm}^3}$

f) Using Volume = length \times width \times height, find the volume of the rectangular prism.



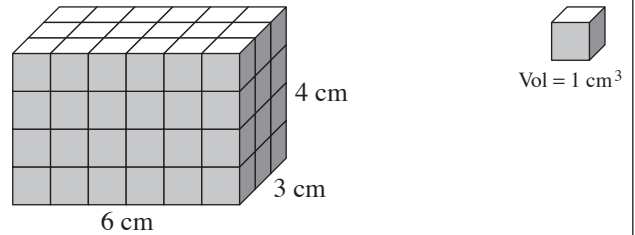
$V = \boxed{\text{cm}^3}$

g) Using Volume = length \times width \times height, find the volume of the rectangular prism.



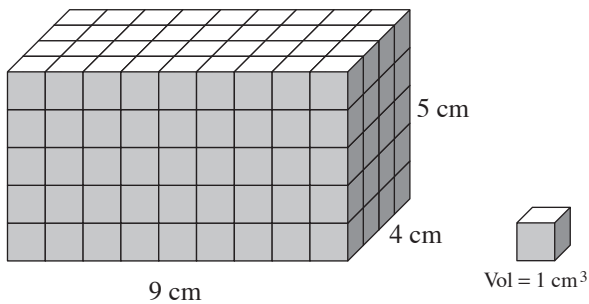
$V =$ =

h) Using $V = lwh$ find the volume of the rectangular prism.



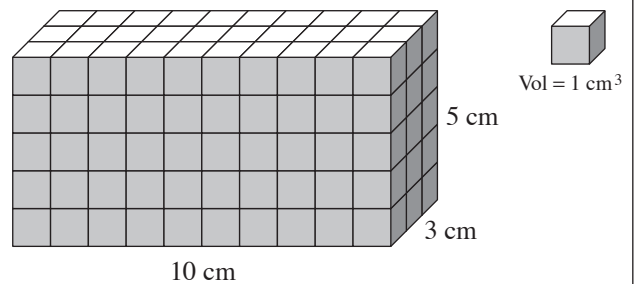
$V =$ =

i) Using $V = lwh$ find the volume of the rectangular prism.



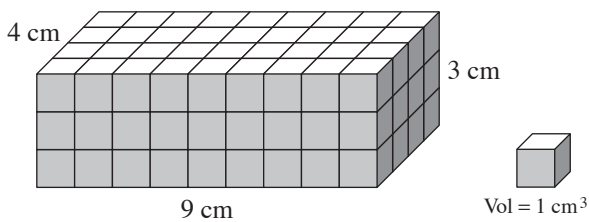
$V =$ =

j) Using $V = lwh$ find the volume of the rectangular prism.



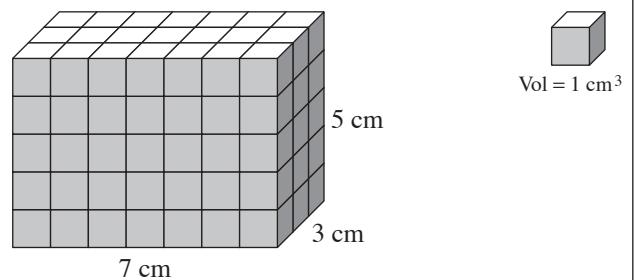
$V =$ =

k) Using $V = lwh$ find the volume of the rectangular prism.



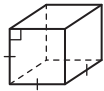
$V =$ =

l) Using $V = lwh$ find the volume of the rectangular prism.



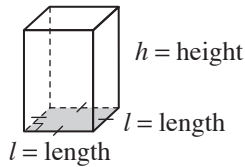
$V =$ =

Volume of a cube



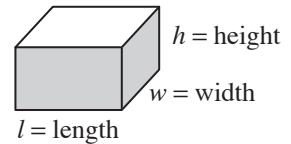
$$V = l \times l \times l = l^3$$

Volume of a square prism



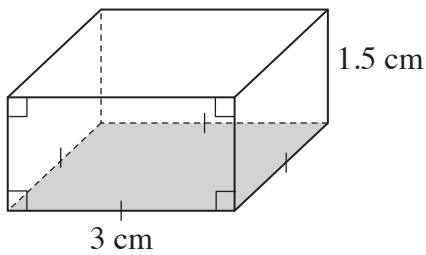
$$V = l \times l \times h = l^2 h$$

Volume of a rectangular prism



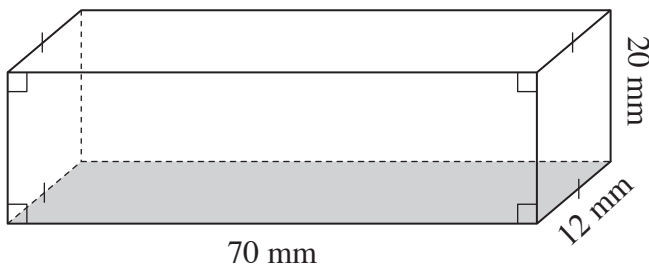
$$V = l \times w \times h = lwh$$

Q. Using $V = l^2 h$ find the volume of the square prism.



A. $V = 3^2 \times 1.5$
 $= 9 \times 1.5$
 $= 13.5 \text{ cm}^3$

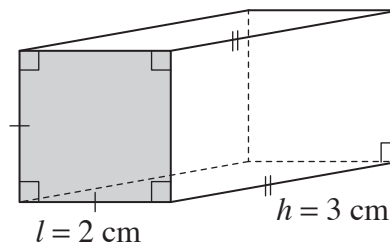
a) Using $V = lwh$ find the volume of the rectangular prism.



$$V = 70 \times 12 \times 20$$

$$= 840 \times 20 = \boxed{16800 \text{ mm}^3}$$

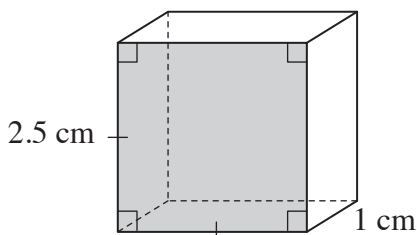
b) Using $V = l^2 h$ find the volume of the square prism.



$$V =$$

$$= \quad = \boxed{\text{cm}^3}$$

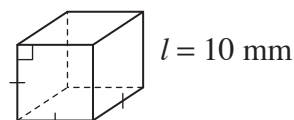
c) Using $V = l^2 h$ find the volume of the square prism.



$$V =$$

$$= \quad = \boxed{\text{cm}^3}$$

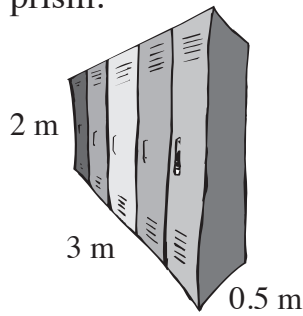
d) Using $V = l^3$ find the volume of the cube.



$$V =$$

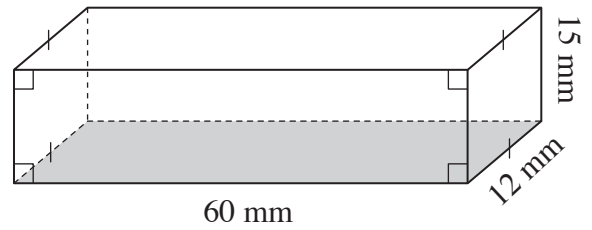
$$= \quad = \boxed{\text{mm}^3}$$

- e) Using $V = lwh$ find the volume of the bank of lockers that is a rectangular prism.



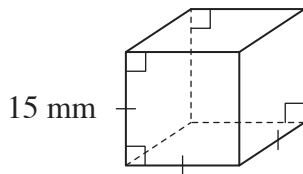
$V =$
.....
= = m^3

- f) Using $V = lwh$ find the volume of the rectangular prism.



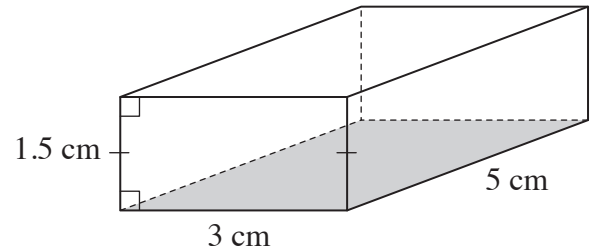
$V =$
.....
= = mm^3

- g) Using $V = l^3$ find the volume of the cube.



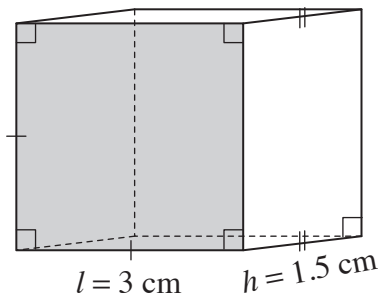
$V =$
.....
= = mm^3

- h) Using $V = lwh$ find the volume of the rectangular prism.



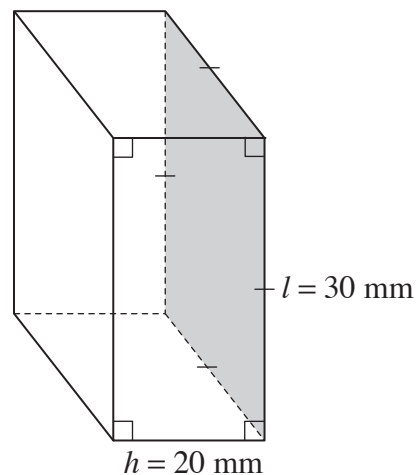
$V =$
.....
= = cm^3

- i) Using $V = l^2h$ find the volume of the square prism.



$V =$
.....
= = cm^3

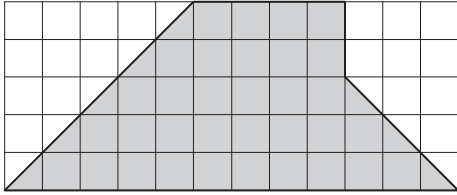
- j) Using $V = l^2h$ find the volume of the square prism.



$V =$
.....
= = mm^3

- Break the shape up into workable parts (rectangles/triangles).
- Calculate the area of each part. (see skills 26.4 to 26.5, pages 252 to 254)
- Add the results.

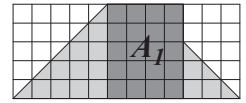
Q. Find the area of the shaded polygon.



A. $A_1 = lw$ where $l = 4$ and $w = 5$

$$= 4 \times 5$$

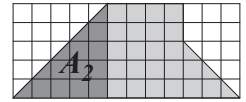
$$= 20$$



$A_2 = \frac{1}{2}bh$ where $b = 5$ and $h = 5$

$$= \frac{1}{2} \times 5 \times 5$$

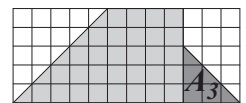
$$= 12.5$$



$A_3 = \frac{1}{2}bh$ where $b = 3$ and $h = 3$

$$= \frac{1}{2} \times 3 \times 3$$

$$= 4.5$$

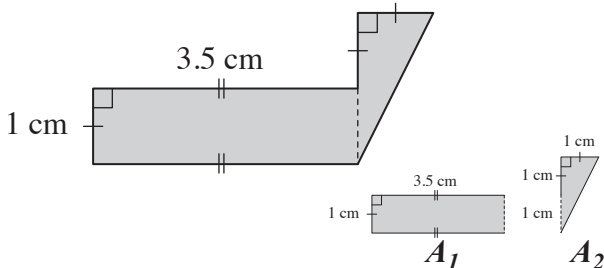


$$A = A_1 + A_2 + A_3$$

$$= 20 + 12.5 + 4.5$$

$$= 37 \text{ sq. units}$$

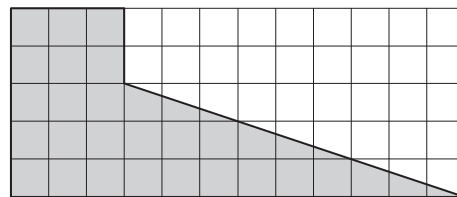
a) Find the area of the shaded polygon.



$$A_1 = 1 \times 3.5 = 3.5 \quad A_2 = \frac{1}{2} \times 1 \times 1 = 0.5$$

$$A = 3.5 + 0.5 = \boxed{4} \text{ cm}^2$$

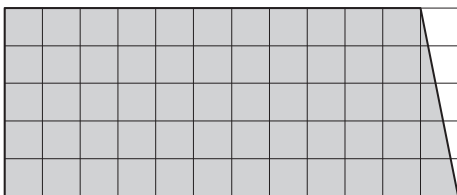
b) Find the area of the shaded polygon.



$$A_1 = \quad A_2 =$$

$$A = \quad = \boxed{\quad} \text{ sq. units}$$

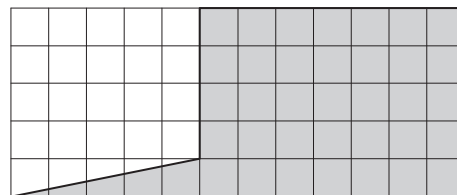
c) Find the area of the shaded polygon.



$$A_1 = \quad A_2 =$$

$$A = \quad = \boxed{\quad} \text{ sq. units}$$

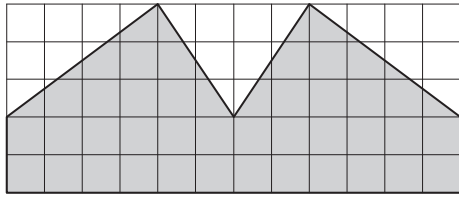
d) Find the area of the shaded polygon.



$$A_1 = \quad A_2 =$$

$$A = \quad = \boxed{\quad} \text{ sq. units}$$

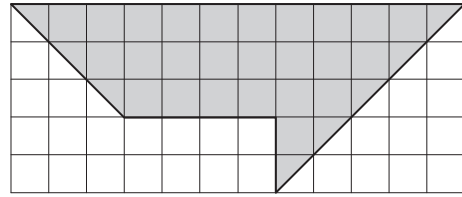
e) Find the area of the shaded polygon.



$A_1 =$ $A_2 =$

$A =$ = sq. units

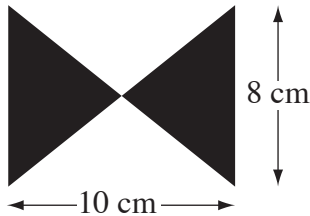
f) Find the area of the shaded polygon.



$A_1 =$ $A_2 =$

$A =$ = sq. units

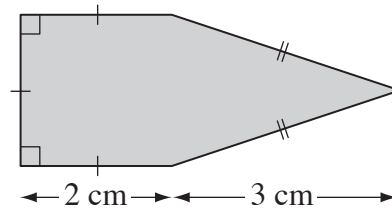
g) Find the area of the bowtie.



$A_1 =$ $A_2 =$

$A =$ = cm^2

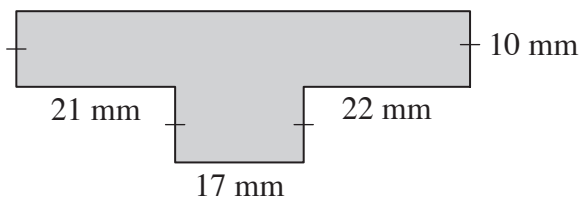
h) Find the area of the polygon.



$A_1 =$ $A_2 =$

$A =$ = cm^2

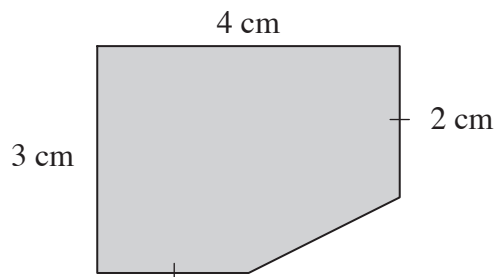
i) Find the area of the shaded polygon.



$A_1 =$ $A_2 =$

$A =$ = mm^2

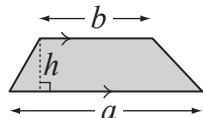
j) Find the area of the polygon.



$A_1 =$ $A_2 =$

$A =$ = cm^2

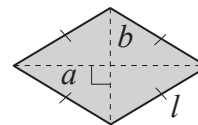
Area of a trapezium



$$A = \frac{1}{2} (\text{base } a + \text{base } b) \times \text{height } h$$

$$= \frac{1}{2} (a + b)h$$

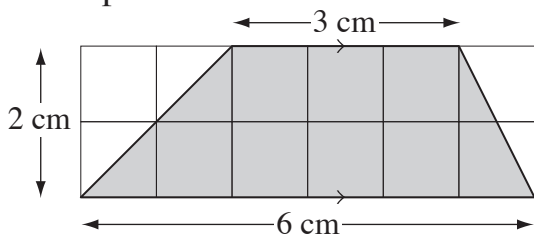
Area of a rhombus



$$A = \frac{1}{2} \times \text{diagonal } a \times \text{diagonal } b$$

$$= \frac{1}{2} ab$$

Q. Using $A = \frac{1}{2}(a + b)h$ find the area of the trapezium.



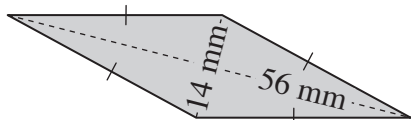
A. $A = \frac{1}{2}(a + b)h$ where $a = 3$, $b = 6$ and $h = 2$

$$= \frac{1}{2} \times (6 + 3) \times 2$$

$$= \frac{1}{2} \times 9 \times 2$$

$$= \mathbf{9 \text{ cm}^2}$$

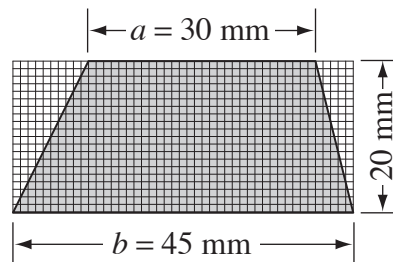
a) Using $A = \frac{1}{2}ab$ find the area of the rhombus.



$$A = \frac{1}{2} \times 14 \times 56$$

$$= 7 \times 56 = \boxed{\text{mm}^2}$$

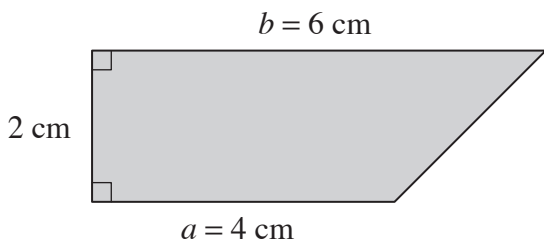
b) Using Area = $\frac{1}{2}(\text{base } a + \text{base } b) \times \text{height}$ find the area of the trapezium.



$$A =$$

$$= \boxed{\text{mm}^2}$$

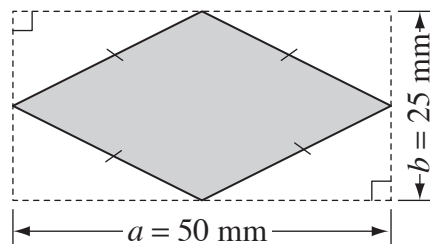
c) Using $A = \frac{1}{2}(a + b)h$ find the area of the trapezium.



$$A =$$

$$= \boxed{\text{cm}^2}$$

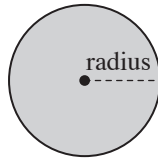
d) Using Area = $\frac{1}{2} \times \text{diagonal } a \times \text{diagonal } b$ find the area of the rhombus.



$$A =$$

$$= \boxed{\text{mm}^2}$$

Area of a circle



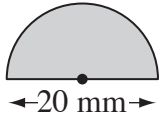
$$A = \pi \times \text{radius} \times \text{radius}$$

$$= \pi r^2$$

where $\pi \approx 3.14\dots$
or $\approx \frac{22}{7}$

Hint: If you are given the diameter then halve to find the radius: $r = \frac{d}{2}$

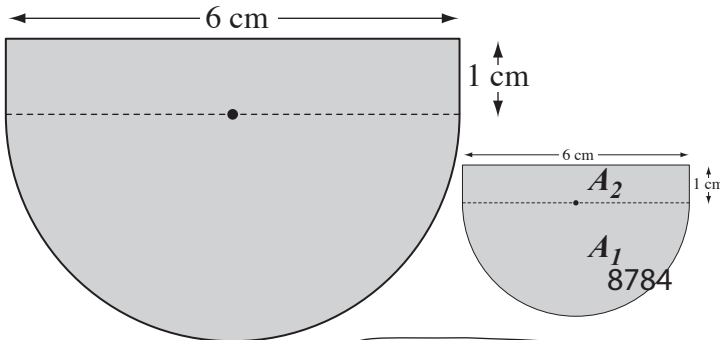
Q. Using $A = \pi r^2$ and $\pi \approx 3.14$, find the area of the semi-circle.



A. Area of circle = πr^2 where $d = 20$ and $r = 10$
 $= 3.14 \times 10^2$
 $= 3.14 \times 100$
 $= 314$
 Area of semi-circle
 $= 314 \div 2$
 $= 157 \text{ mm}^2$

$r = \frac{d}{2}$

a) Using $A = \pi r^2$ and $\pi \approx 3.14$, find the area of the shaded shape.



If $d = 6$ then $r = 3$

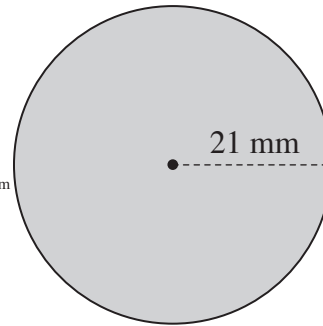
$\div 2$ for the semi-circle

$$A_1 = 3.14 \times 3 \times 3 \div 2 = 14.13$$

$$A_2 = 6 \times 1 = 6 \text{ and using } A = A_1 + A_2$$

$$A = 14.13 + 6 = \boxed{\text{cm}^2}$$

b) Using $A = \pi r^2$ and $\pi \approx \frac{22}{7}$, find the area of the circle.

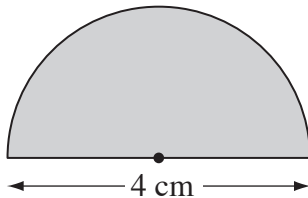


$$A =$$

$$=$$

$$= \boxed{\text{mm}^2}$$

c) Using $A = \pi r^2$ and $\pi \approx 3.14$, find the area of the semi-circle.

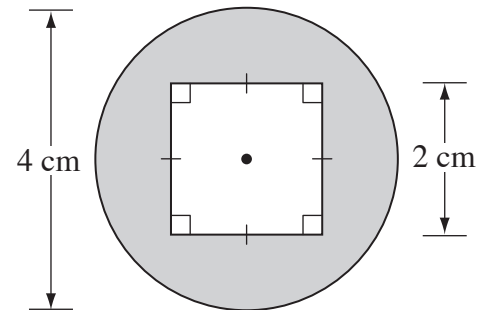


$$A =$$

$$=$$

$$= \boxed{\text{cm}^2}$$

d) Using $A = \pi r^2$ and $\pi \approx 3.14$, find the area of the shaded shape.



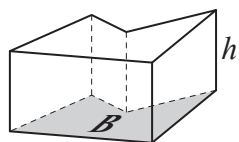
$$A_1 =$$

$$A_2 =$$

$$A =$$

$$= \boxed{\text{cm}^2}$$

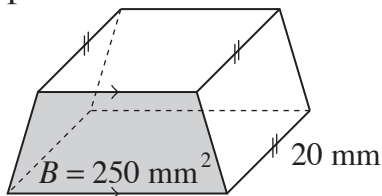
Volume of a prism



$$V = \text{Area of base} \times \text{height of prism}$$

$$= Bh$$

Q. Using $V = Bh$ find the volume of the prism.

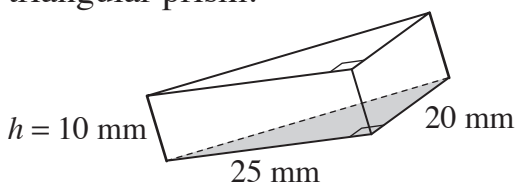


A. $A = Bh$ where $B = 250$ and $h = 20$

$$= 250 \times 20$$

$$= 5000 \text{ mm}^3$$

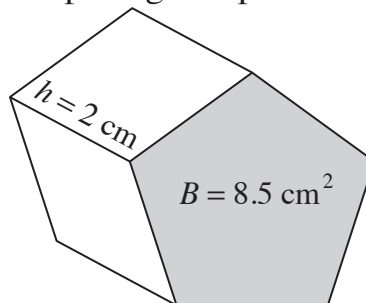
a) Using $V = Bh$ find the volume of the triangular prism.



$$B = \frac{1}{2} \times 25 \times 20 = 250$$

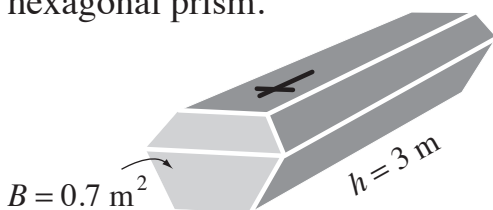
$$V = 250 \times 10 = \boxed{\text{mm}^3}$$

b) Using Volume = area of the base \times height of the prism find the volume of the pentagonal prism.



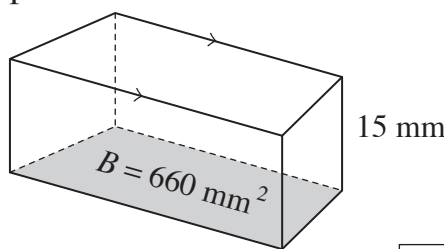
$$V = \boxed{\text{cm}^3}$$

c) Using $V = Bh$ find the volume of the hexagonal prism.



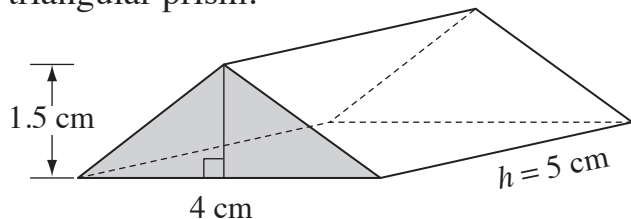
$$V = \boxed{\text{m}^3}$$

d) Using $V = Bh$ find the volume of the prism.



$$V = \boxed{\text{mm}^3}$$

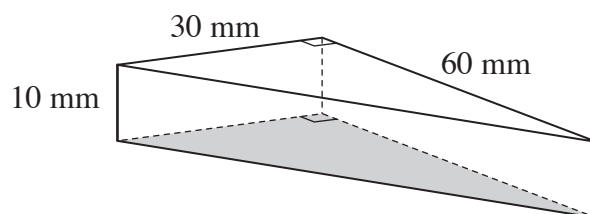
e) Using $V = Bh$ find the volume of the triangular prism.



$$B =$$

$$V = \boxed{\text{cm}^3}$$

f) Using $V = Bh$ find the volume of the triangular prism.



$$B =$$

$$V = \boxed{\text{mm}^3}$$

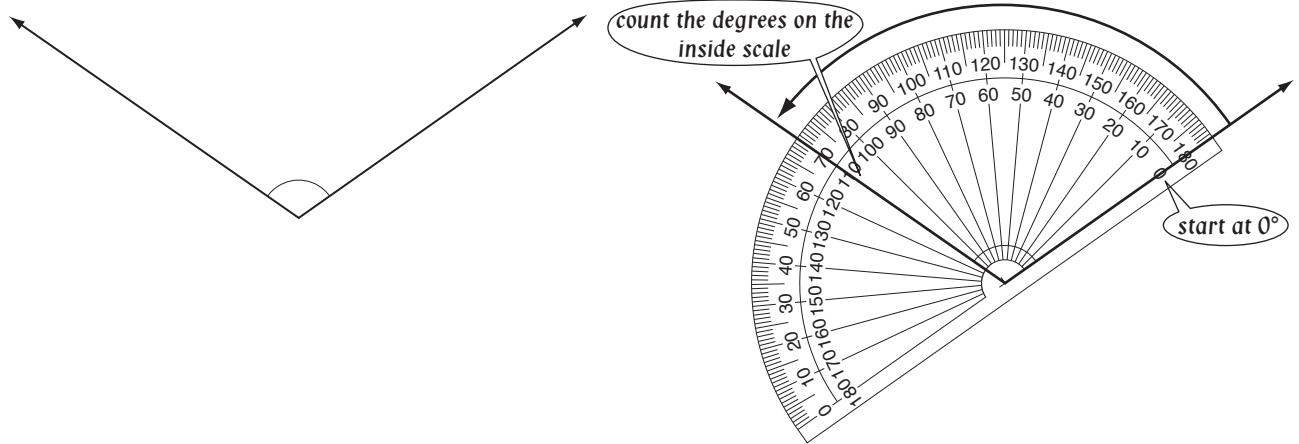
27. [Shapes]

Skill 27.1 Measuring angles using a protractor (1).

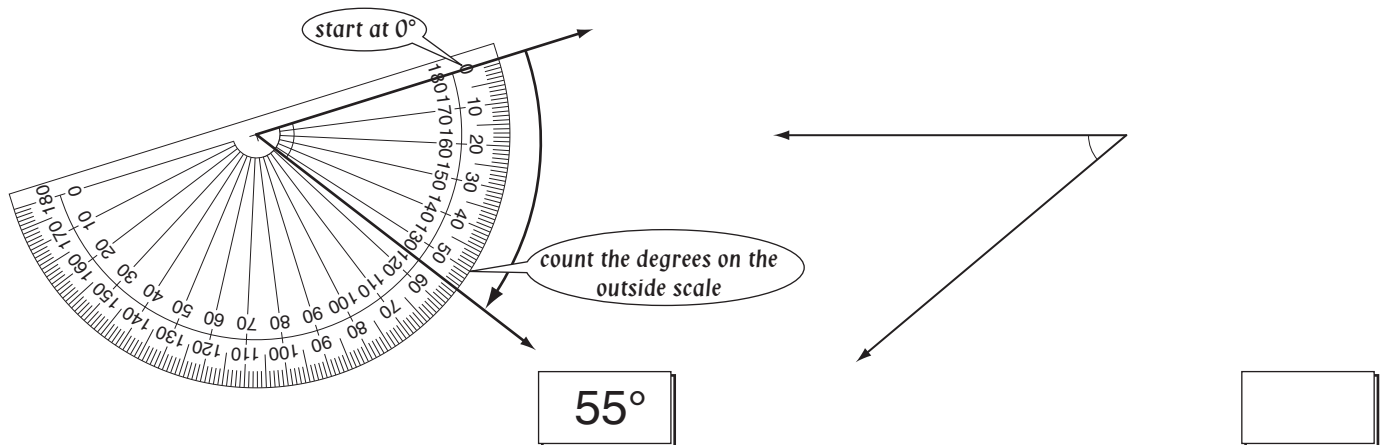
MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Place the centre of the protractor at the vertex (corner) of the angle.
- Align one of the lines forming the angle to pass through 0° on either the inside or outside scale.
- Read the measurement where the other line of the angle crosses the scale on the protractor.

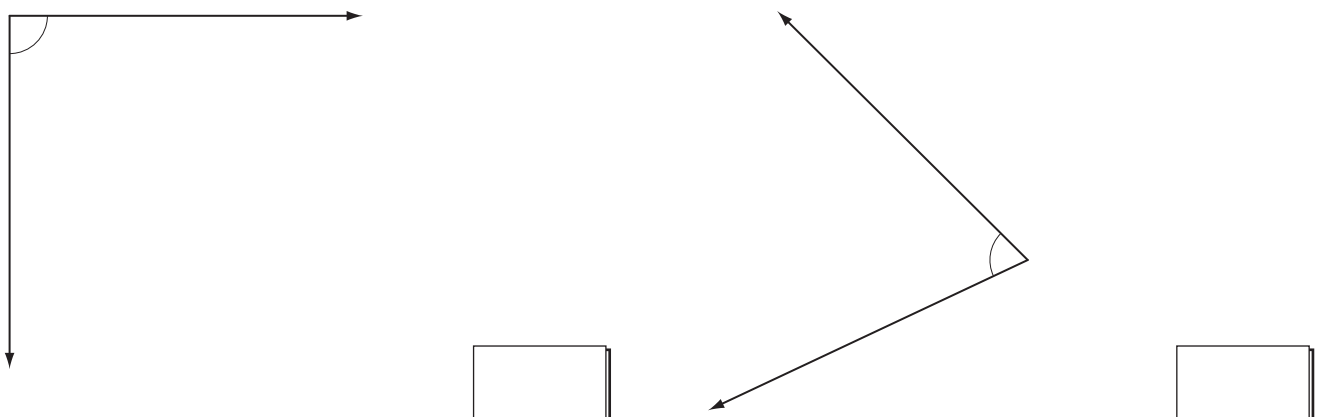
Q. Use a protractor to measure this angle. **A.** 110°



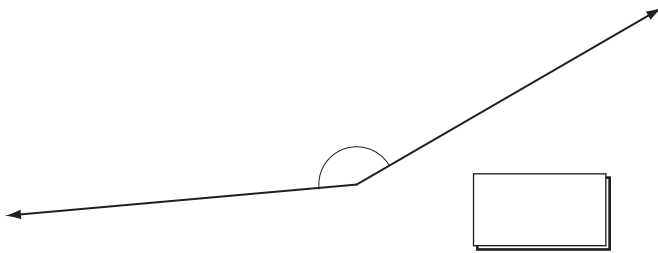
a) Use a protractor to measure this angle. **b)** Use a protractor to measure this angle.



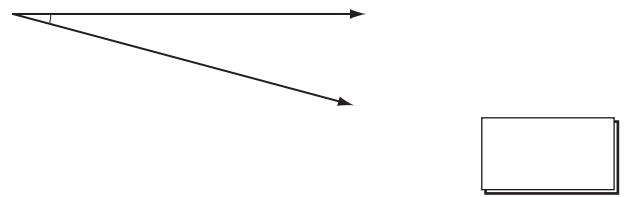
c) Use a protractor to measure this angle. **d)** Use a protractor to measure this angle.



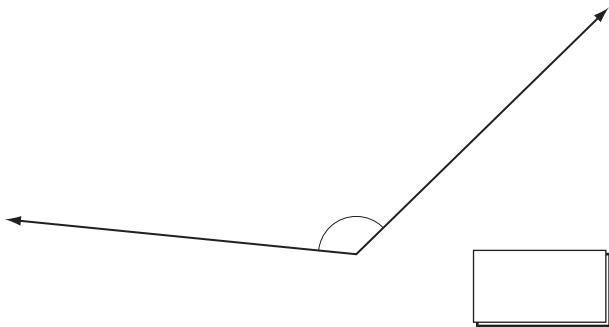
e) Use a protractor to measure this angle.



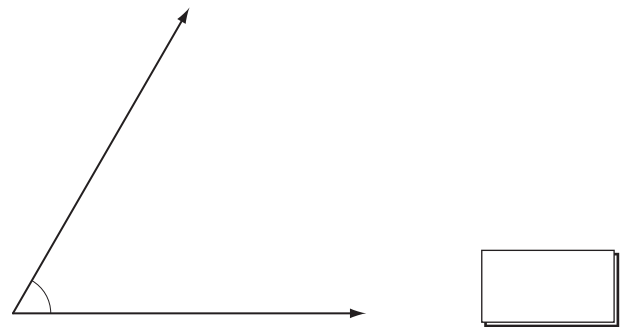
f) Use a protractor to measure this angle.



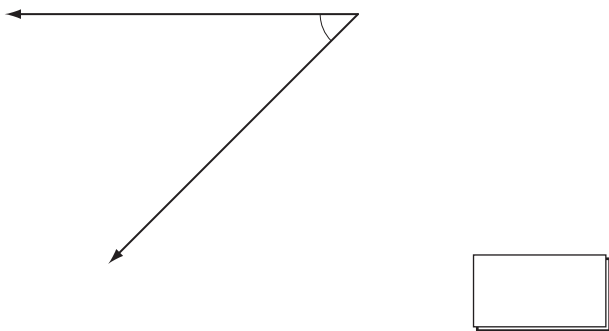
g) Use a protractor to measure this angle.



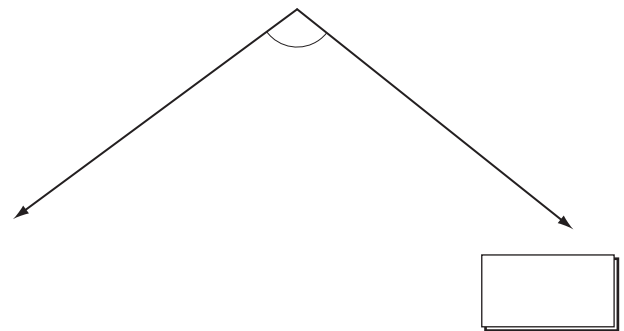
h) Use a protractor to measure this angle.



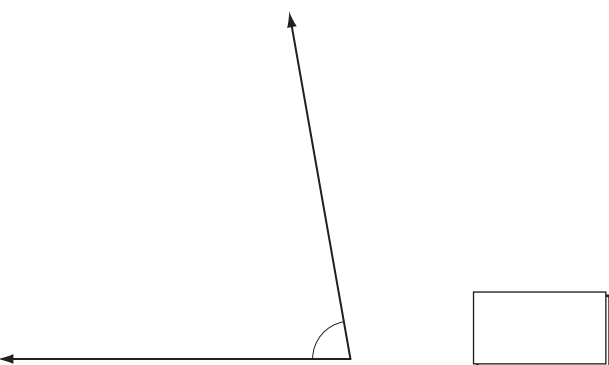
i) Use a protractor to measure this angle.



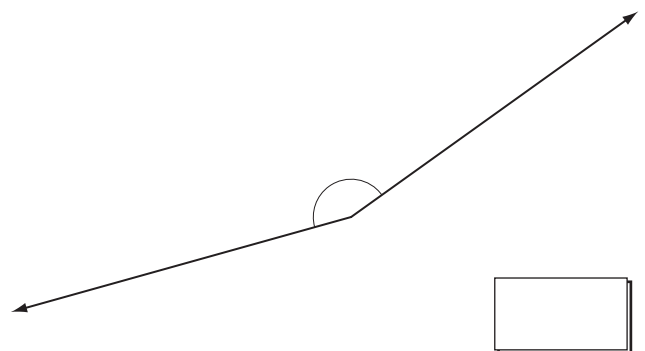
j) Use a protractor to measure this angle.



k) Use a protractor to measure this angle.

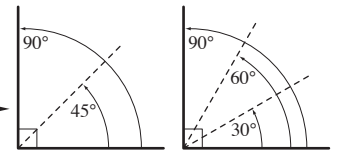


l) Use a protractor to measure this angle.



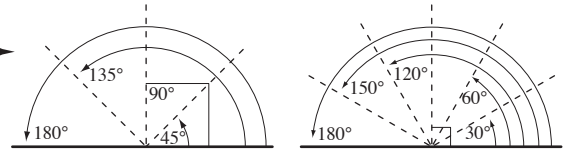
To estimate the size of an acute angle

- Draw a right angle (90°) overlapping one line of the given angle.
- Divide the right angle into smaller divisions, e.g. halves or thirds.

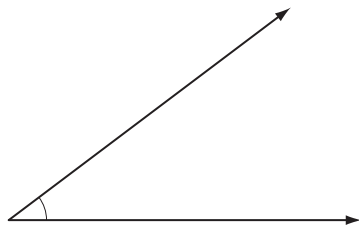


To estimate the size of an obtuse angle

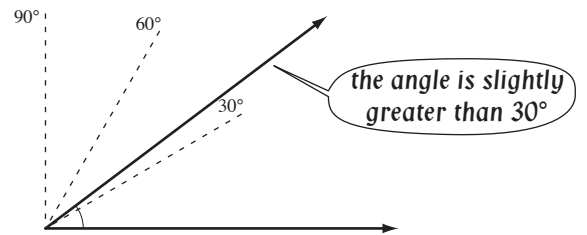
- Draw a straight angle (180°) overlapping one line of the given angle.
- Divide the straight angle into smaller divisions, e.g. quarters or sixths.



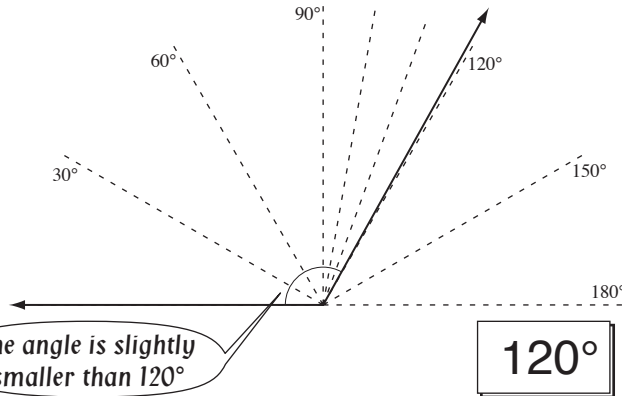
Q. Without measuring, would you estimate that the size of this angle is closer to 35° or to 50° ?



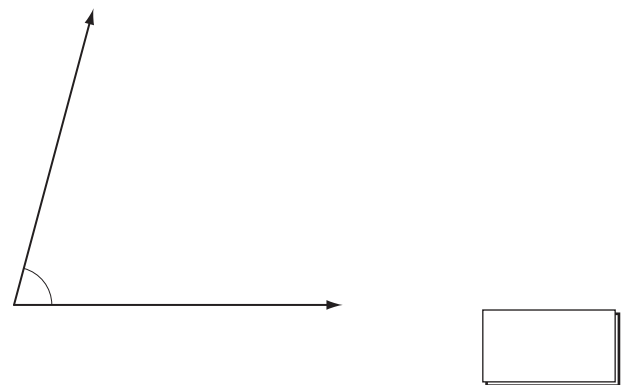
A. 35°



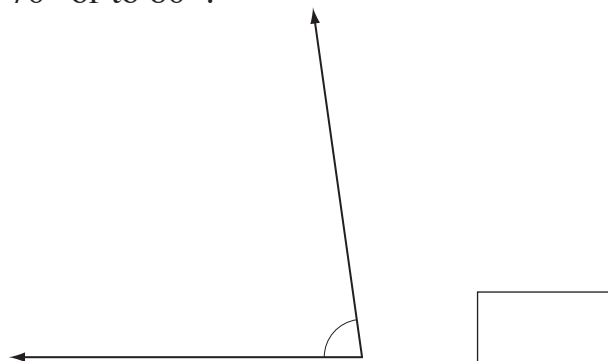
a) Without measuring, would you estimate that the size of this angle is closer to 110° or to 120° ?



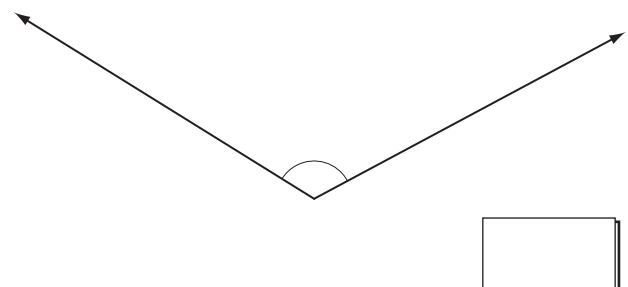
b) Without measuring, would you estimate that the size of this angle is closer to 75° or to 90° ?



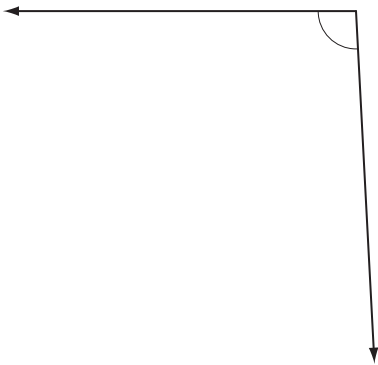
c) Without measuring, would you estimate that the size of this angle is closer to 70° or to 80° ?



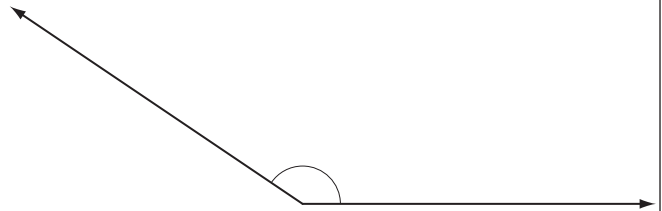
d) Without measuring, would you estimate that the size of this angle is closer to 125° or to 140° ?



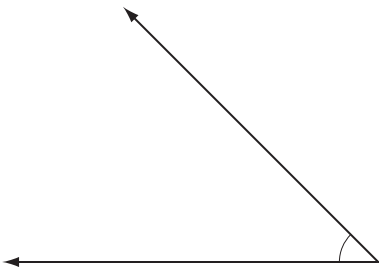
e) Without measuring, would you estimate that the size of this angle is closer to 95° or to 110° ?



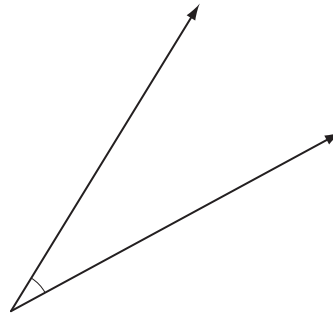
f) Without measuring, would you estimate that the size of this angle is closer to 135° or to 145° ?



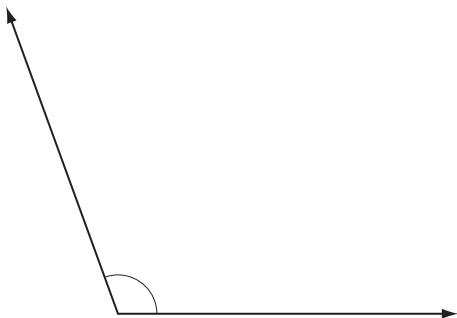
g) Without measuring, would you estimate that the size of this angle is closer to 45° or to 60° ?



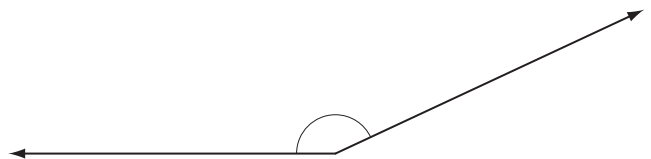
h) Without measuring, would you estimate that the size of this angle is closer to 30° or to 45° ?



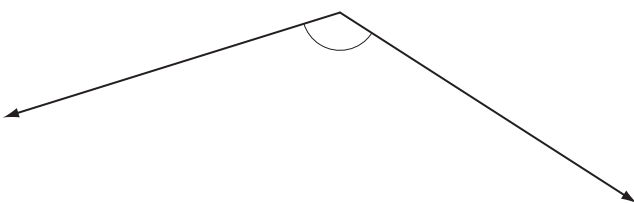
i) Without measuring, would you estimate that the size of this angle is closer to 95° or to 110° ?



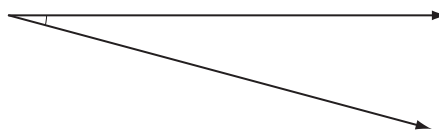
j) Without measuring, would you estimate that the size of this angle is closer to 155° or to 170° ?



k) Without measuring, would you estimate that the size of this angle is closer to 130° or to 150° ?



l) Without measuring, would you estimate that the size of this angle is closer to 5° or to 15° ?

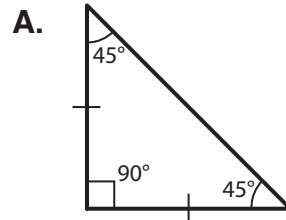


Skill 27.3 Drawing lines and polygons.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

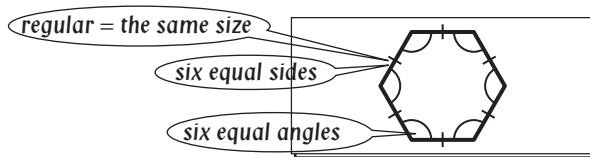
- Consider the definitions of triangles, squares, rectangles, rhombi, parallelograms, kites, trapeziums and regular polygons. (see Glossary)
- Mark:
 Right angles with a corner (\perp).
 Congruent angles with similar curved lines (\frown)
 (the second pair of congruent angles takes on a pair of curved lines).
 Congruent sides with a dash ($|$)
 (the second pair of congruent lines takes on a pair of dashes).
 Parallel lines with an arrow ($>$)
 (the second pair of parallel lines takes on a second pair of arrows).

Q. Draw an isosceles right-angled triangle marking the congruent sides and congruent angles.

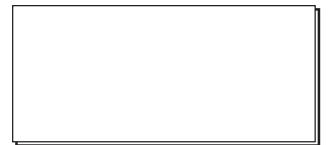


One corner marking the right angle (90°)
 One dash marking each of the congruent sides
 One curved line marking each of the congruent angles (45°)

a) Draw a regular hexagon marking the congruent sides and congruent angles.



b) Draw a rectangle marking all congruent sides and diagonals.



c) Draw a rhombus marking all congruent sides and perpendicular diagonals.



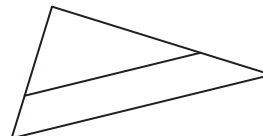
d) Draw an isosceles obtuse-angled triangle marking the congruent sides and congruent angles.



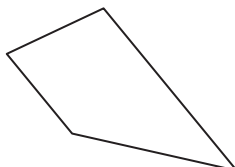
e) Draw a regular pentagon marking the congruent sides and congruent angles.



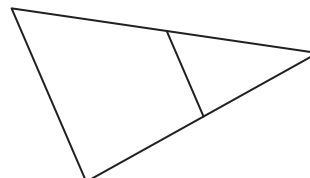
f) Use arrows to show the pair of parallel lines in this diagram.



g) Use arrows to show the pair of parallel lines in this diagram.



h) Use arrows to show the pair of parallel lines in this diagram.



Skill 27.4 Classifying angles.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

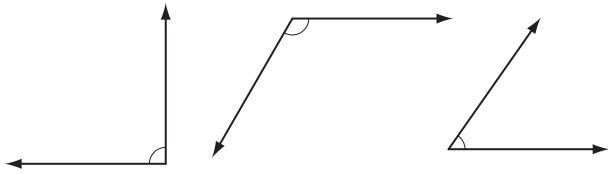
- Consider the definitions and properties of a variety of angles.

(see Glossary and Maths Facts, page 386)

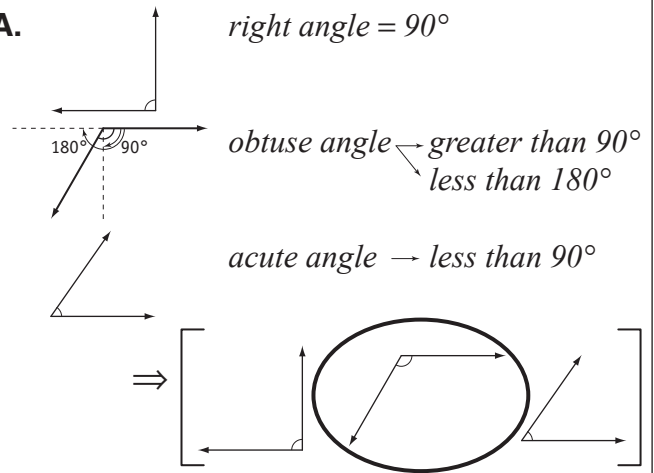
Hints: An angle can be classified according to its size (acute, right, obtuse, straight and reflex).

Two angles can be classified according to their position in relation to one another (adjacent, supplementary, complementary or vertically opposite).

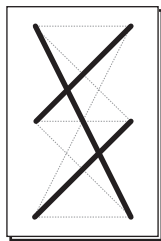
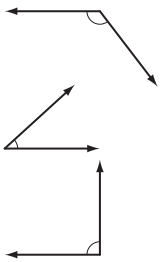
Q. Circle the obtuse angle.



A.



a) Match each angle to its description:

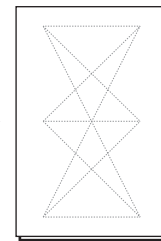
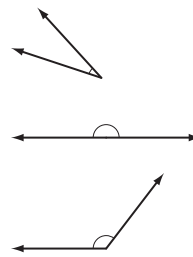


acute

right

obtuse

b) Match each angle to its description:

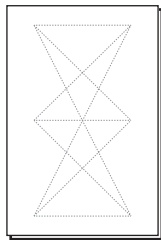
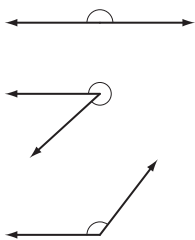


obtuse

acute

straight

c) Match each angle to its description:

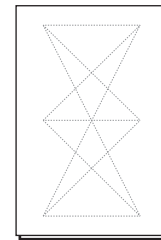
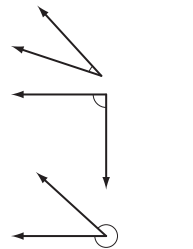


obtuse

reflex

straight

d) Match each angle to its description:

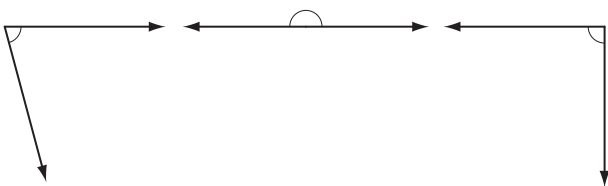


acute

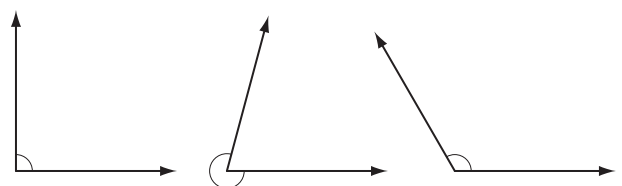
reflex

right

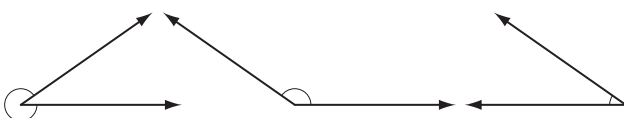
e) Circle the right angle.



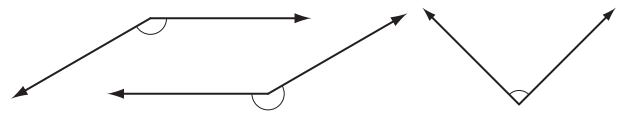
f) Circle the reflex angle.



g) Circle the acute angle.



h) Circle the obtuse angle.



Skill 27.5 Classifying and describing the properties of triangles.

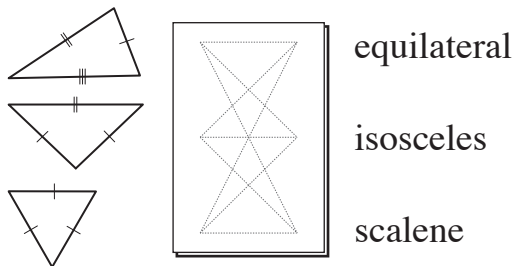
MM4.2 11 2233 44
MM5.1 11 2233 44

- Look for equal sides or equal angles.
- Look at the types of angles inside the triangle.

| Sides and angles | Triangle type |
|--------------------------|--------------------|
| no equal sides/angles | scalene |
| two equal sides/angles | isosceles |
| three equal sides/angles | equilateral |

| Angles | Triangle type |
|------------------|----------------------|
| all acute angles | acute-angled |
| one right angle | right-angled |
| one obtuse angle | obtuse-angled |

Q. Match each triangle to its description:



A.

no equal sides ⇒ **scalene**

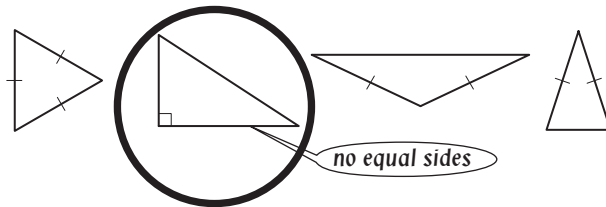
two equal sides ⇒ **isosceles**

three equal sides ⇒ **equilateral**

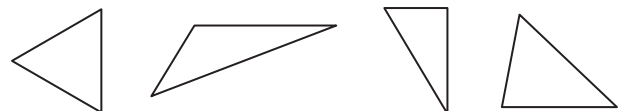
⇒

equilateral
isosceles
scalene

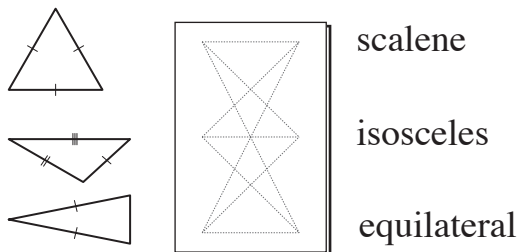
a) Circle the triangle that is **not** isosceles.



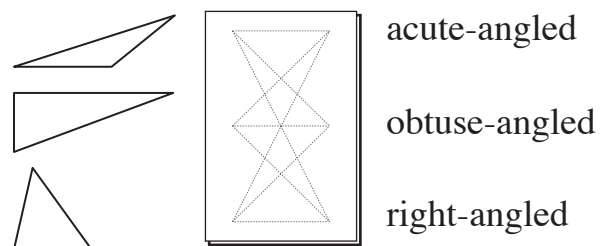
b) Circle the triangle that is obtuse-angled.



c) Match each triangle to its description:



d) Match each triangle to its description:



e) I am a 2-dimensional shape with three sides. I have two of my sides of equal length. What am I?

- A) a square
- B) a right-angled triangle
- C) an isosceles triangle
- D) an equilateral triangle



f) I am a 2-dimensional shape with three sides. I have an obtuse angle. What am I?

- A) an acute-angled triangle
- B) a right-angled triangle
- C) an equilateral triangle
- D) an obtuse-angled triangle



- Consider the properties of squares, rectangles, rhombi, parallelograms, kites and trapeziums. (see Glossary, page 360)

Q. I am a quadrilateral with no parallel sides. I have one pair of opposite angles equal, and my diagonals intersect at right angles. What am I?

- A) a rhombus
B) a trapezium
C) a kite
D) a square

- A.** A) a rhombus has opposite sides parallel $\Rightarrow A$ false
B) a trapezium has one pair of opposite sides parallel $\Rightarrow B$ false
C) a kite has a pair of opposite angles equal and diagonals intersecting at right angles $\Rightarrow C$ true
D) a square has opposite sides parallel $\Rightarrow D$ false

The answer is **C**.

a) I am a 2-dimensional shape with four sides. Both my pairs of opposite sides are parallel. All angles are equal to 90° . What am I?

- A) a trapezium
B) a rectangle
C) a rhombus
D) a parallelogram

b) I am a quadrilateral with all my sides equal in length. My diagonals intersect at right angles, but are not equal in length. What am I?

- A) a kite
B) a rectangle
C) a rhombus
D) a parallelogram

c) I am a 2-dimensional shape with four sides. My diagonals are equal, and all my sides are equal. What am I?

- A) a rhombus
B) a rectangle
C) a parallelogram
D) a square

d) I am a quadrilateral with all my angles equal to 90° . My diagonals are equal in length. What am I?

- A) a trapezium
B) a parallelogram
C) a rectangle
D) a rhombus

e) I am a 2-dimensional shape with four sides. My diagonals are not equal in length and bisect each other but not at right angles. What am I?

- A) a rhombus
B) a parallelogram
C) a kite
D) a trapezium

f) I am a 2-dimensional shape with four sides. Adjacent angles are not equal and I have two axes of symmetry. What am I?

- A) a rhombus
B) a rectangle
C) a parallelogram
D) a square

g) I am a quadrilateral with both pairs of opposite sides parallel and diagonals equal in length. What am I?

- A) a kite
B) a rectangle
C) a rhombus
D) a parallelogram

h) I am a quadrilateral with both pairs of opposite sides equal in length, but no axis of symmetry. What am I?

- A) a trapezium
B) a parallelogram
C) a rectangle
D) a rhombus

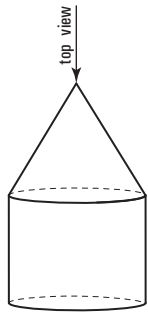
EITHER

- Imagine what you would see from the stated direction

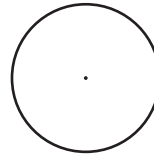
OR

- Make a model and observe the view.

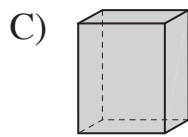
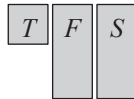
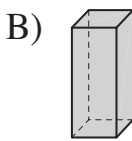
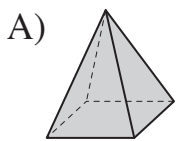
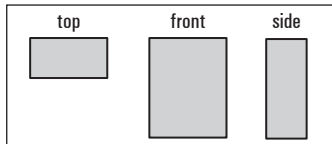
Q. Sketch the top view of this solid.



A.



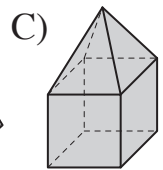
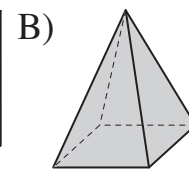
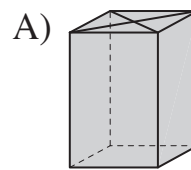
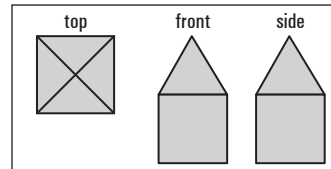
a) Which solid has the top, front and side views shown?



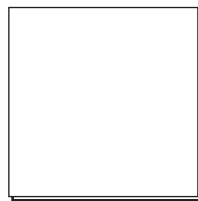
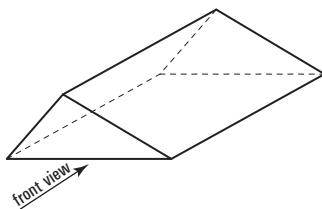
*T F S
as above*



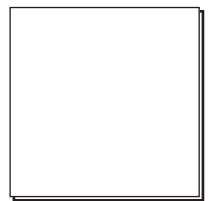
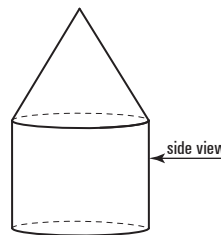
b) Which solid has the top, front and side views shown?



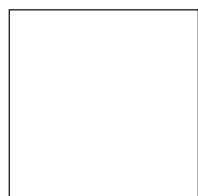
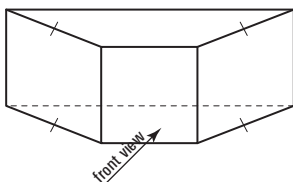
c) Sketch the front view of this solid.



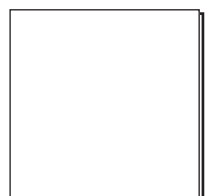
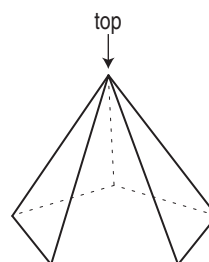
d) Sketch the side view of this solid.



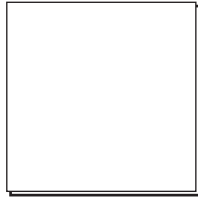
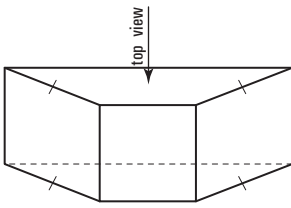
e) Sketch the front view of this solid.



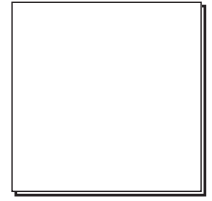
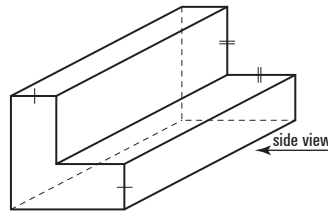
f) Sketch the top view of this solid.



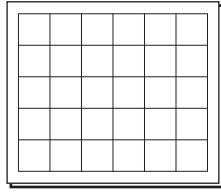
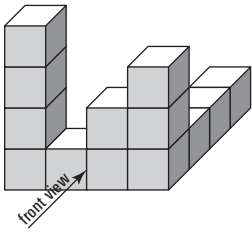
g) Sketch the top view of this solid.



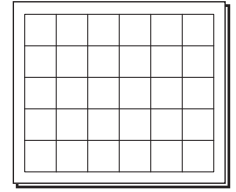
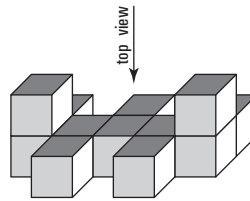
h) Sketch the side view of this solid.



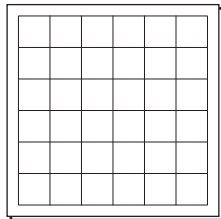
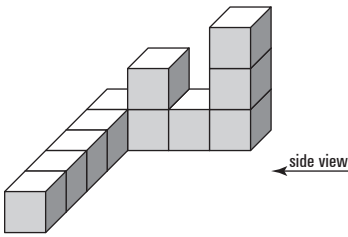
i) Draw the front view of this solid.



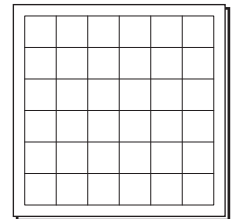
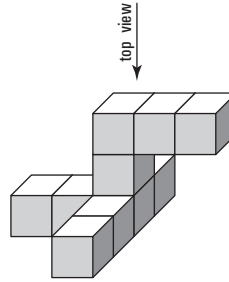
j) Draw the top view of this solid.



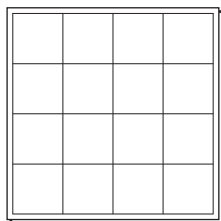
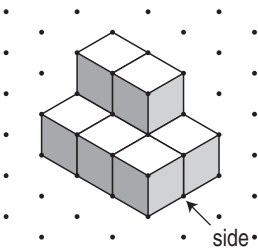
k) Draw the side view of this solid.



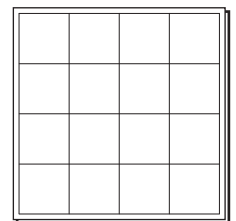
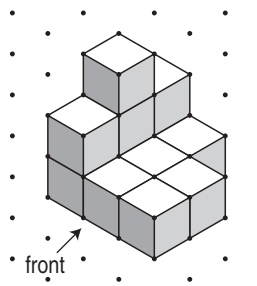
l) Draw the top view of this solid.



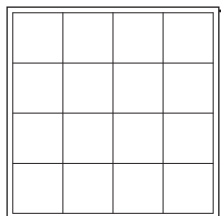
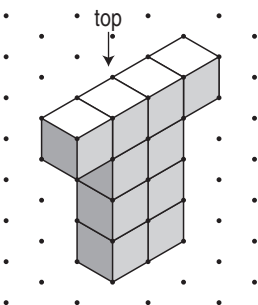
m) Draw the side view of this solid.



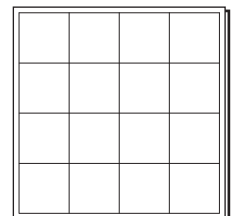
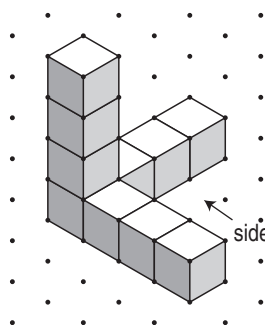
n) Draw the front view of this solid.



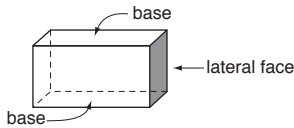
o) Draw the top view of this solid.



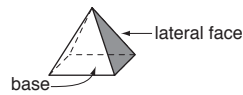
p) Draw the side view of this solid.



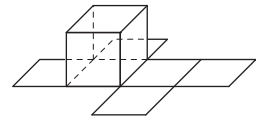
Prism



Pyramid



Cube



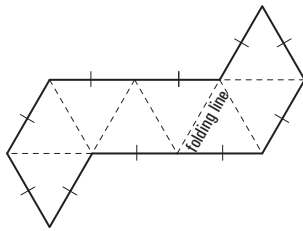
EITHER

- Identify the shapes in the net.
- Imagine the shape folded.

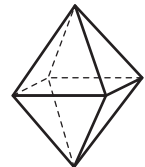
OR

- Make a model by tracing, cutting out and folding the net.

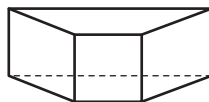
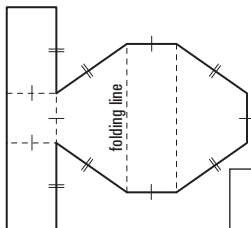
Q. What 3-dimensional shape can this net be used to make?



A. *regular octahedron*

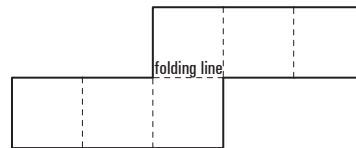


a) What 3-dimensional shape can this net be used to make?

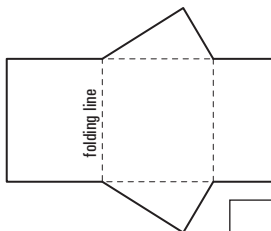


trapezoidal prism

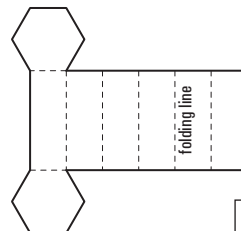
b) What 3-dimensional shape can this net be used to make?



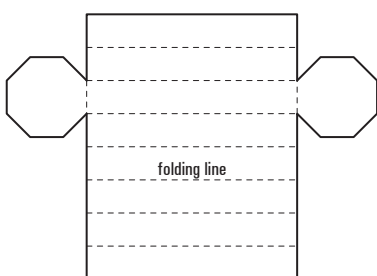
c) What 3-dimensional shape can this net be used to make?



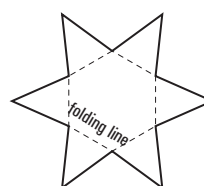
d) What 3-dimensional shape can this net be used to make?



e) What 3-dimensional shape can this net be used to make?

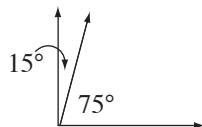


f) What 3-dimensional shape can this net be used to make?



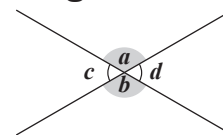
Complementary angles - add to 90°

$$15^\circ + 75^\circ = 90^\circ$$



Vertically opposite angles - are equal

$$\angle a = \angle b, \angle c = \angle d$$



To find the size of an angle when its complementary angle/angles are given

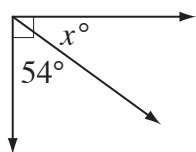
EITHER

- Subtract the given angles from 90° .

OR

- Write an equation involving the unknown angle x° .
- Solve the equation for x° .

Q. Find the value of x° .



A. x° and 54° are complementary: OR

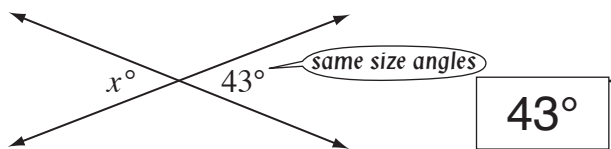
$$x^\circ = 90^\circ - 54^\circ = 36^\circ$$

$$x^\circ + 54^\circ = 90^\circ$$

$$x^\circ + 54^\circ - 54^\circ = 90^\circ - 54^\circ$$

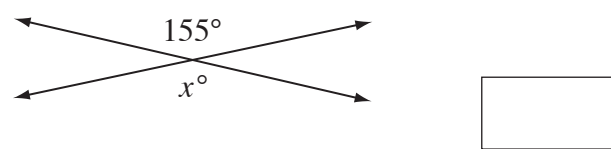
$$x^\circ = 36^\circ$$

a) Find the value of x° .

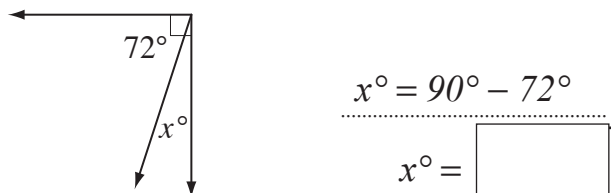


43°

b) Find the value of x° .



c) Find the value of x° .



$$x^\circ = 90^\circ - 72^\circ$$

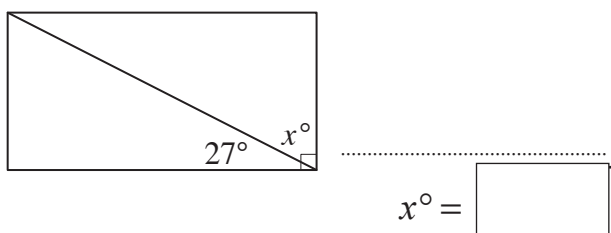
$x^\circ =$

d) Find the value of x° .



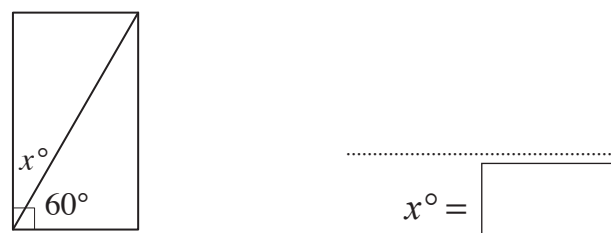
$x^\circ =$

e) Find the value of x° .



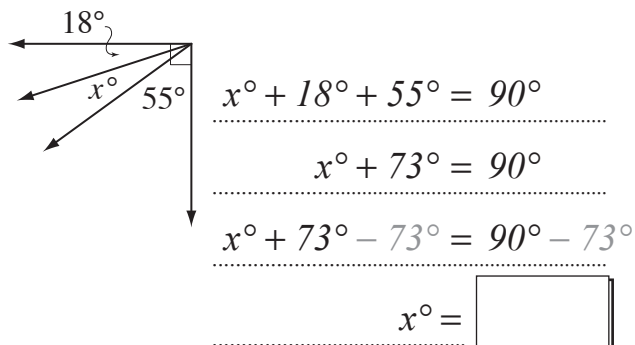
$x^\circ =$

f) Find the value of x° .



$x^\circ =$

g) Find the value of x° .



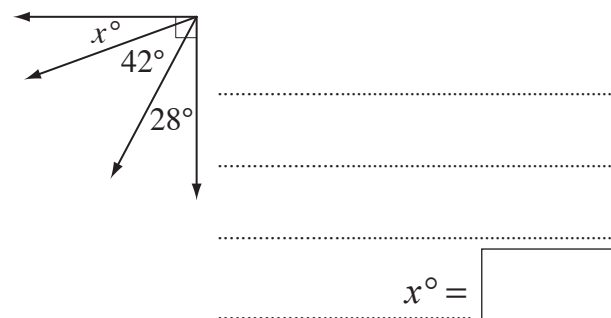
$$x^\circ + 18^\circ + 55^\circ = 90^\circ$$

$$x^\circ + 73^\circ = 90^\circ$$

$$x^\circ + 73^\circ - 73^\circ = 90^\circ - 73^\circ$$

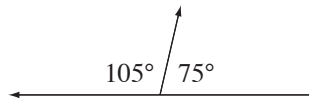
$x^\circ =$

h) Find the value of x° .



$x^\circ =$

Supplementary angles - add to 180°



$$105^\circ + 75^\circ = 180^\circ$$

To find the size of an angle when its supplementary angle/angles are given

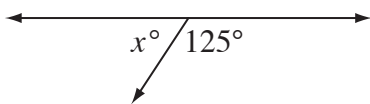
EITHER

- Subtract the given angles from 180° .

OR

- Write an equation involving the unknown angle x° .
- Solve the equation for x° .

Q. Find the value of x° .



A. x° and 125° are supplementary:

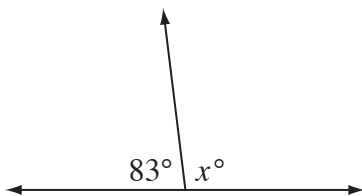
$$x^\circ = 180^\circ - 125^\circ = 55^\circ$$

OR $x^\circ + 125^\circ = 180^\circ$

$$x^\circ + 125^\circ - 125^\circ = 180^\circ - 125^\circ$$

$$x^\circ = 55^\circ$$

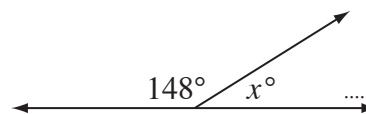
a) Find the value of x° .



$$x^\circ = 180^\circ - 83^\circ$$

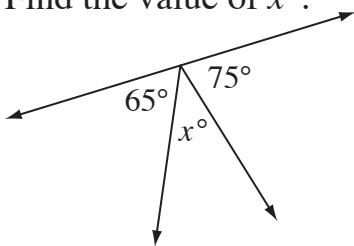
$$x^\circ = \boxed{97^\circ}$$

b) Find the value of x° .



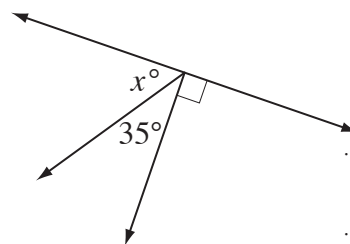
$$x^\circ = \boxed{}$$

c) Find the value of x° .



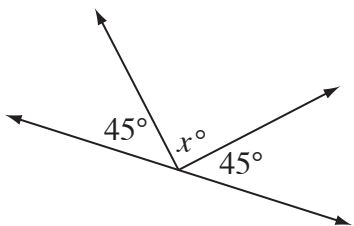
$$x^\circ = \boxed{}$$

d) Find the value of x° .



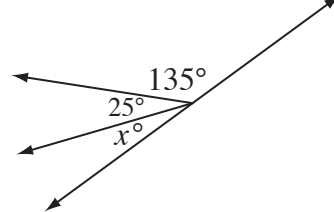
$$x^\circ = \boxed{}$$

e) Find the value of x° .



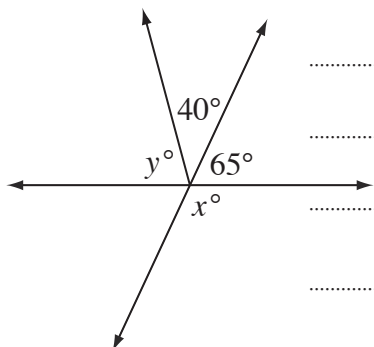
$$x^\circ = \boxed{}$$

f) Find the value of x° .



$$x^\circ = \boxed{}$$

g) Find the values of x° and y° .

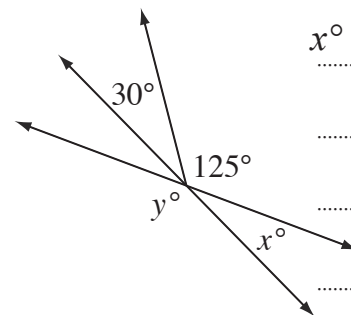


$$x^\circ + 65^\circ = 180^\circ$$

$$x^\circ = \boxed{}$$

$$y^\circ = \boxed{}$$

h) Find the values of x° and y° .



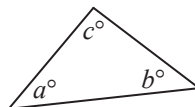
$$x^\circ + 30^\circ + 125^\circ = 180^\circ$$

$$x^\circ = \boxed{}$$

$$y^\circ = \boxed{}$$

Sum of interior angles in a triangle = 180°

$$a^\circ + b^\circ + c^\circ = 180^\circ$$



To find the size of an angle of a triangle when the other two angles are given

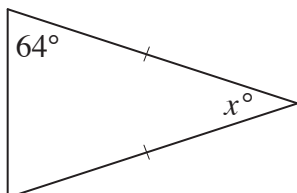
EITHER

- Subtract the sum of the given angles from 180° .

OR

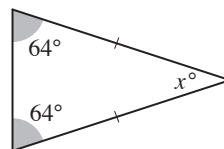
- Write an equation involving the unknown angle x° .
- Solve the equation for x° .

Q. Find the value of x° .



A. *Isosceles triangle* \Rightarrow base angles are equal:

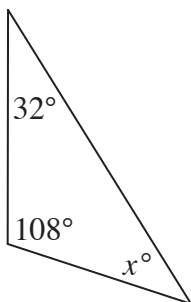
$$\begin{aligned} x^\circ &= 180^\circ - (64^\circ + 64^\circ) \\ &= 180^\circ - 128^\circ \\ &= 52^\circ \end{aligned}$$



OR

$$\begin{aligned} x^\circ + 64^\circ + 64^\circ &= 180^\circ \\ x^\circ + 128^\circ - 128^\circ &= 180^\circ - 128^\circ \\ x^\circ &= 52^\circ \end{aligned}$$

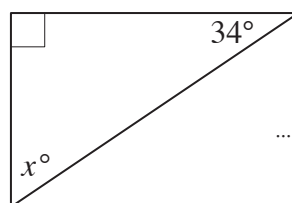
a) Find the value of x° .



$$\begin{aligned} x^\circ &= 180^\circ - (32^\circ + 108^\circ) \\ &= 180^\circ - 140^\circ \end{aligned}$$

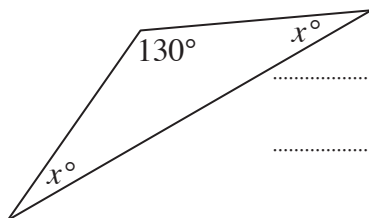
$$x^\circ = \boxed{40^\circ}$$

b) Find the value of x° .



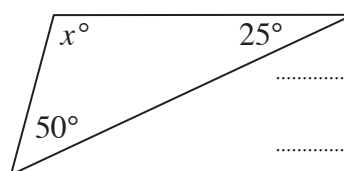
$$x^\circ = \boxed{}$$

c) Find the value of x° .



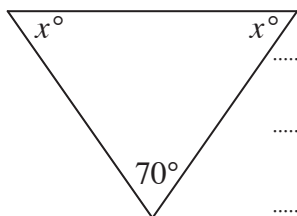
$$x^\circ = \boxed{}$$

d) Find the value of x° .



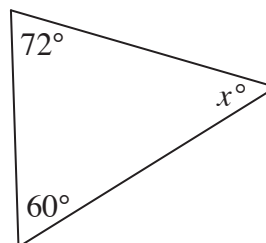
$$x^\circ = \boxed{}$$

e) Find the value of x° .



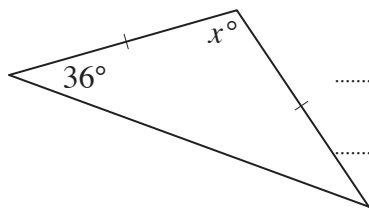
$$x^\circ = \boxed{}$$

f) Find the value of x° .



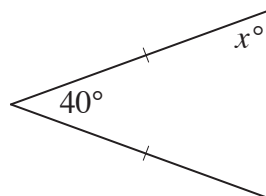
$$x^\circ = \boxed{}$$

g) Find the value of x° .



$$x^\circ = \boxed{}$$

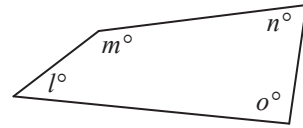
h) Find the value of x° .



$$x^\circ = \boxed{}$$

Sum of interior angles in a quadrilateral = 360°

$$l^\circ + m^\circ + n^\circ + o^\circ = 360^\circ$$



To find the size of an angle of a quadrilateral when the other two angles are given

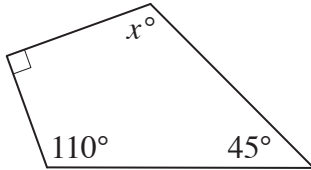
EITHER

- Subtract the sum of the given angles from 360° .

OR

- Write an equation involving the unknown angle x° .
- Solve the equation for x° .

Q. Find the value of x° .



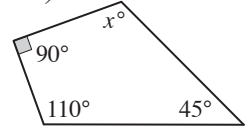
A. $x^\circ = 360^\circ - (90^\circ + 110^\circ + 45^\circ)$
 $= 360^\circ - 245^\circ$
 $= 115^\circ$

OR

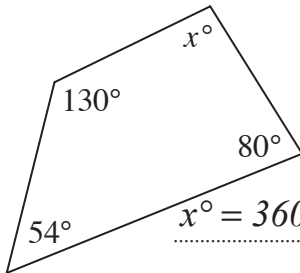
$$x^\circ + 90^\circ + 110^\circ + 45^\circ = 360^\circ$$

$$x^\circ + 245^\circ - 245^\circ = 360^\circ - 245^\circ$$

$$x^\circ = 115^\circ$$



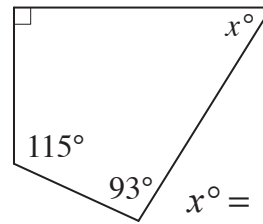
a) Find the value of x° .



$$x^\circ = 360^\circ - (130^\circ + 54^\circ + 80^\circ)$$

$$= 360^\circ - 264^\circ = \boxed{96^\circ}$$

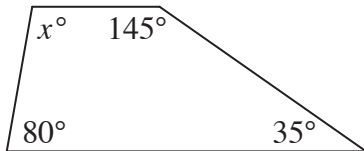
b) Find the value of x° .



$$x^\circ =$$

$$= \boxed{}$$

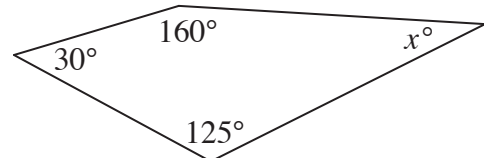
c) Find the value of x° .



$$x^\circ =$$

$$= \boxed{}$$

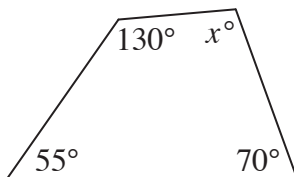
d) Find the value of x° .



$$x^\circ =$$

$$= \boxed{}$$

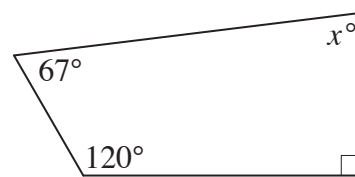
e) Find the value of x° .



$$x^\circ =$$

$$= \boxed{}$$

f) Find the value of x° .



$$x^\circ =$$

$$= \boxed{}$$

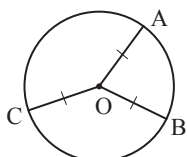
Skill 27.13 Describing the properties of circles.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Consider the definitions and properties of radius (plural radii), chord, diameter, tangent and circumference of a circle. (see Glossary, and Math Facts, page 386)

Radius

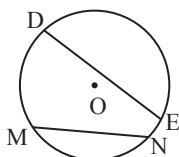
joins the centre with any point on the circle



$$OA = OB = OC$$

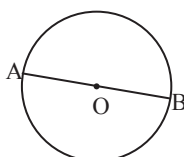
Chord

joins any two points on the circle



Diameter

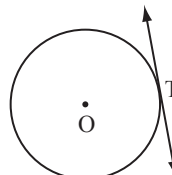
a chord passing through the centre



$$AB = 2OA$$

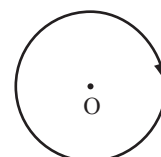
Tangent

a line touching the circle in one point



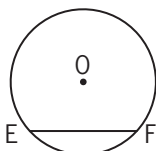
Circumference

the distance around the circle



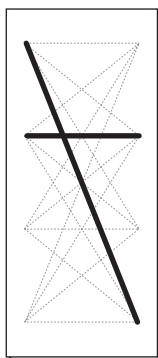
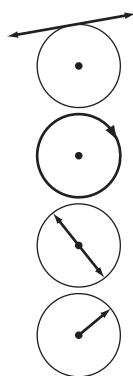
Q. What is \overline{EF} in this diagram?

- A) diameter
- B) tangent
- C) chord
- D) radius



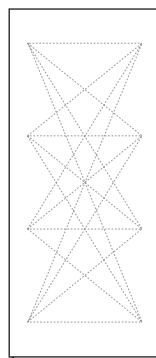
A. \overline{EF} joins two points on the circle and does not pass through the centre \Rightarrow **chord**

a) Match each diagram to its description:



- diameter
- circumference
- radius
- tangent

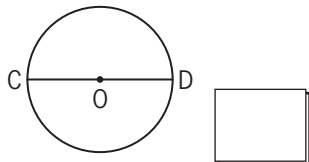
b) Match each diagram to its description:



- circumference
- radius
- diameter
- area

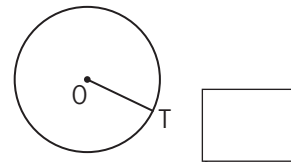
c) What is \overline{CD} in this diagram?

- A) tangent
- B) diameter
- C) radius
- D) circumference

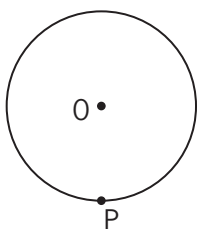


d) What is \overline{OT} in this diagram?

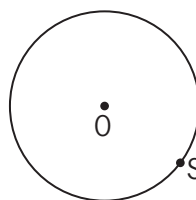
- A) chord
- B) tangent
- C) diameter
- D) radius



e) Draw the diameter passing through P.



f) Draw the radius passing through S.



28. [Location / Transformation]

Skill 28.1 Following directions and using compass bearings to describe location on a map.

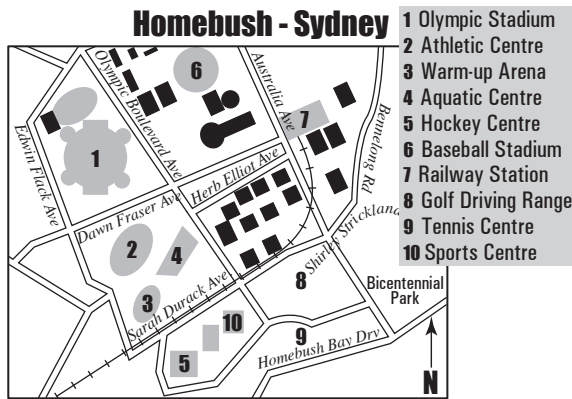
MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Follow the directions one at a time.

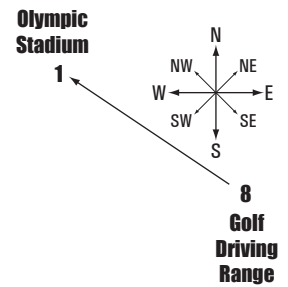
Hints: A compass showing North will allow you to find your bearings.

Clockwise from North, "Never Eat Sea Weed" is one way to remember the 4 point compass.

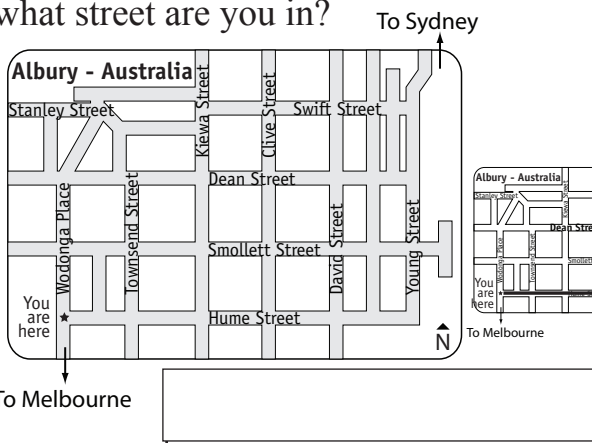
Q. At Homebush, in which direction is the Olympic Stadium from the Golf Driving Range?



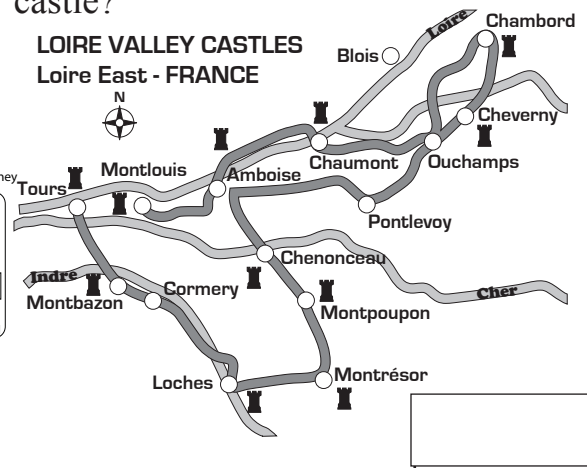
A. *NW* Focus on the relevant information.



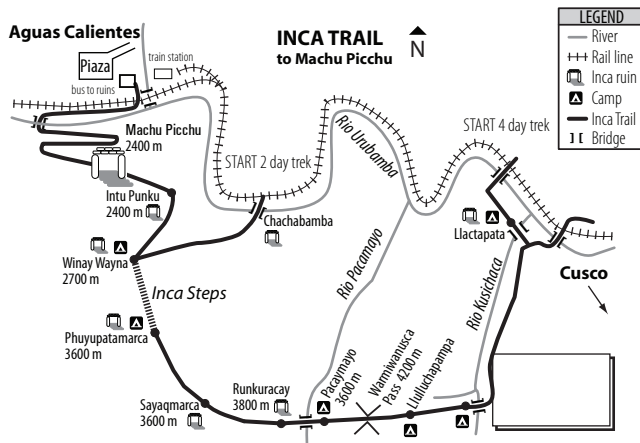
a) From where you are, travel east until you reach David Street. Then walk north. If you take the second turn left, what street are you in?



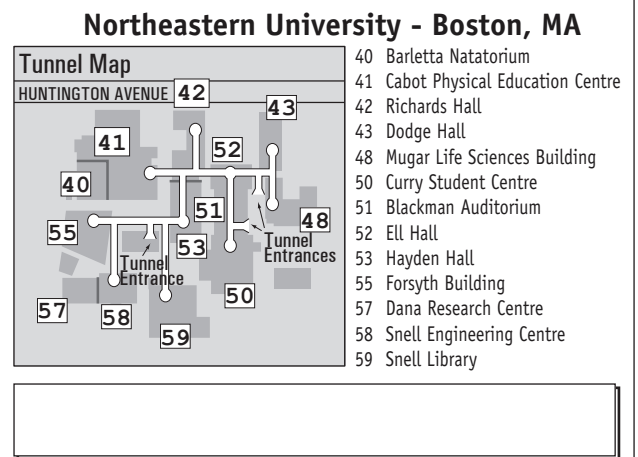
b) From Montrésor castle, which direction do you have to drive to reach Loches castle?



c) From the northern most bridge over Rio Kusichaca you travel south-east on the Inca Trail until the T intersection. Then you turn right and follow the Inca Trail to the Inca Steps. How many more bridges do you cross?



d) Using the closest tunnel entrance to building 58, take the first turn right, then turn left. Turn right and walk to the end of the tunnel. If you turn left again, which building are you facing?



Skill 28.2 Identifying and classifying symmetry in two-dimensional shapes MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Imagine a line along which the shape can be folded to have one part fit exactly over the other part.

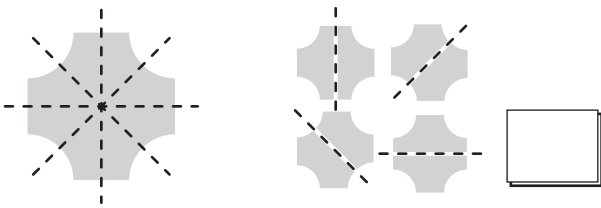
Q. Draw the axes of symmetry for these shapes. Circle the shapes that are both horizontally and vertically symmetrical.



A.

| | | | |
|-------------------------------|---------|----------|-------------------------------|
| | | | |
| vertical & horizontal ✓ | oblique | vertical | vertical & horizontal ✓ |

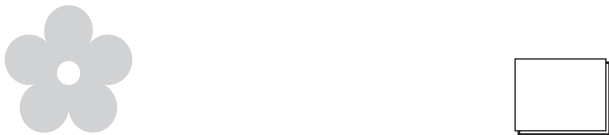
a) Draw all the axes of symmetry for this shape. How many axes of symmetry does this shape have?



b) Draw all the axes of symmetry for this shape. How many axes of symmetry does this shape have?



c) Draw all the axes of symmetry for this shape. How many axes of symmetry does this shape have?



d) Draw all the axes of symmetry for this shape. How many axes of symmetry does this shape have?



e) Draw the axes of symmetry for these shapes. Circle the shapes that have horizontal symmetry.



f) Draw the axes of symmetry for these shapes. Circle the shapes that are both horizontally and vertically symmetrical.



g) Draw the axes of symmetry for these shapes. Circle the shapes that have vertical symmetry.



h) Draw the axes of symmetry for these shapes. Circle the shapes that are both horizontally and vertically symmetrical.



Skill 28.3 Using a scale to calculate distance on a map.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Place a piece of paper against the scale matching the starting points.
- Slide the paper across the length of the scale marking the start and end points as you go.
- Add together the scale lengths covered.

Q. You walk from the Inspiration Point to Grand View, along the marked path. What distance did you travel in kilometres?

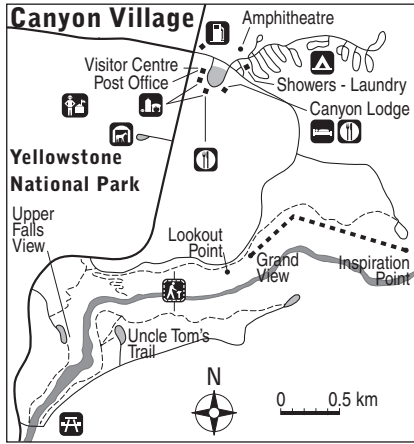
A. $0.5 + 0.5 + 0.5$
 $= 1.5 \text{ km}$

There are 2 distances to be measured.

Mark the start of the first distance and the turning point on paper. Rotate the paper to match the second distance and then mark the end.

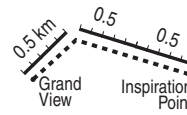
Check the paper against the scale.

Slide the paper along the scale as necessary.

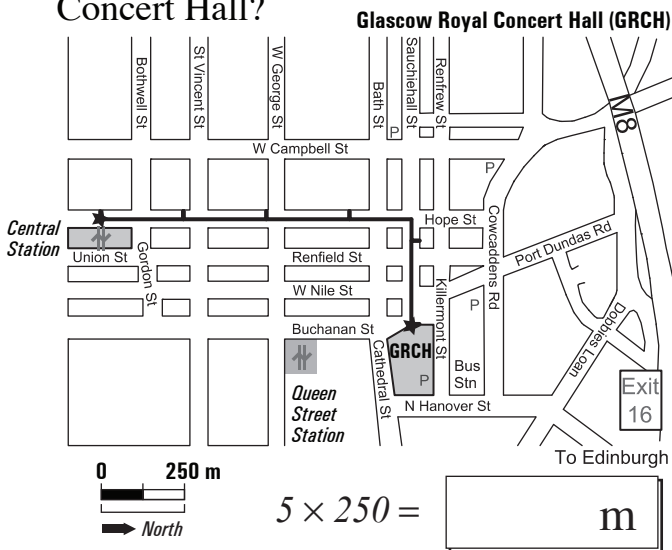


Services & Facilities

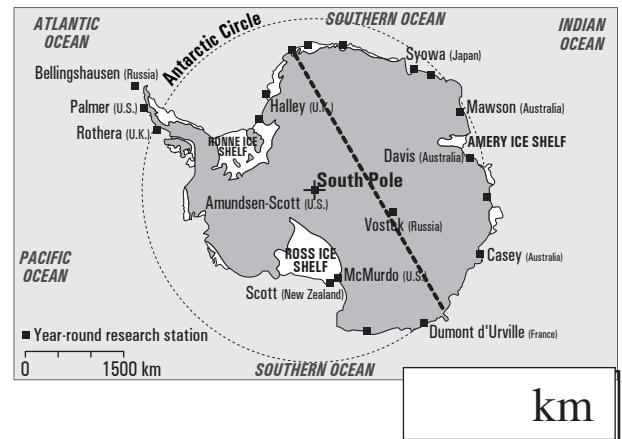
- Ranger station
- Campground
- Lodging
- Food service
- Picnic area
- Store
- Gas station
- Self-guiding trail
- Horse rental



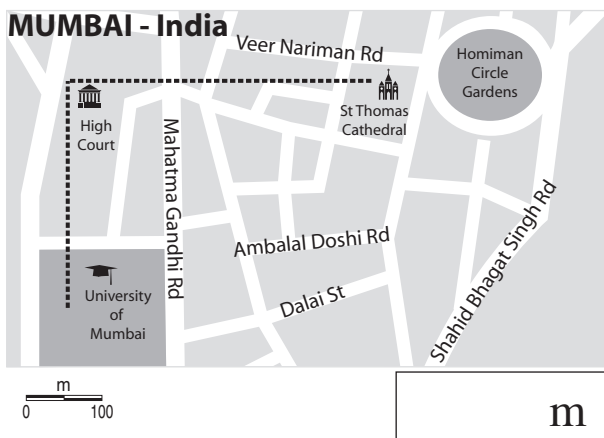
a) How far is it from Central Station, along Hope St. to the Glasgow Royal Concert Hall?



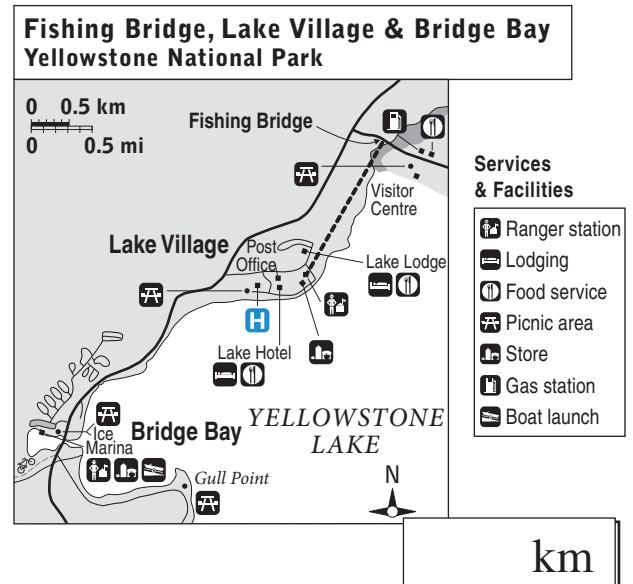
b) Using the scale, what is the marked distance on this map of Antarctica?



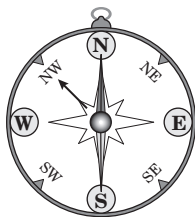
c) Using the scale, what is the marked distance from the University via the High Court to the Homiman Circle Gardens?



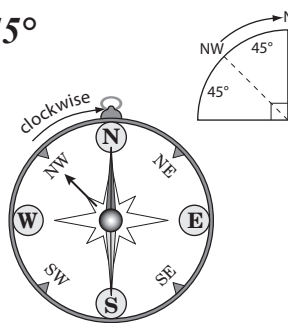
d) Using the scale, what is the marked distance from the ranger station closest to Lake Hotel to Fishing Bridge?



Q. According to the compass, you are facing north-west. How many degrees clockwise must you turn to face north?



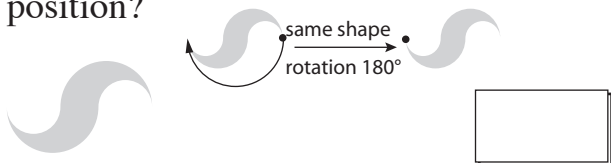
A. 45°



Find the North direction.

Calculate the number of degrees by picturing a circle.

a) By how many degrees must this shape be rotated to first match the original position?



b) By how many degrees must this shape be rotated to first match the original position?



c) By how many degrees must this shape be rotated to first match the original position?



d) By how many degrees must this shape be rotated to first match the original position?



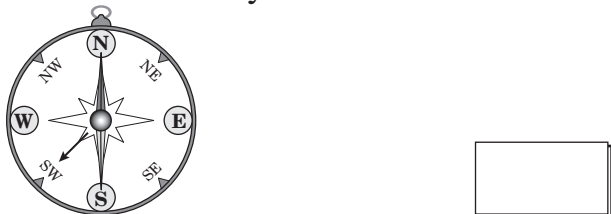
e) By how many degrees must the big hand of this clock rotate to show exactly 11:05?



f) By how many degrees must the big hand of this clock rotate to show exactly 2:00?



g) This compass shows that you are facing south-west. How many degrees clockwise must you turn to face north?



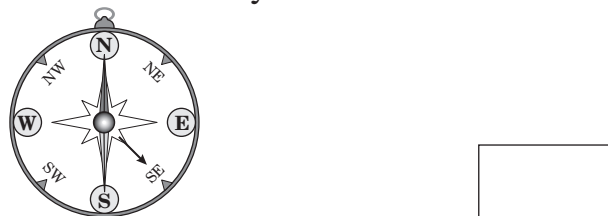
h) This compass shows that you are facing south. How many degrees anticlockwise must you turn to face north-west?



i) How many degrees must the big hand of this clock turn to show exactly 9:45?



j) According to the compass, you are facing south-east. How many degrees clockwise must you turn to face west?



Translation (slide)

- Move the shape up (positive, vertically), down (negative, vertically), left (negative, horizontally) or right (positive, horizontally) on the grid, without flipping, turning or changing its size.

Reflection (like in a mirror)

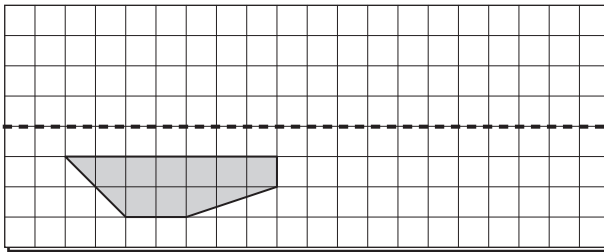
- Draw a perpendicular line to the mirror line from each vertex of the shape.
- Extend the perpendicular line beyond the mirror line by the same distance.
- Plot and join the reflected points.

Rotation (turning about a point or centre of rotation)

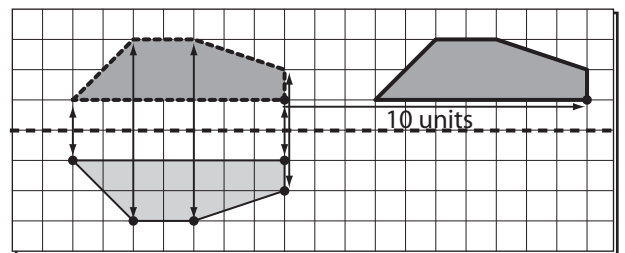
- Rotate each vertex by the given angle, in the given direction.
- Plot and join the rotated points.

Hint: The resulting shapes are always congruent to the original shapes (same size and shape).

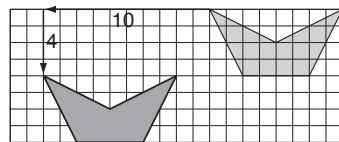
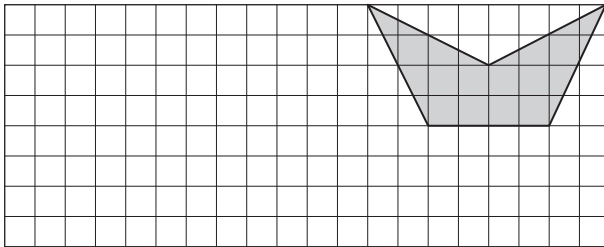
Q. Redraw this shape after reflecting it in the horizontal dotted line and then translating it 10 units to the right.



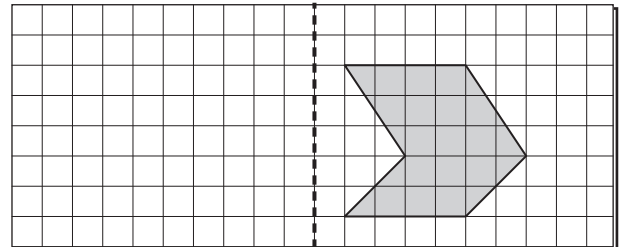
A.



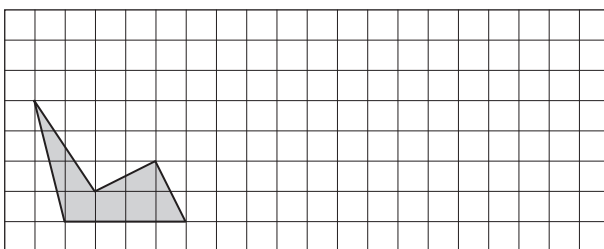
a) Redraw this shape after translating it 10 units to the right and 4 units down.



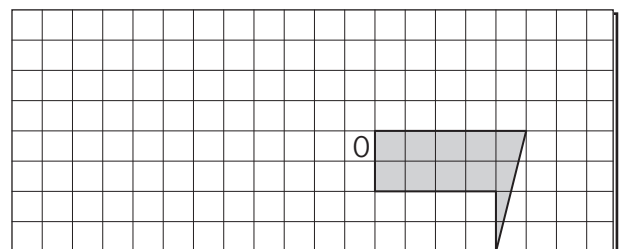
b) Redraw this shape after reflecting it in the vertical dotted line.



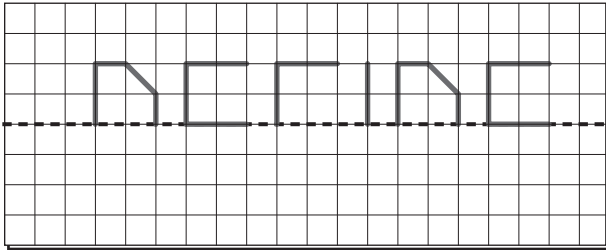
c) Redraw this shape after translating it 3 units up and 4 units to the right.



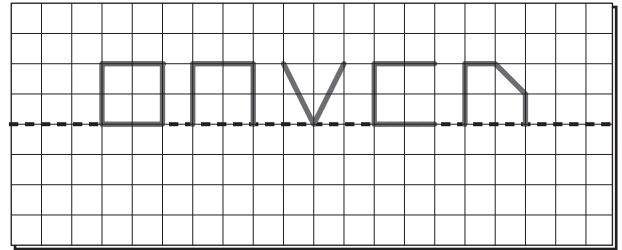
d) Redraw this shape after rotating it 180° about the point O.



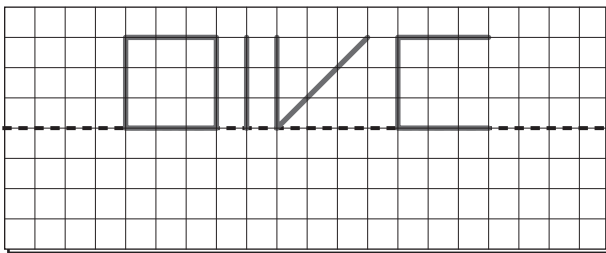
- e) Redraw this diagram after reflecting it in the horizontal dotted line.



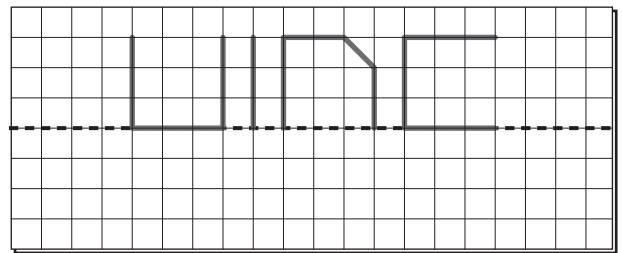
- f) Redraw this diagram after reflecting it in the horizontal dotted line.



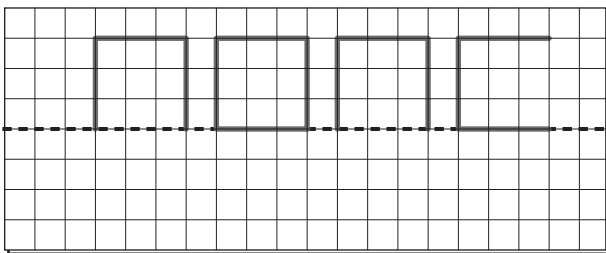
- g) Redraw this diagram after reflecting it in the horizontal dotted line.



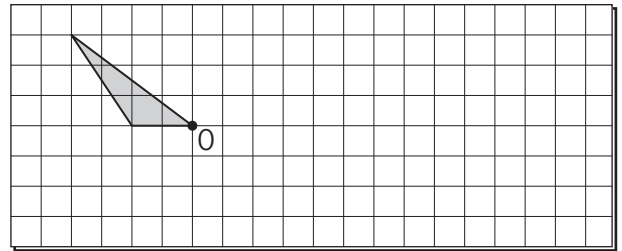
- h) Redraw this diagram after reflecting it in the horizontal dotted line.



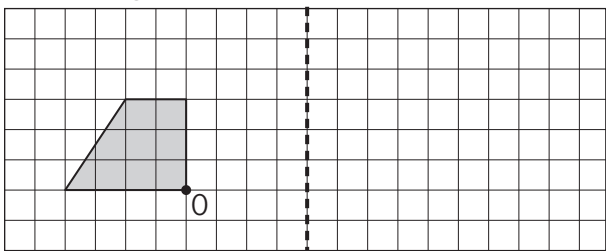
- i) Redraw this diagram after reflecting it in the horizontal dotted line.



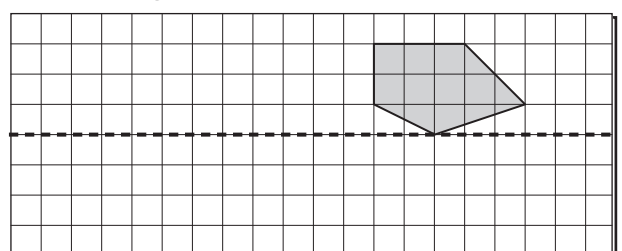
- j) Redraw this shape after rotating it 180° about point O and then translating it 2 units up.



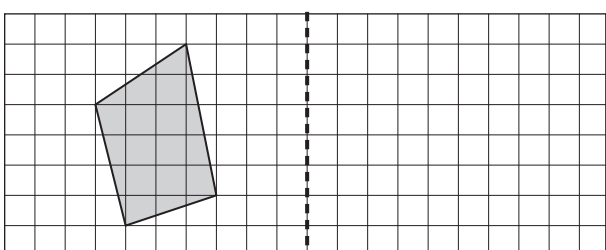
- k) Redraw this shape after rotating it 90° clockwise about point O and then reflecting it in the vertical dotted line.



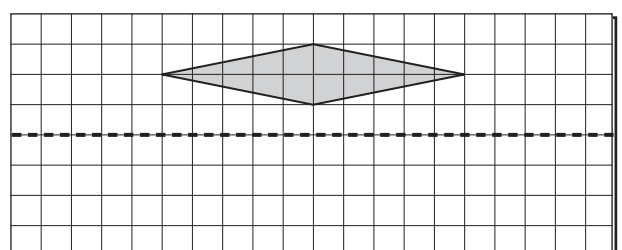
- l) Redraw this shape after reflecting it in the horizontal dotted line and then translating it 9 units to the left.



- m) Redraw this quadrilateral after reflecting it in the vertical dotted line and then translating it 2 units to the right.



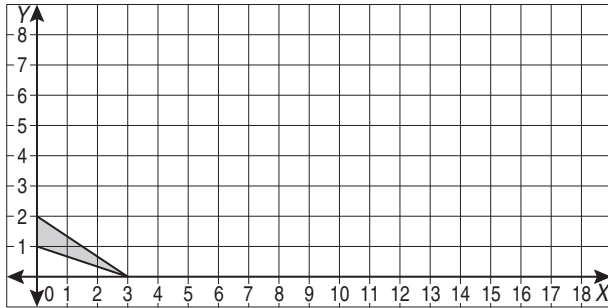
- n) Redraw this rhombus after reflecting it in the horizontal dotted line and then translating it 2 units to the left.



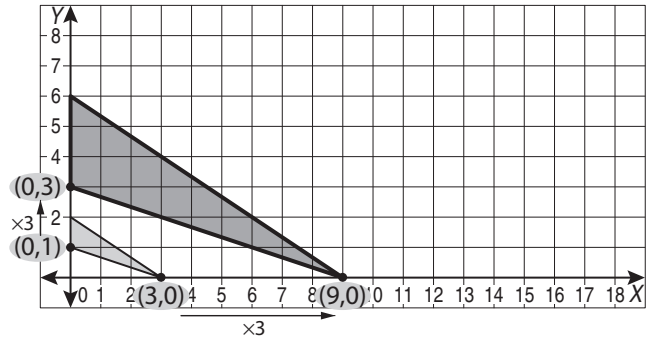
- Multiply or divide the x- and y-coordinates of the vertices of the given shape.
- Plot the new points.
- Join these points to form a new shape.

Hint: The resulting shape is always similar to the original shape (same shape, but different size).

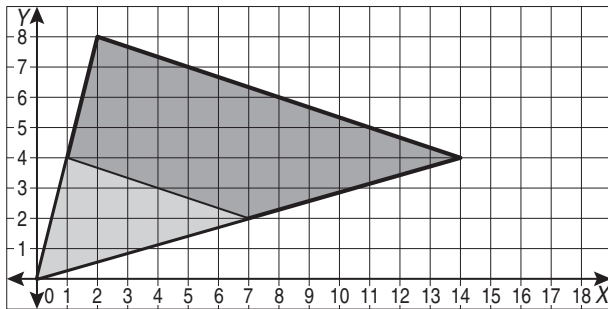
Q. Redraw the shape after multiplying the coordinates of its vertices by 3.



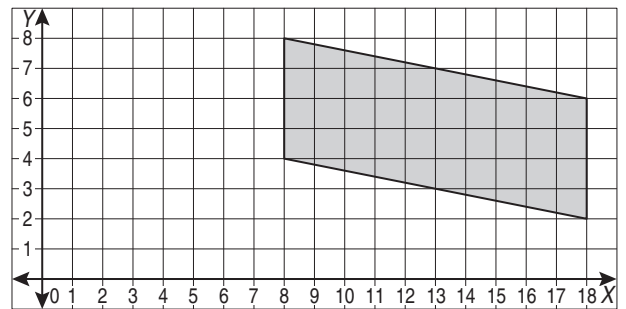
A.



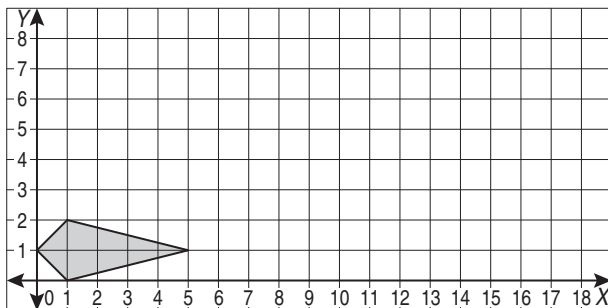
a) Redraw the triangle after doubling the coordinates of its vertices.



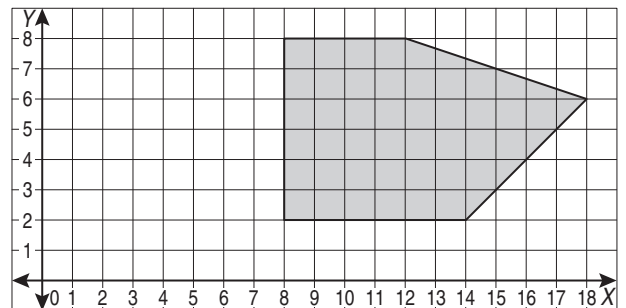
b) Redraw the parallelogram after halving the coordinates of its vertices.



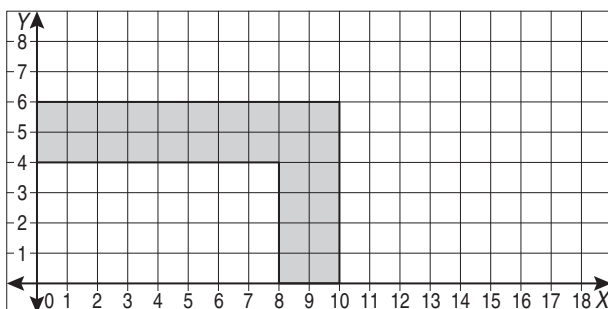
c) Redraw the kite after multiplying the coordinates of its vertices by 3.



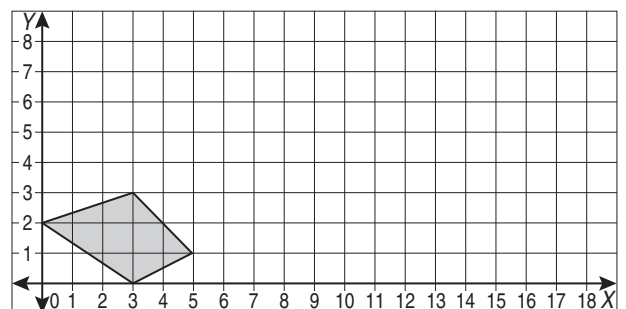
d) Redraw the shape after halving the coordinates of its vertices.



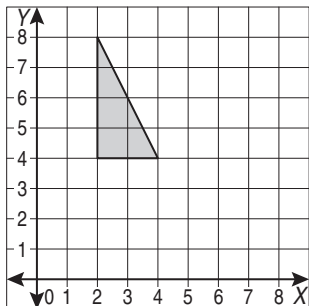
e) Redraw the shape after halving the coordinates of its vertices.



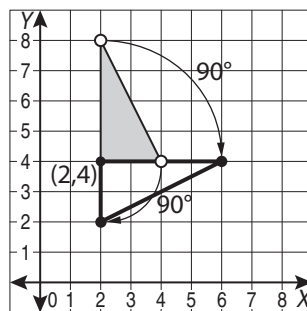
f) Redraw the shape after doubling the coordinates of its vertices.



Q. Redraw this triangle after rotating it 90° clockwise about the point of coordinates (2,4).



A.



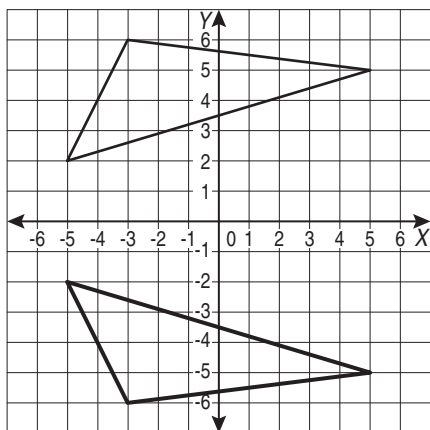
Move each vertex of the triangle by 90° clockwise.

Plot the new points.

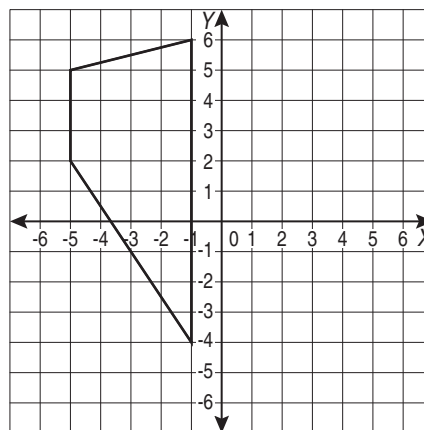
The point of coordinates (2,4) does not move.

Join the new points.

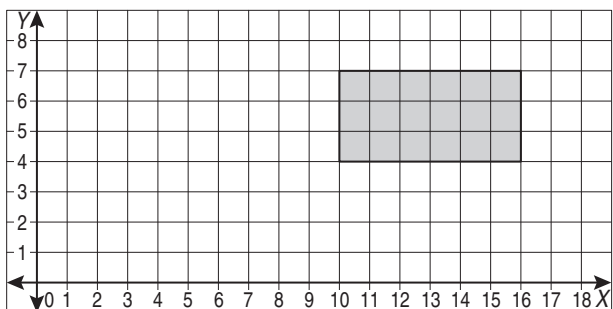
a) Redraw this triangle after reflecting it in the x -axis.



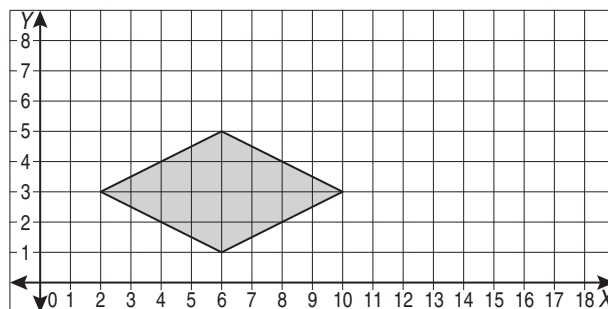
b) Redraw this trapezium after reflecting it in the y -axis.



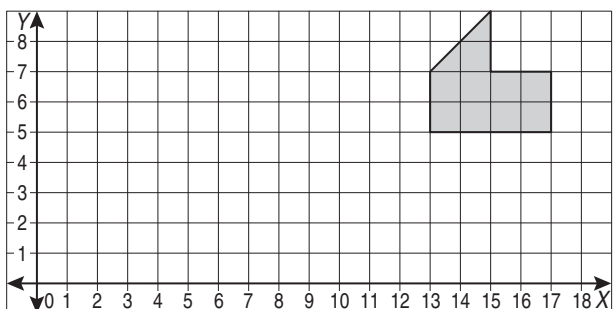
c) Redraw this rectangle after subtracting 4 units from the coordinates of its vertices.



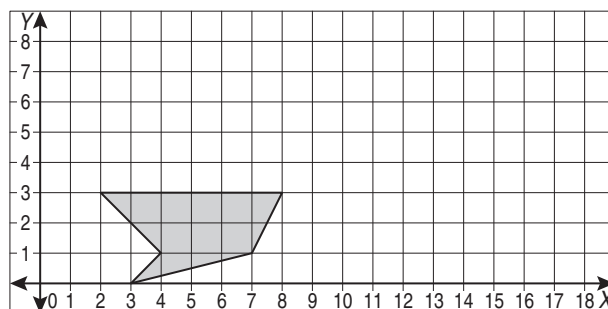
d) Redraw this rhombus after adding 3 units to the coordinates of its vertices.



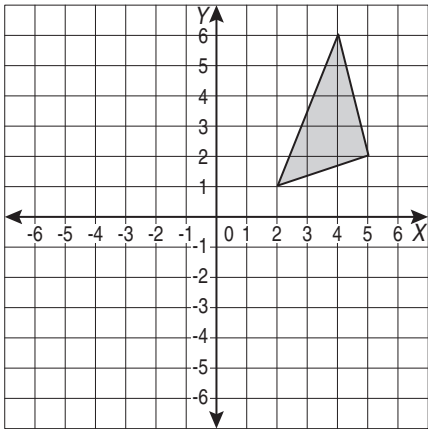
e) Redraw this shape after subtracting 5 units from the coordinates of its vertices.



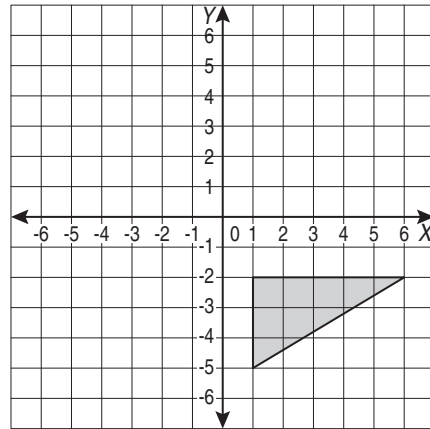
f) Redraw this shape after adding 5 units to the coordinates of its vertices.



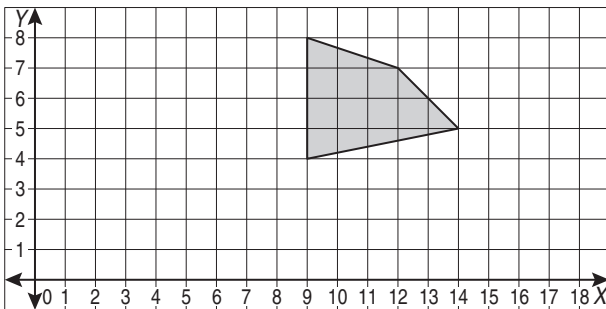
- g)** Redraw this triangle after subtracting 5 units from the x -coordinates and 6 units from the y -coordinates of its vertices.



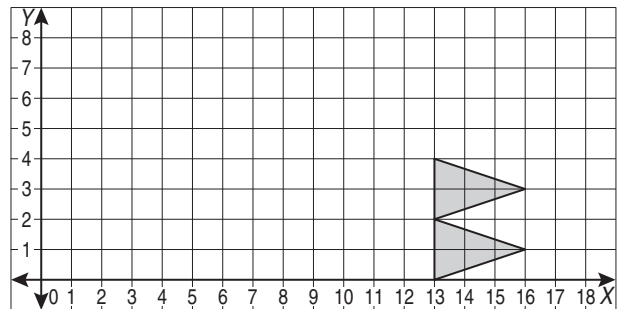
- h)** Redraw this triangle after adding 4 units to the x -coordinates and 7 units to the y -coordinates of its vertices.



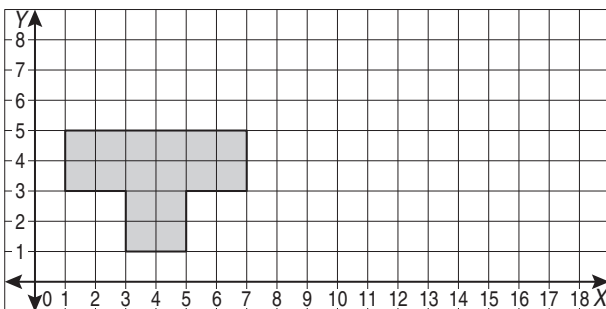
- i)** Redraw this shape after rotating it 180° about the point of coordinates (9,4).



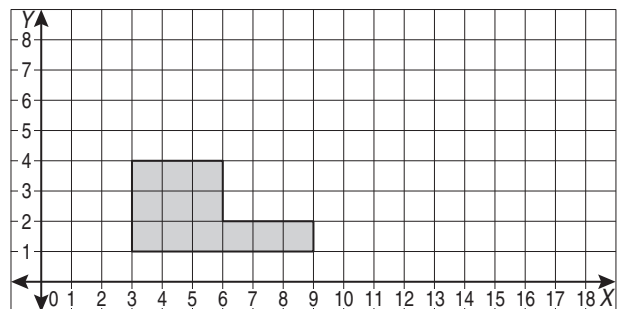
- j)** Redraw this shape after rotating it 180° about the point of coordinates (13,4).



- k)** Redraw this shape after rotating it 180° about the point of coordinates (7,5).



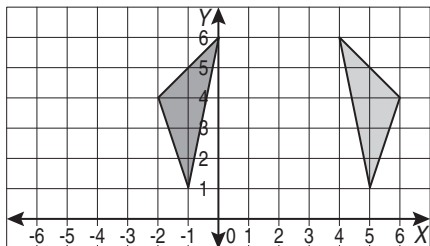
- l)** Redraw this shape after rotating it 90° clockwise about the point of coordinates (9,1).



- The transformation is a **translation** if the two shapes have the same size and orientation.
- The transformation is a **reflection** if the two shapes have the same size and are symmetrical about a vertical or horizontal line.
- The transformation is a **rotation** if the two shapes have the same size, different orientation and are **not** symmetrical about a vertical or horizontal line.

Q. Which transformation has moved the triangle?

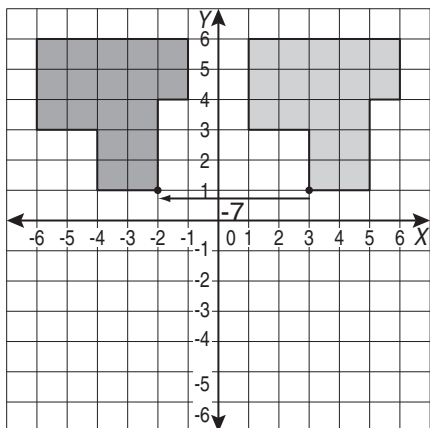
- A) a translation of -4 along the x -axis
 B) a reflection in the line $x = 2$
 C) a rotation of 180°



- A. A) the shapes have different orientation \Rightarrow not a translation
 B) the shapes are symmetrical about a vertical line \Rightarrow a reflection
 C) the shapes are symmetrical about a vertical line \Rightarrow not a rotation
 The answer is **B**.

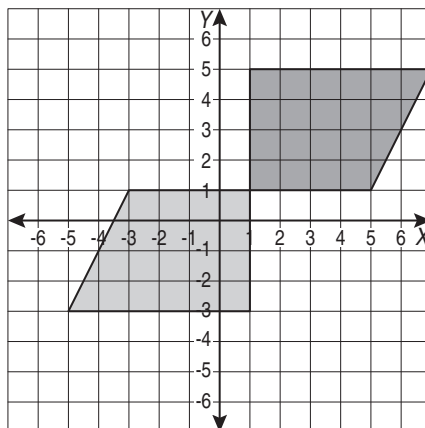
a) Which transformation has moved the shape?

- A) a translation of -7 along the x -axis
 B) a reflection in the y -axis
 C) a rotation of 180°



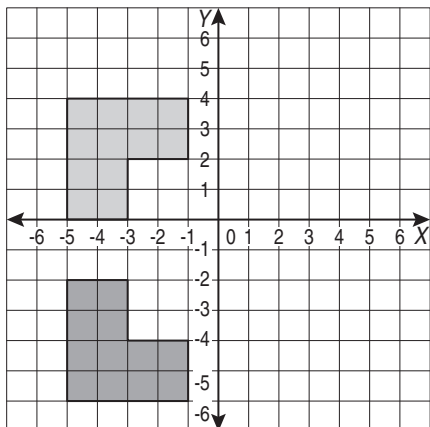
b) Which transformation has moved the trapezium?

- A) a translation of 4 along the x -axis
 B) a reflection in the line $x = 1$
 C) a rotation of 180°



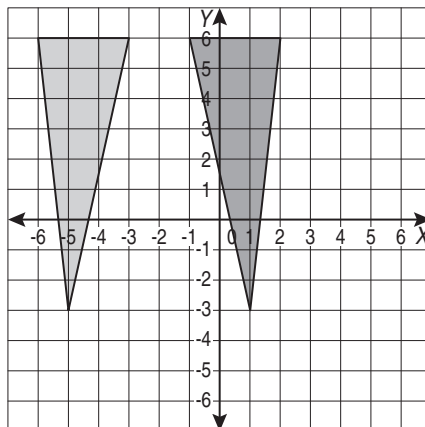
c) Which transformation has moved the shape?

- A) a translation of -6 along the y -axis
 B) a reflection in the line $x = -1$
 C) a rotation of 90° anticlockwise



d) Which transformation has moved the triangle?

- A) a translation of -3 along the y -axis
 B) a reflection in the line $y = -2$
 C) a rotation of 90° clockwise

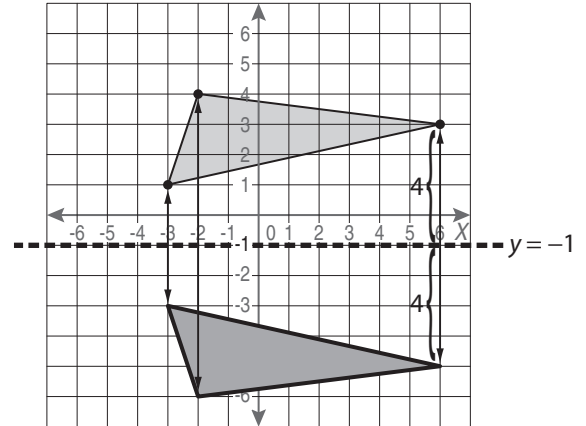
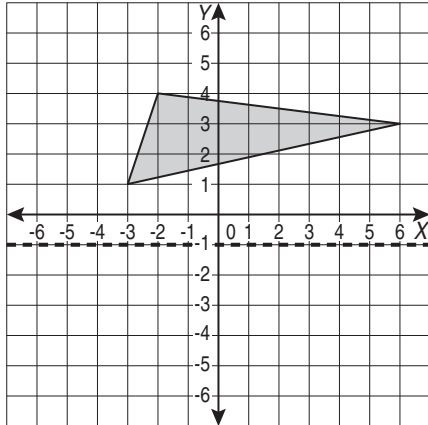


Reflection (like in a mirror)

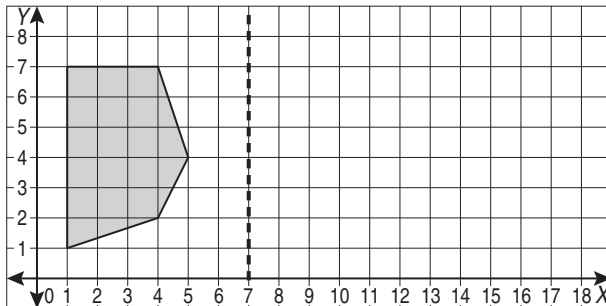
- Draw a perpendicular line to the mirror line from each vertex of the shape.
- Extend the perpendicular line beyond the mirror line by the same number of units.
- Plot and join the reflected points.

Hint: The resulting shapes are always congruent to the original shapes (same size and shape).

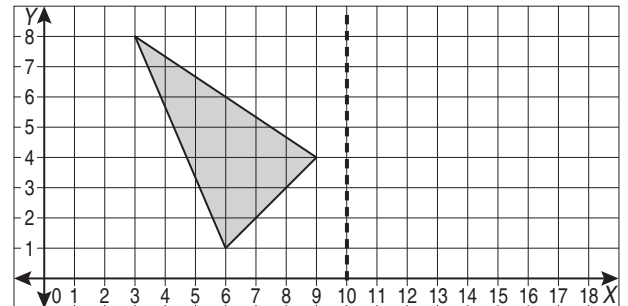
Q. Redraw this triangle after reflecting it in the line of equation $y = -1$ **A.**



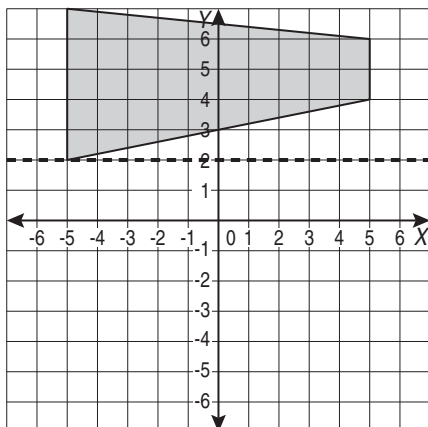
a) Redraw this shape after reflecting it in the line of equation $x = 7$



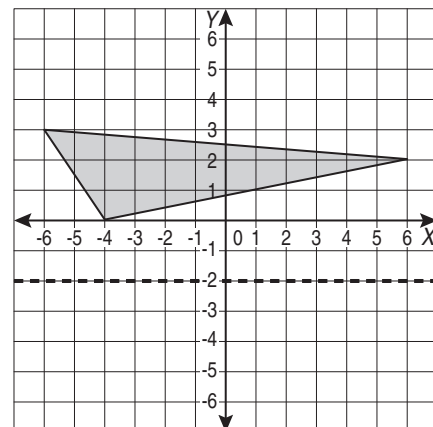
b) Redraw this triangle after reflecting it in the line of equation $x = 10$



c) Redraw this trapezium after reflecting it in the line of equation $y = 2$



d) Redraw this triangle after reflecting it in the line of equation $y = -2$



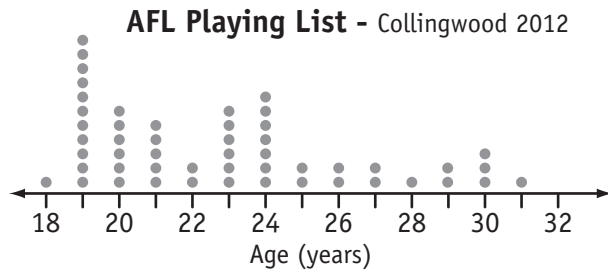
29. [Statistics]

Skill 29.1 Interpreting dot plots.

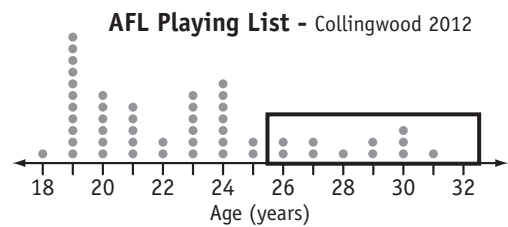
MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Hint: Each dot (•), cross (x) or picture shows the position of a sample of the data above a number line.

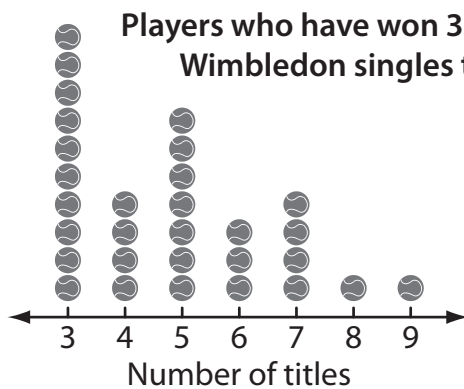
Q. How many Collingwood players are over the age of 25?



A. $2 + 2 + 1 + 2 + 3 + 1$
 $= 11$

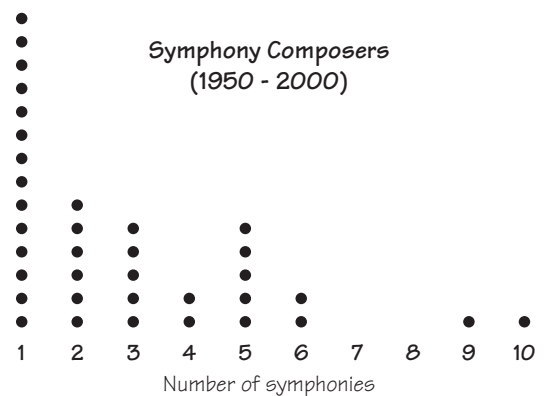


a) How many players have won more than 6 Wimbledon titles?



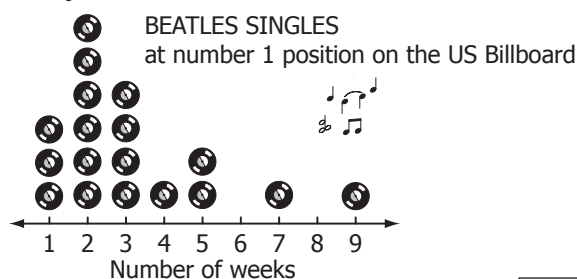
=

b) Between 1950 and 2000, how many musicians composed more than 4 symphonies?



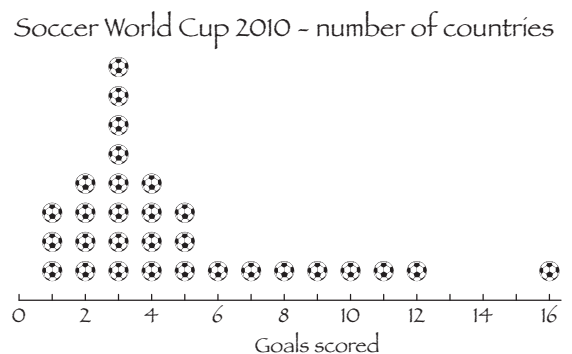
=

c) 'Hey Jude' was The Beatles single that held the number one position on the US Billboard for the longest amount of time. For how many weeks was 'Hey Jude' at number one?



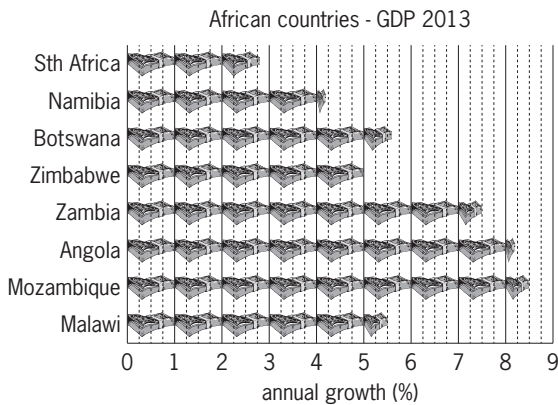
=

d) How many countries scored more than 5 goals in the 2010 soccer world cup?

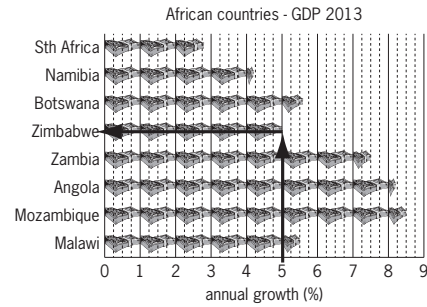


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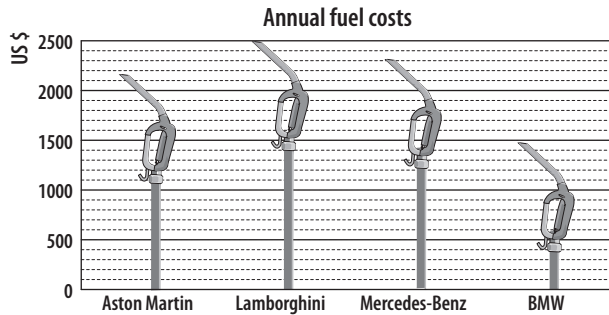
Q. Which African country had 5% annual growth in 2013?



A. Zimbabwe



a) Which car has closest to \$2200 each year in fuel costs?

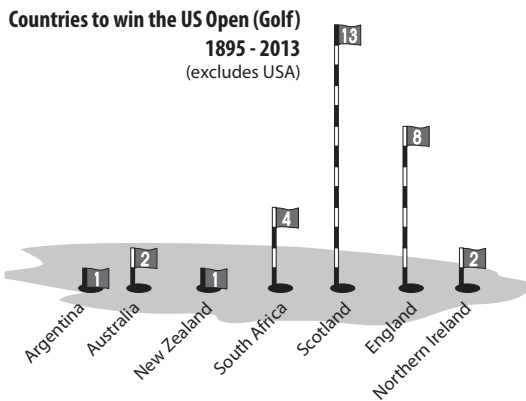


b) Which river is closest to 6000 km in length?

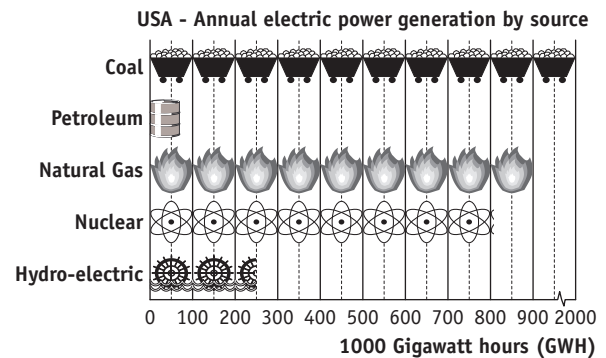


Ω = 1000 km in length

c) Which country has won the US Open twice as often as South Africa?



d) Which source of power generates approximately 250 000 gigawatt hours of electricity each year in the USA?



- Read the title and sub-headings.
- Check what each row (across) and column (down) represents.
- To find the information you need, follow a row across to where it meets the relevant column.
- Using the information gathered, perform any calculations necessary.

Q. Which type of nut contains twice as much protein as a walnut?

| Nut (100 g) | energy (kj) | proteins (g) | fats (g) | carbohydrates (g) |
|-------------|-------------|--------------|----------|-------------------|
| cashew | 2314 | 18.2 | 43.9 | 28.72 |
| peanut | 2385 | 25 | 47 | 16.5 |
| almond | 2418 | 19.8 | 50 | 19 |
| pistachio | 2391 | 21.4 | 46 | 27.7 |
| walnut | 2578 | 9.9 | 59 | 8.6 |

A. *almond*

Walnut protein is 9.9 g

$$9.9 \times 2 = 19.8$$

Almond protein is 19.8 g

| Nut (100 g) | energy (kj) | proteins (g) | fats (g) | carbohydrates (g) |
|-------------|-------------|--------------|----------|-------------------|
| cashew | 2314 | 18.2 | 43.9 | 28.72 |
| peanut | 2385 | 25 | 47 | 16.5 |
| almond | 2418 | 19.8 | 50 | 19 |
| pistachio | 2391 | 21.4 | 46 | 27.7 |
| walnut | 2578 | 9.9 | 59 | 8.6 |

a) Of the birds listed, which bird has a wingspan of 3.4 metres?

| Wing Spans (m) | | | | | | | |
|----------------|--------------------|-------------|------|---------------|--------|-------|-----------|
| barn owl | wedge tailed eagle | kooka-burra | swan | white pelican | condor | stork | albatross |
| 0.9 | 2.5 | 2 | 2.2 | 3 | 3 | 3.4 | 3.5 |

b) Which type of coal has the highest percentage of carbon?

| Coal Type | moisture | carbon | other |
|---------------------|----------|--------|-------|
| lignite | 35% | 30% | 35% |
| sub-bituminous coal | 10% | 75% | 15% |
| bituminous coal | 5% | 80% | 15% |
| anthracite | 3% | 92% | 5% |

c) Which activity expends one third of the amount of kj per minute as swimming?

| Energy needed (kJ per minute) | | | | | | |
|-------------------------------|---------|------------|------------------|----------|---------|-----------|
| sleeping | writing | house work | tennis (doubles) | swimming | cycling | sprinting |
| 4 | 10 | 16 | 21 | 30 | 36 | 42 |

d) How many chemicals in seawater have a content of more than one part per thousand?

| Principal constituents of seawater | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Bicarbonate (HCO ₂) | Sulphate (SO ₄) | Chloride (Cl) | Bromide (Br) | Total dissolved solids (Salinity) | |
|------------------------------------|----------------------|------------------------------|-------------|---------------|---------------------------------|-----------------------------|---------------|--------------|-----------------------------------|-------|
| | Chemical Constituent | Content (parts per thousand) | 0.419 | 1.304 | 10.710 | 0.390 | 0.145 | 2.690 | 19.350 | 0.070 | 19.350 |
| Content (parts per thousand) | 0.419 | 1.304 | 10.710 | 0.390 | 0.145 | 2.690 | 19.350 | 0.070 | 19.350 | |

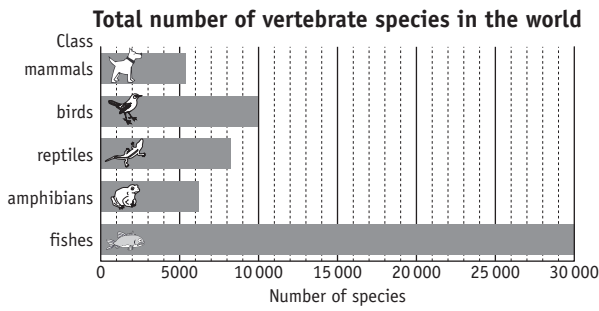
e) Which ski field listed below has the second most number of lifts?

| Australian snow field | Skiable area (hectares) | Number of Lifts |
|-----------------------|-------------------------|-----------------|
| Perisha Blue | 1245 | 49 |
| Thredbo | 480 | 14 |
| Selwyn | 45 | 12 |
| Charlotte Pass | 50 | 4 |
| Mt Buller | 180 | 25 |
| Mt Hotham | 245 | 13 |
| Falls Creek | 451 | 14 |
| Mt Baw Baw | 30 | 7 |

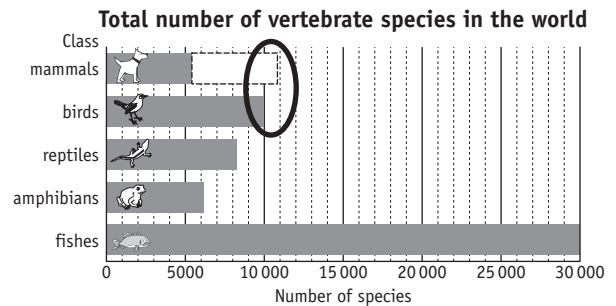
f) Which animal has the greatest $\frac{\text{jump height}}{\text{weight}}$ ratio?

| How high can they jump? | Antelope | Human | Cat | Galago | Cuban tree frog | Locust | Flea | |
|-------------------------|------------|---------|--------|--------|-----------------|--------|--------|--------|
| Animal | Weight (g) | 200 000 | 70 000 | 2500 | 300 | 12.9 | 3 | 0.0005 |
| Weight (g) | 200 000 | 70 000 | 2500 | 300 | 12.9 | 3 | 0.0005 | |
| Jump height (cm) | 250 | 60 | 150 | 225 | 65 | 45 | 10 | |

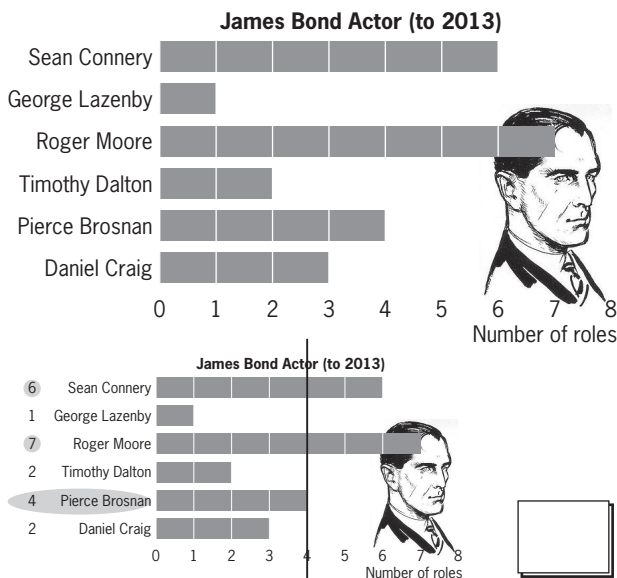
Q. Which vertebrate class has closest to twice as many species as mammals?



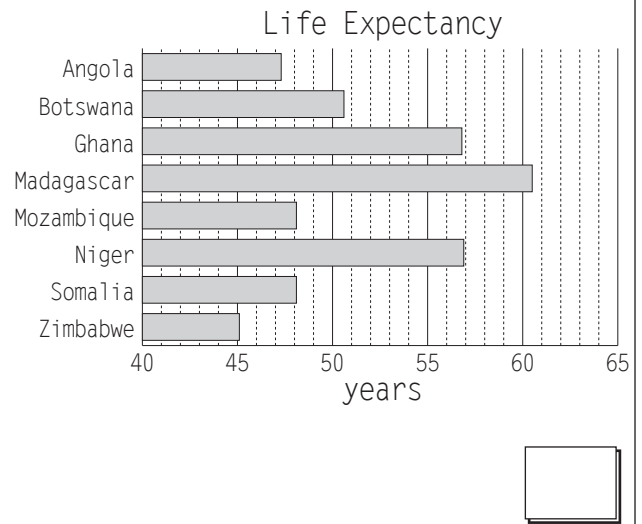
A. *birds* Find the mammals bar. Double the bar length and compare to bar lengths.



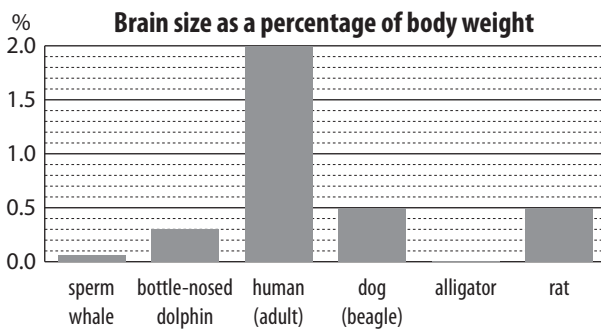
a) How many actors have played James Bond more often than Pierce Brosnan?



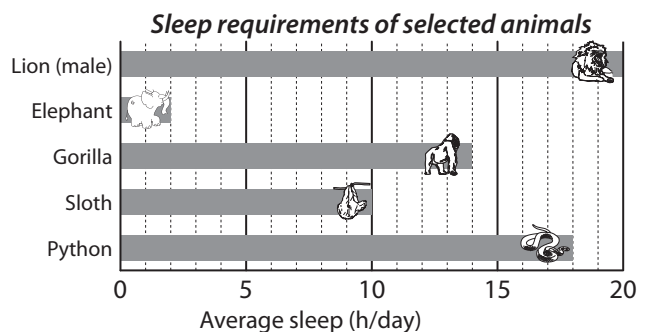
b) Using the graph below, how many countries have a life expectancy of less than 50 years?



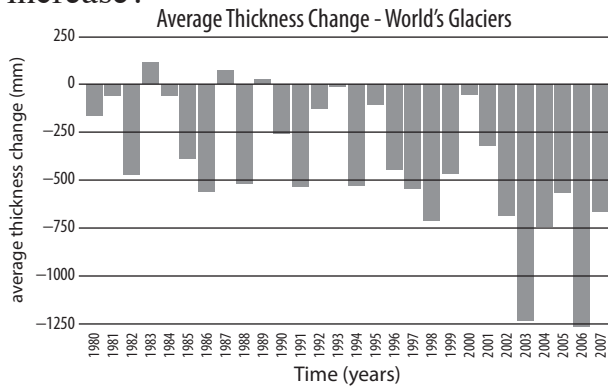
c) Which creature listed below has a brain weighing 0.3% of their body weight?



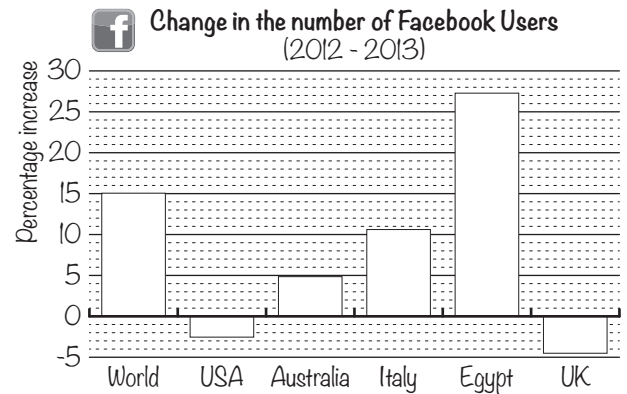
d) Which of the animals shown below sleeps for 7 times as many hours as an elephant?



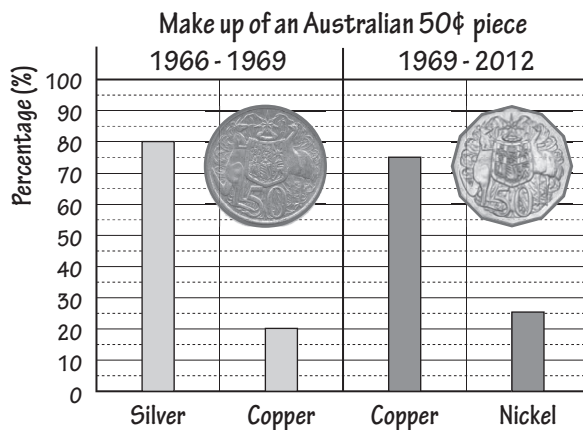
- e) In which years did the average thickness of the world's glaciers increase?



- f) Which of the countries shown has a percentage increase of facebook users closest to 5%?

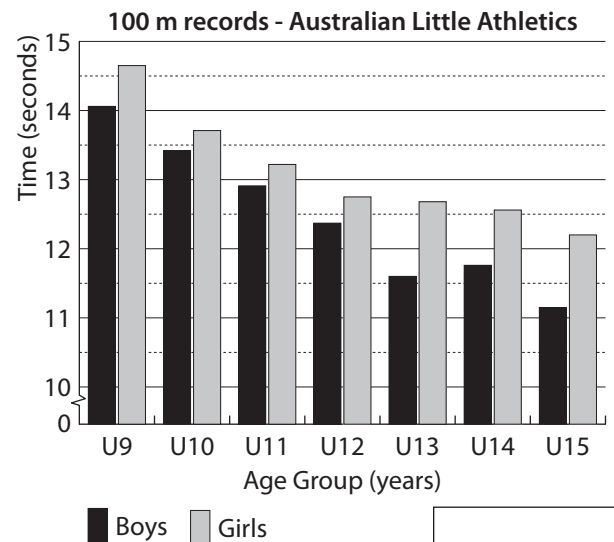


- g) After 1969 what is the percentage difference in the amount of copper in a 50 cent piece?



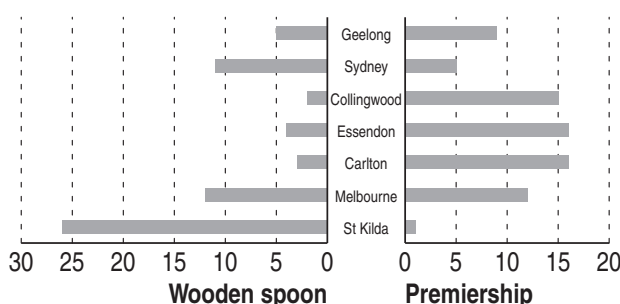
%

- h) In which age group is there the least difference in 100 m records for boys and girls at Little Athletics?

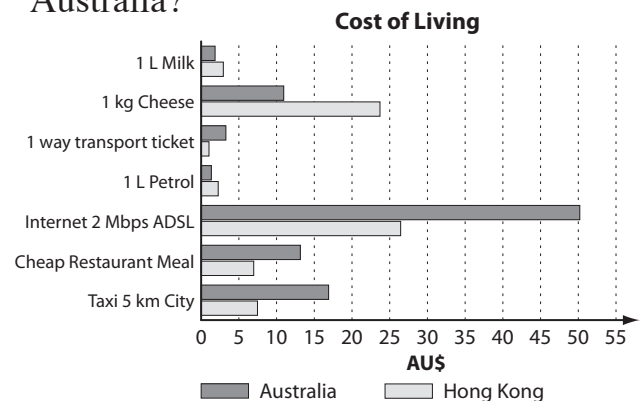


- i) How many of these AFL teams have won both more than 10 premierships and less than 5 wooden spoons since 1900?

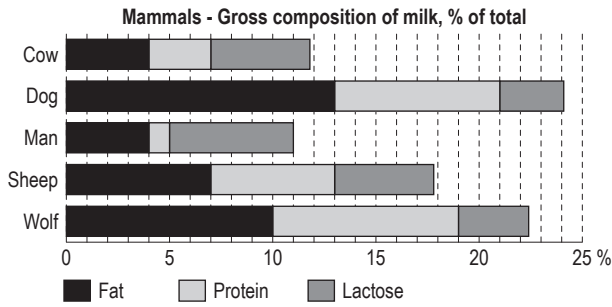
AFL Premierships / Wooden spoons 1900 - 2012



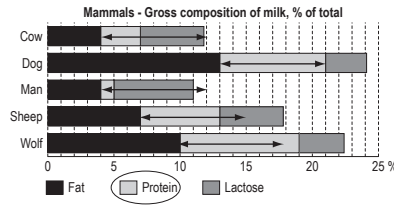
- j) Which cost of living item is twice as expensive in Hong Kong as it is in Australia?



Q. Which of the mammals shown has the highest protein content in their milk?

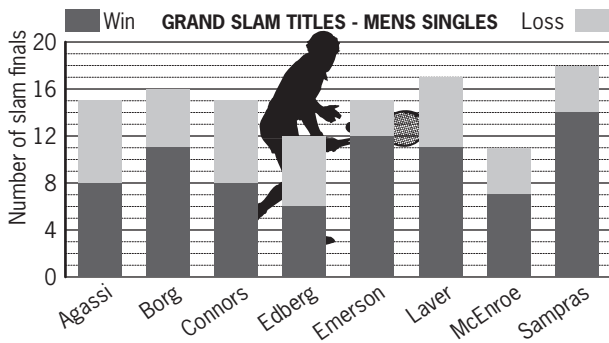


A. *wolf*



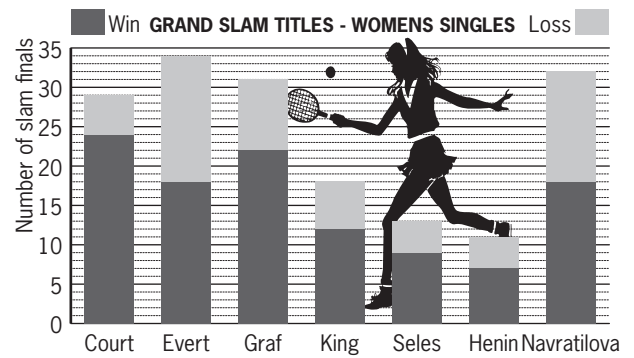
The width of the wolf bar for protein represents 9%.
No other bar for protein content is as long in any other mammal shown.

a) Who had the best ratio of wins to losses in their grand slam singles finals?

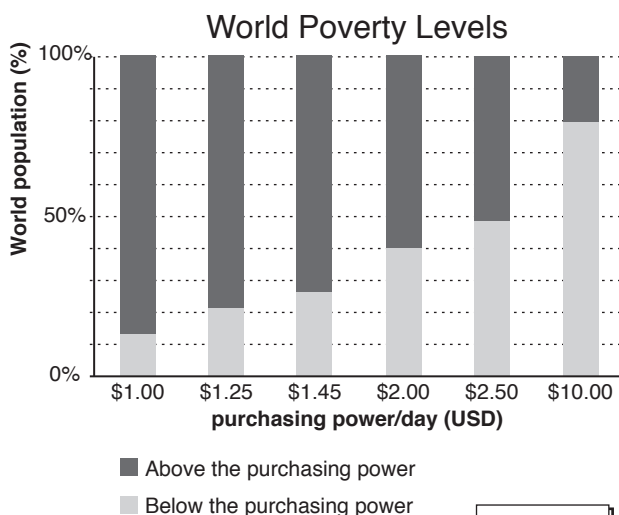


Emerson

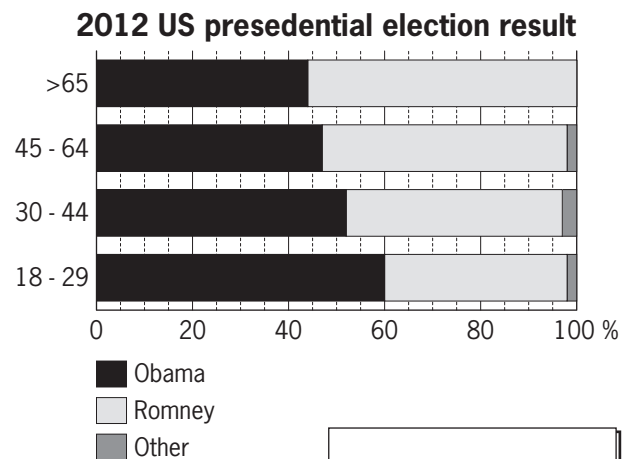
b) Who had the best ratio of wins to losses in their grand slam singles finals?



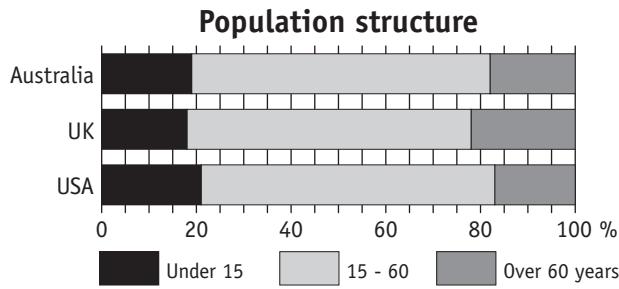
c) What percentage of the world's population lives on less than \$10 a day?



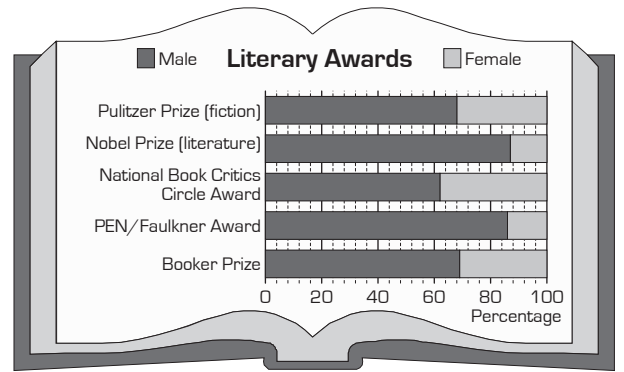
d) Obama and Romney split their votes 51% to 47% in the 2012 election. Which age group best reflects this result?



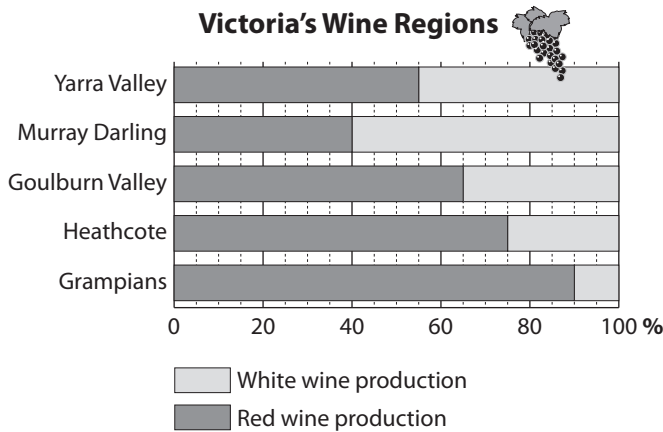
e) Which of the countries shown below has approximately 22% of their population over 60 years of age?



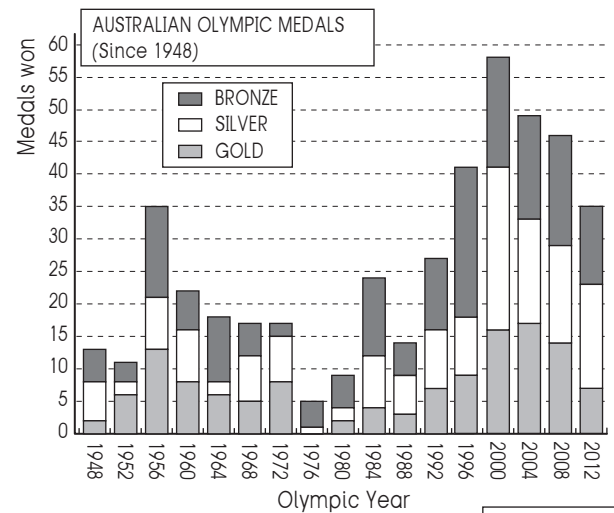
f) For which of the literary awards shown did males make up closest to three fifths of the recipients?



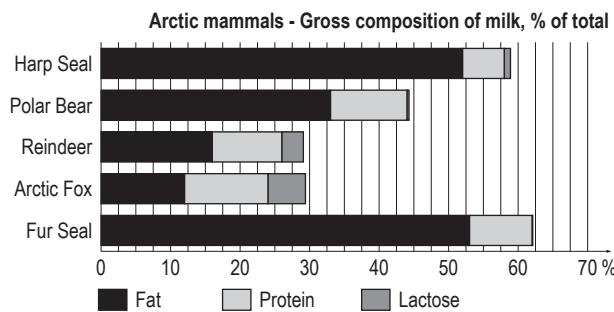
g) In which of the wine regions shown does red wine production account for two fifths of total production?



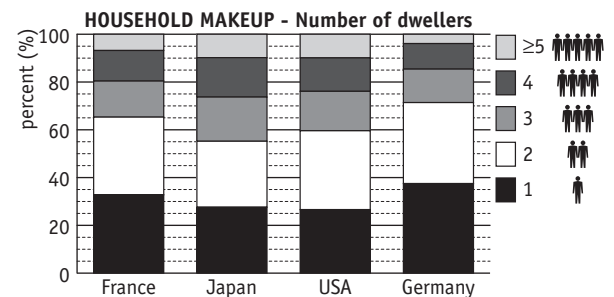
h) Of all the years in which Australia has won more than 15 medals, which year produced the least gold medals?



i) Which of the mammals shown has the lowest protein content in their milk?



j) Which country has the highest percentage of people living on their own?



Skill 29.6 Calculating the mean and median of sets of data (1).

MM4.2 11 22 33 44
MM5.1 11 22 33 44

Mean (or average)

- Add all the values in the set.
- Divide the total by the number of values in the set.

Set of data: 5, 1, 5, 3, 2, 1, 5, 2

Mean $1 + 1 + 2 + 2 + 3 + 5 + 5 + 5 = 24$
8 values so $24 \div 8 = 3$

Median (middle value)

- Write all the values in order.
- Odd numbered set - middle value.
- Even numbered set - average of the 2 middle values.

Set of data (even): 5, 1, 5, 3, 2, 1, 5, 2

Ordered set: 1, 1, 2, 2, 3, 5, 5, 5

Median $\frac{2+3}{2} = \frac{5}{2} = 2.5$

- Q.** This table shows the number of ski runs at selected resorts in Colorado. Find the mean and median of the data.

| Resorts in Colorado - ski runs | | | | | |
|--------------------------------|----|----|----|----|-----|
| 33 | 44 | 52 | 76 | 84 | 131 |

- A.** *Mean*

$$33 + 44 + 52 + 76 + 84 + 131 = 420$$

$$420 \div 6$$

$$= 70$$

6 values in the set, so divide by 6

Median

33, 44, 52, 76, 84, 131 order values

$$\frac{52+76}{2} = \frac{128}{2}$$

find middle value

$$= 64$$

average 2 middle values

- a)** This table shows the number of stations on some of the monorails in the USA. Find the median of the data.

| Monorails of USA (Number of Stations) | | | | | | | | | |
|---------------------------------------|---|---|---|---|---|---|---|---|---|
| 2 | 2 | 2 | 3 | 4 | 6 | 7 | 8 | 8 | 8 |

2, 2, 2, 3, 4, 6, 7, 8, 8, 8 middle values

$$\Rightarrow \frac{4+6}{2} = \frac{10}{2}$$

average 2 middle values

median =

- b)** This table shows the NASCAR sprint finishes for Carl Edwards between 2005 and 2009 at Pocono Raceway. Find the median of the data.

| Pocono Raceway NASCAR sprint car series '05 - '09 finishes - Carl Edwards | | | | | | | | |
|---|---|---|---|---|----|----|----|----|
| 1 | 1 | 2 | 4 | 9 | 14 | 21 | 25 | 39 |

\Rightarrow

median =

- c)** This table shows the atomic number of the non-metals in the periodic table of elements. Find the median of the data.

Non-metals • Periodic table of elements

| | | | | | |
|------------|--------------|------------|----------------|-------------|---------------|
| Carbon (C) | Nitrogen (N) | Oxygen (O) | Phosphorus (P) | Sulphur (S) | Selenium (Se) |
| 6 | 7 | 8 | 15 | 16 | 34 |

\Rightarrow

median =

- d)** This table shows a 7-day temperature forecast for Hamilton. Find the median high temperature for the interval.

| Hamilton NZ 7-day Forecast Oct 16 2013 | | | | | | | |
|--|------|------|------|------|------|------|------|
| | WED | THU | FRI | SAT | SUN | MON | TUE |
| High | 19°C | 21°C | 22°C | 22°C | 23°C | 23°C | 22°C |
| Low | 10°C | 5°C | 10°C | 4°C | 5°C | 10°C | 10°C |

order values

\Rightarrow

median =

- e) This table shows the average lifespan of some animals. Find the mean of the data.

ANIMAL LIFESPANS - years

| cat | camel | rhinoceros | grizzly bear |
|-----|-------|------------|--------------|
| 12 | 12 | 15 | 25 |

4 values in the set, so divide by 4

$$12 + 12 + 15 + 25 = 64$$

$$\text{Mean} = 64 \div 4$$

mean =

- f) Ada selects scrabble letters that spell the 7 letter word 'quartz'. Find the mean value of her tiles.

Value of Scrabble tile selection

| A | U | R | T | Y | Q | Z |
|---|---|---|---|---|----|----|
| 1 | 1 | 1 | 1 | 4 | 10 | 10 |

$$\text{Mean} =$$

mean =

- g) This table shows the number of calories per serving of some carbohydrates. Find the mean of the data.

Carbohydrate Calories per 100 g

| | |
|-----------|-----|
| potatoes | 70 |
| macaroni | 95 |
| spaghetti | 100 |
| pasta | 105 |
| rice | 140 |
| bread | 210 |

$$\text{Mean} =$$

mean =

- h) This table shows the number of stations on some of Europe's monorails. Find the mean of the data.

Europe's monorails (Number of Stations)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|
| 2 | 2 | 2 | 2 | 2 | 3 | 3 | 5 | 6 | 20 |
|---|---|---|---|---|---|---|---|---|----|

$$\text{Mean} =$$

mean =

- i) This table shows the number of petals on some flower species. Find the mean and median of the data.

Number of petals

| Lily | Iris | Fuschia | Buttercup | Amaryllis | Narcissus | Delphinium |
|------|------|---------|-----------|-----------|-----------|------------|
| 3 | 3 | 4 | 5 | 6 | 6 | 8 |

$$\text{Mean} =$$

$$\text{Median} =$$

mean =

median =

- j) This table shows the total number of medals won by the USA at the winter Olympics from 1992 to 2010. Find the mean and median of the data.

[Round to the nearest integer.]

United States Winter Olympics Medals

| year | 1992 | 1994 | 1998 | 2002 | 2006 | 2010 |
|--------|------|------|------|------|------|------|
| medals | 11 | 13 | 13 | 34 | 25 | 37 |

$$\text{Mean} =$$

$$\text{Median} =$$

mean =

median =

Mode (most common value)

Range

- Write all the values in order.
- Subtract the lowest value from the highest value.

Hint: A set of data can have more than one mode if two or more values repeat the same number of times.

Set of data: 5, 1, 5, 3, 2, 1, 5, 2
Ordered set: 1, 1, 2, 2, 3, 5, 5, 5

Mode 5
Range $5 - 1 = 4$

Q. The number of scrabble tiles available for each letter is shown below. Find the mode and range of the data.

Numbers of Scrabble tiles

| Z | Q | X | J | K | Y | W | V | H | F | P | M | C | B | G | D | U | L | S | R | T | N | O | I | A | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|
| 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 6 | 6 | 6 | 8 | 9 | 9 | 12 | |

A. Mode
= 2

Range
 $12 - 1$
= 11

Numbers of Scrabble tiles

| Z | Q | X | J | K | Y | W | V | H | F | P | M | C | B | G | D | U | L | S | R | T | N | O | I | A | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|
| 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 6 | 6 | 6 | 8 | 9 | 9 | 12 | |

difference between highest and lowest

The value 2 is in the set 9 times

a) This table shows the NASCAR sprint finishes for Jeff Gordon between 2005 and 2009 at Pocono Raceway. Find the mode and range of the data.

| Pocono Raceway NASCAR sprint car series '05 - '09 finishes - Jeff Gordon | | | | | | | | |
|--|---|---|---|---|----|----|----|----|
| 1 | 3 | 4 | 4 | 9 | 10 | 13 | 14 | 34 |

The value 4 is in the set 2 times

Range = $34 - 1 = 33$

mode = range =

b) The values of scrabble tiles are shown below. Find the mode and range of the data.

Values of Scrabble tiles

| A | E | I | L | N | O | R | S | T | U | D | G | B | C | M | P | F | H | V | W | Y | K | J | X | Q | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 8 | 8 | 10 | 10 |

Range =

mode = range =

c) This table shows the total number of gold medals won by Great Britain at the summer Olympics. Find the mode and range of the data.

Great Britain Olympic Gold Medals

| year | 1984 | 1988 | 1992 | 1996 | 2000 | 2004 | 2008 |
|--------|------|------|------|------|------|------|------|
| medals | 5 | 5 | 5 | 1 | 11 | 9 | 19 |

Range =

mode = range =

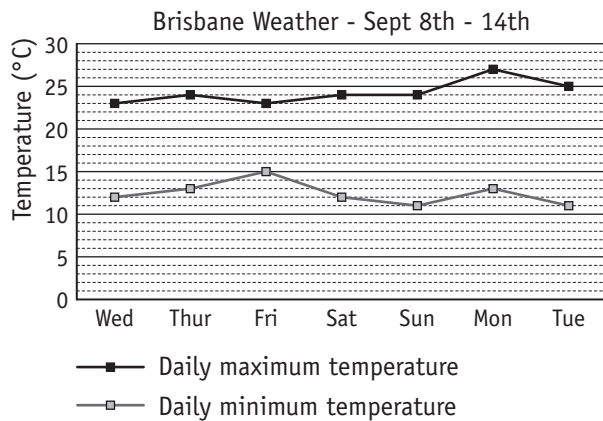
d) This table shows the number of calories per serving of some fruits. Find the mode and range of the data.

| Fruit | Calories per 100 g |
|------------|--------------------|
| Apple | 47 |
| Orange | 40 |
| Banana | 95 |
| Grapes | 60 |
| Kiwi fruit | 49 |
| Pear | 40 |

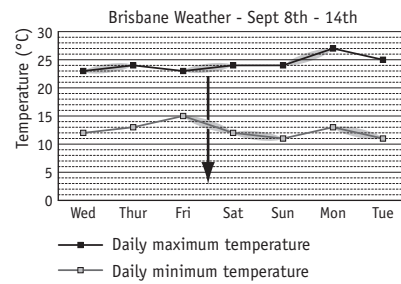
Range =

mode = range =

Q. In Brisbane, between which 2 days did the maximum temperature increase and the minimum temperature decrease?



A. Friday & Saturday

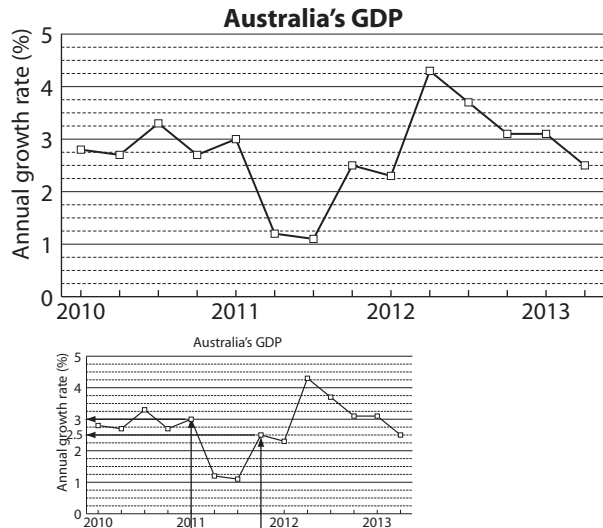


Find the daily maximum temperature graph and mark where the line increases between days.

Then find the minimum graph and mark where the line decreases.

They match between Friday and Saturday.

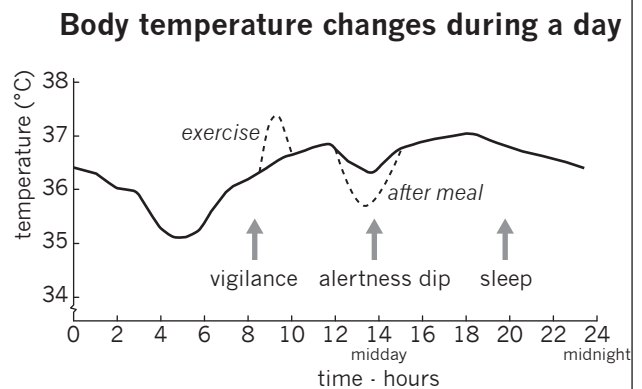
a) What was the difference in Australia's annual growth in GDP between January 2011 and October 2011?



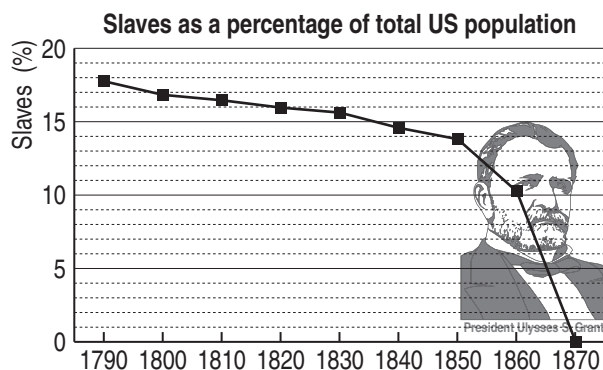
0.5 %

b) At what time of day is your body temperature the lowest?

[Give your answer to the nearest hour.]

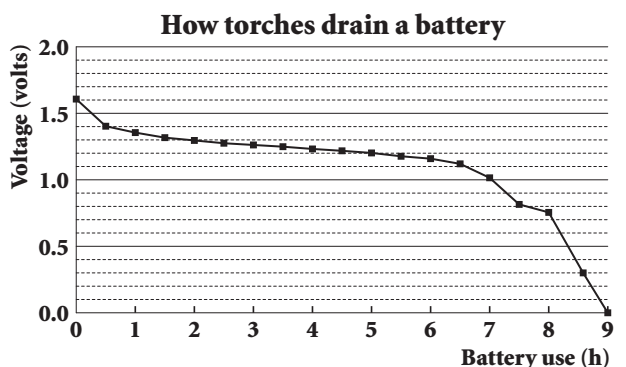


c) In which decade was the biggest percentage decrease in the number of slaves?



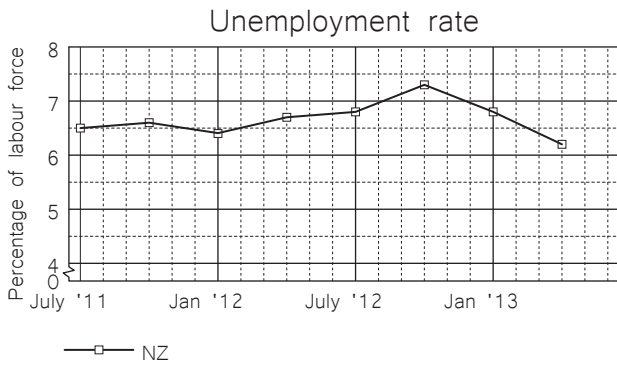
1850s

d) For how many hours would this torch have been in use if the battery had 1.2 volts remaining?

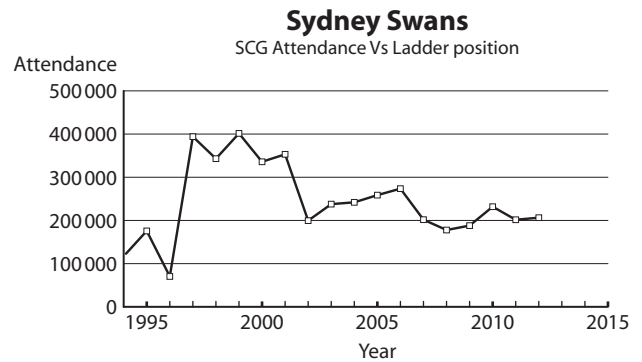


3 h

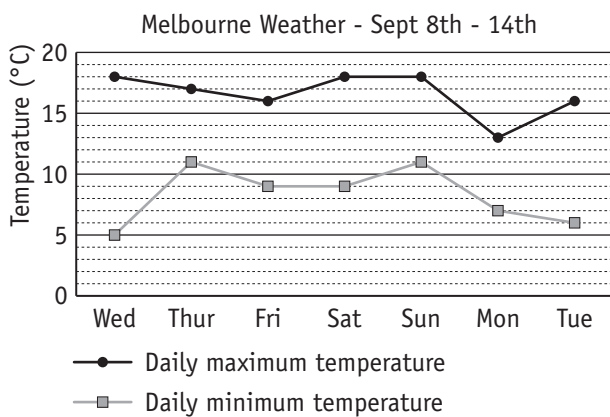
e) What was the unemployment rate in New Zealand in February 2012?



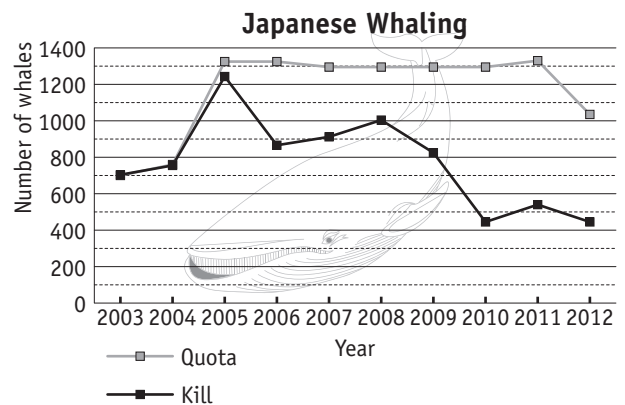
f) Between which two consecutive years did the Sydney Swans attendance increase the most?



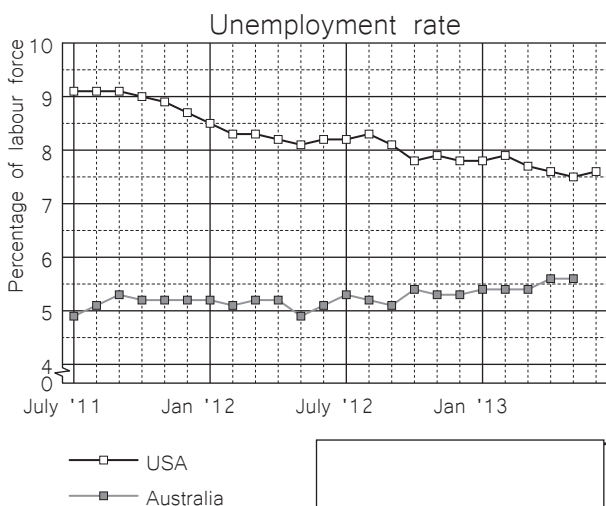
g) Which day of the week in Melbourne had a difference between the daily maximum and daily minimum temperatures of 9°C?



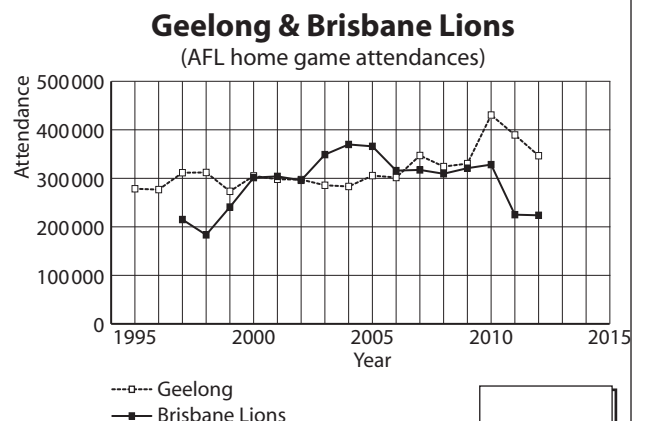
h) In which year was there the greatest difference between the quota and the kill by Japanese whalers?



i) Which country has the least change in unemployment rate between July 2011 and July 2012?

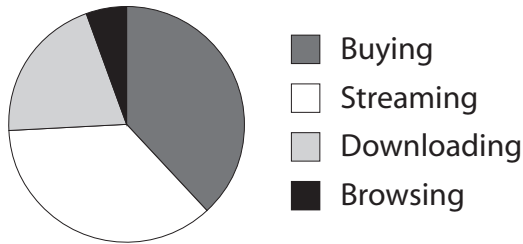


j) Between 2000 and 2006 Brisbane Lions's home game attendance exceeded Geelong's home game attendance apart from one year. Which year was this?

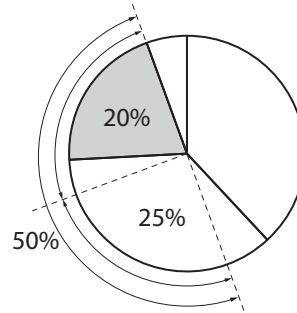


Q. Which activity makes up 20% of iTunes traffic?

Daily iTunes traffic composition

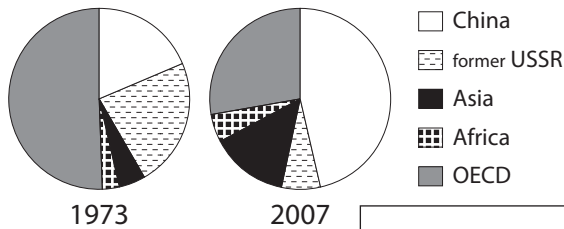


A. downloading



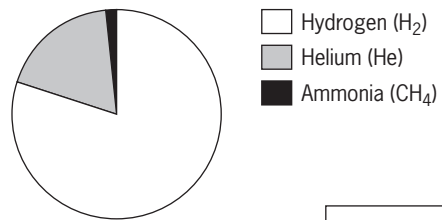
a) Which region closest to halved their hard coal production between 1973 and 2007?

Hard coal production



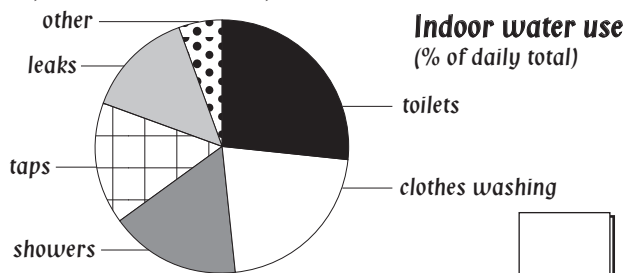
b) Which element makes up about 80% of Neptune's atmosphere?

Atmospheric composition of Neptune



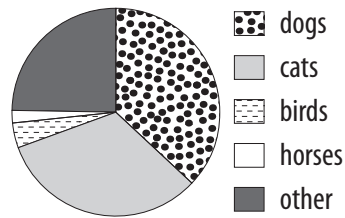
c) Approximately what percentage of indoor water usage is accounted for by showers?

- A) 5% B) 15%
C) 25% D) 50%



d) Which two animals account for 70% of all pets?

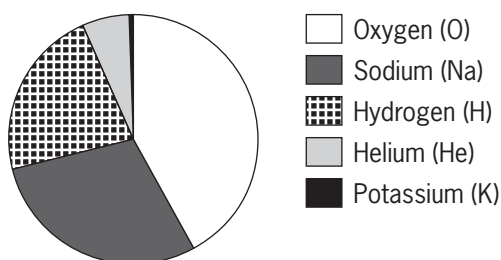
Pet owners' choice



e) Approximately what percentage of Mercury's atmosphere is sodium?

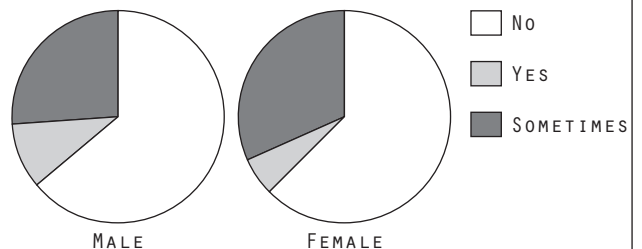
- A) 15% B) 20%
C) 30% D) 45%

Atmospheric composition of Mercury



f) Which response, to accepting a stranger as a friend on facebook, is most similar between males and females?

ACCEPTING STRANGERS AS FRIENDS ON FACEBOOK?



To complete a stem-and-leaf plot from a given set of data

- Write the values from the data set - each unit digit is a leaf beside its corresponding tens (or hundreds) digit, which is a stem.

Hint:

| tens value | units value | |
|------------|-------------|-------------|
| STEM | LEAF | |
| 0 | 2 | = 2 |
| 1 | 5 7 | = 15 and 17 |

| hundreds & tens values | units value | |
|------------------------|-------------|-------|
| STEM | LEAF | |
| 23 | 7 | = 237 |

To calculate values from a stem-and-leaf plot

Median (middle value)

- Count the number of leaves.

If an odd number of leaves:

- Count from the top left leaf until you reach the middle leaf.
- This digit is the unit and must be put with the corresponding stem.

If an even number of leaves:

- Count from the top left leaf until you reach the two middle leaves.
- Read the digits with their corresponding stems.
- Find the average of the 2 middle numbers.

Range

- Subtract the lowest number (top left leaf) from the highest number (bottom right leaf).

Data set of 13 elements:

{ 13, 18, 18, 19, 20, 21, 21, 22, 22, 22, 29, 30, 31 }

median (7th element) = 21

range

| stem | leaves | lowest value = 13 |
|------|---------------|--------------------|
| 1 | 3 8 8 9 | median = 21 |
| 2 | 0 1 1 2 2 2 9 | |
| 3 | 0 1 | highest value = 31 |

range = high - low

= 31 - 13

= 18

Q. This stem-and-leaf plot shows the number of winners of the Tour de France by country. Find the median of the data.

| Stem | Leaf |
|------|---------------|
| 0 | 1 1 1 2 2 4 9 |
| 1 | 0 2 8 |
| 2 | |
| 3 | 6 |

1 | 8 = 18

A. 11 countries have Tour de France winners ⇒
median = 6th score
= 4

| Stem | Leaf |
|------|---------------|
| 0 | 1 1 1 2 2 4 9 |
| 1 | 0 2 8 |
| 2 | |
| 3 | 6 |

1 | 8 = 18

Annotations: 5 values above, middle leaf, 5 values below

- a) Complete the stem-and-leaf plot for the data:
48, 56, 73, 55, 48, 62, 72, 49, 57, 44,
59, 60, 66, 55

| Stem | Leaf |
|------|---------|
| 4 | 4 _ _ _ |
| 5 | 5 _ _ _ |
| — | — _ _ _ |
| — | — _ _ _ |

Key
3 | 5 = 35

- b) Complete the stem-and-leaf plot for the data showing the results of the women's high jump at the 1968 - 2008 Olympics:
205, 206, 201, 205, 202, 203, 202, 197,
193, 192, 182

| Stem | Leaf |
|------|---|
| 18 | <u>2</u> 23 \| 5 = 235 cm |
| — | — _ _ _ |
| — | — _ _ _ |

- c) Find the median and range of the monthly average high temperatures for Adelaide, SA.

| Stem | Leaf |
|------|-----------------------------|
| 1 | <u>5</u> 6 7 9 9 |
| 2 | 2 <u>3</u> 5 6 7 9 <u>9</u> |

lowest score = 15
highest score = 29
2 | 5 = 25°C
12 scores so middle score halfway between score 6 (22) and score 7 (23)

median =

.....

range =

.....

median =

range =

- d) This stem-and-leaf plot shows the results of the men's pole vault jump at the 1968 - 2008 Olympics. Find the median and range of the data.

| Stem | Leaf |
|------|-----------|
| 54 | 0 |
| 55 | 0 0 |
| 56 | |
| 57 | 5 8 |
| 58 | 0 |
| 59 | 0 0 2 5 6 |

53 | 1 = 531 cm

median =

.....

range =

.....

median =

range =

- e) Find the median and range for these 15 American states that have the lowest number of counties.

| Stem | Leaf |
|------|-------------|
| 0 | 3 5 5 8 |
| 1 | 0 4 4 5 6 7 |
| 2 | 1 3 4 9 9 |

1 | 4 = 14 counties

median =

.....

range =

.....

median =

range =

- f) This stem-and-leaf plot shows the water consumption rates per kilogram of body weight for selected livestock. Find the median and range of the data.

| Stem | Leaf |
|------|-------|
| 7 | 0 |
| 8 | 0 5 8 |
| 9 | 4 |
| 10 | 0 |
| 11 | 8 9 |
| 12 | 5 |
| 13 | 0 |
| 14 | |
| 15 | |
| 16 | 0 8 9 |

12 | 6 = 126 mL

median =

.....

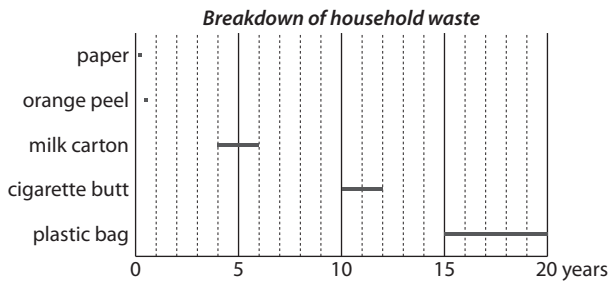
range =

.....

median =

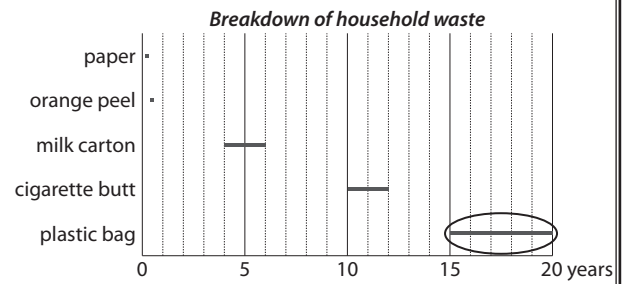
range =

Q. Of the items shown which has the longest breakdown time span?

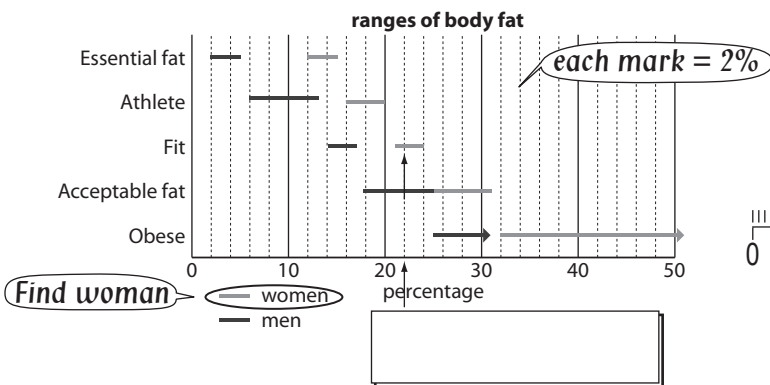


A. *plastic bag*

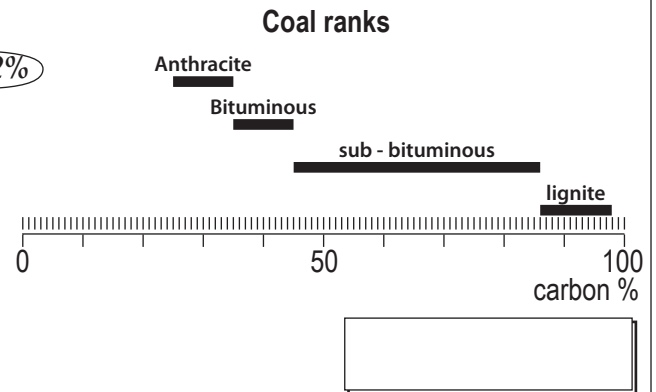
Check the length of each line segment.



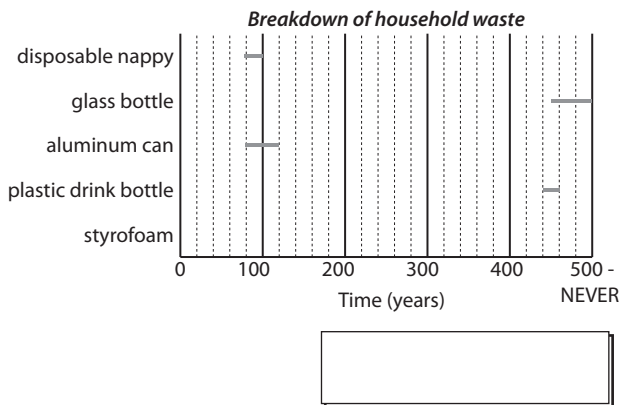
a) If you were a female with 22% body fat into which category would you fall?



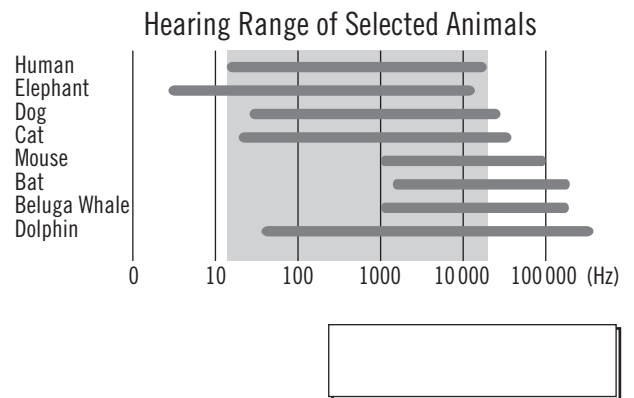
b) A sample of coal contains 38% carbon. To which category does it belong?



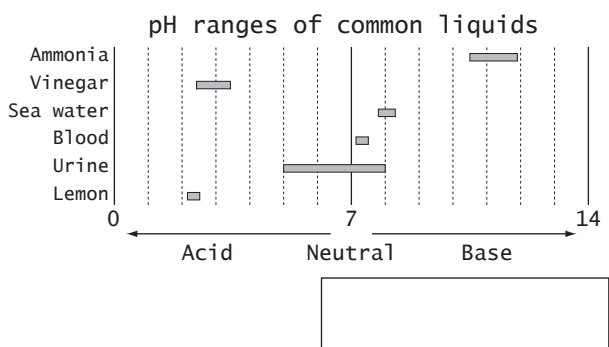
c) Apart from styrofoam which product has the longest breakdown time span?



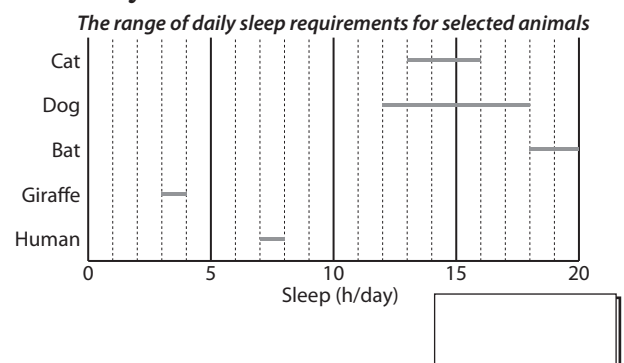
d) Which animal can hear sounds with a frequency of less than 10 Hz?



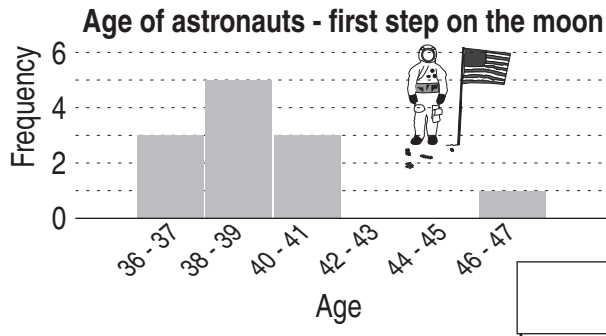
e) Of the liquids shown below which could have a pH that is neutral?



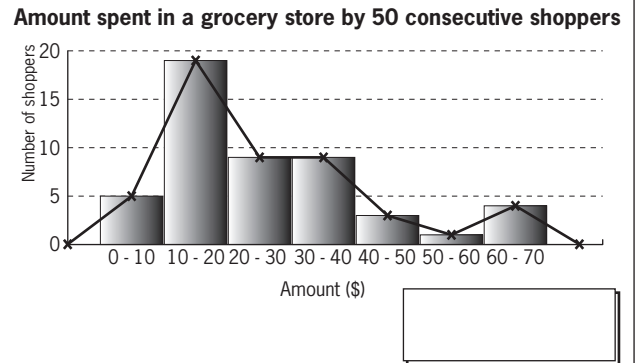
f) Which animal sleeps the most hours each day?



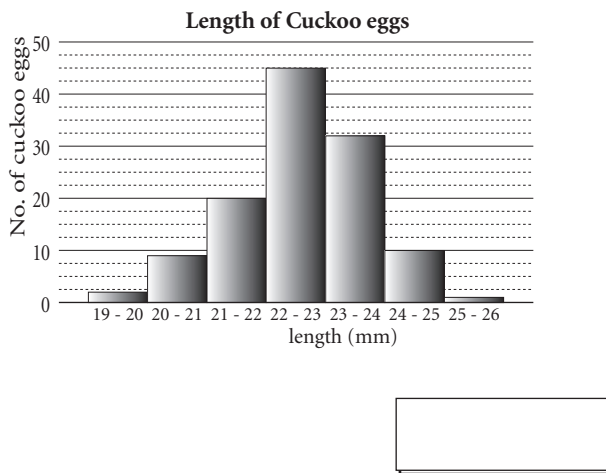
g) How many astronauts were less than 40 years old when they first stepped on the moon?



h) Did most shoppers spend more or less than \$20?

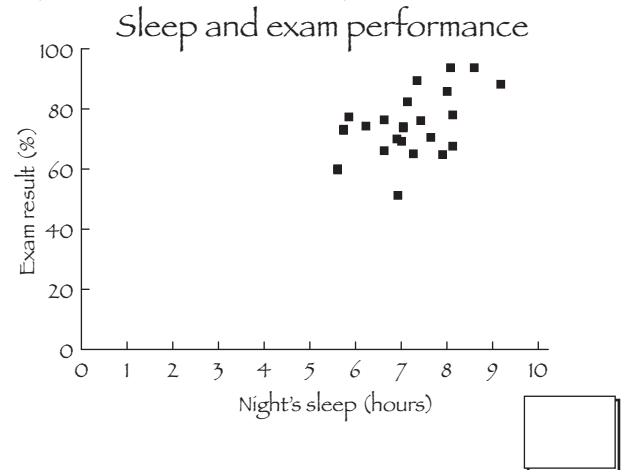


i) Are more cuckoo eggs longer than or shorter than 23 mm?



j) Based on this data what is a reasonable exam result for a student who sleeps for 6 hours on the night before their exam?

- A) 20%
- B) 40%
- C) 60%
- D) 100%

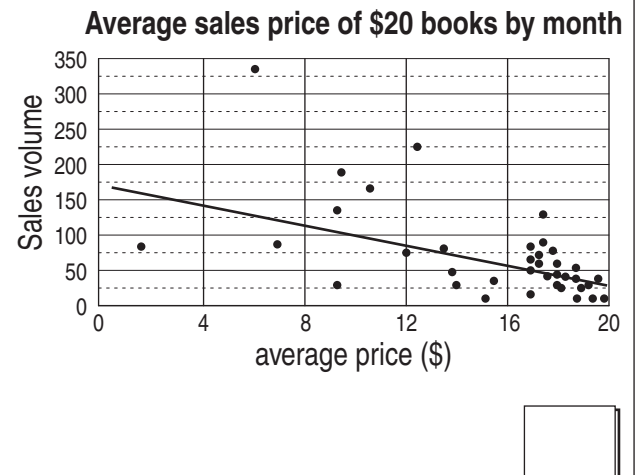
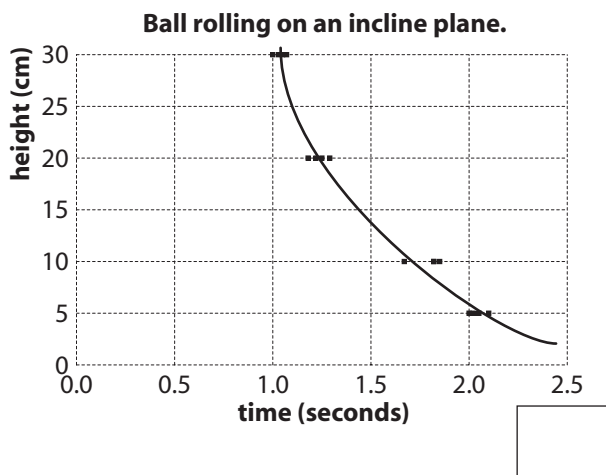


k) An inclined plane is propped at one end to a certain height and a ball is rolled down. Which best describes the trend line for the time taken for a ball to roll the length of the inclined plane?

- A) no height, faster rolling ball
- B) greater height, faster rolling ball
- C) lesser height, faster rolling ball

l) Which best describes the sample?

- A) increased price, decreased sales
- B) increased price, increased sales
- C) decreased price, decreased sales



30. [Probability]

Skill 30.1 Describing the degree of likelihood of an event.

MM4.2 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

Q. There are 27 marbles in a bag and 18 of them are green. How many marbles do you have to select to make sure you have at least one green marble?

A. *Chances of selecting a green marble = 18*
Chances of selecting a different color marble = 27 - 18 = 9

⇒ **10**

It is possible to select all 9 other coloured marbles before you choose a green marble.

a) There are 6 red, 2 purple and 4 white rulers in a drawer. What is the largest number of rulers you could select from the drawer without taking a white ruler?

red = 6, purple = 2, white = 4

6 red + 2 purple =

b) There are 8 chocolate, 10 milk and 5 cream biscuits in a box. How many biscuits do you have to pick to make sure you have at least one chocolate biscuit?

..... =

c) Linda has 8 maltesers and 12 coolmints in her bag. How many lollies does she need to take out of her bag to make sure she has at least 3 coolmints?

..... =

d) There are 7 orange, 9 red and 6 white jellybeans in a jar. Without looking, how many jellybeans do you have to select in order to pick at least one white jellybean?

..... =

e) There are twenty different pairs of socks in the drawer. Without looking, how many socks need to be picked up in order to have a pair of matching socks?

..... =

f) Of the 300 songs on an iPod, 185 are pop songs. How many songs do you need to play on a random setting to be sure you will hear a pop song?

..... =

g) Of the 18 movies on Tom's computer, 6 are comedies. How many movies does Tom have to watch on a random setting to be sure he watches a comedy?

..... =

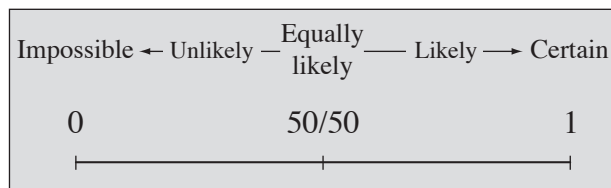
h) How many people do you need to gather to be sure that at least two of them were born on the same day of the week?

..... =

Hints: Probability ranges from 0 to 1.

The closer the probability is to 1, the more likely the event is to happen.

The closer the probability is to 0, the more unlikely the event is to happen.



Q. 'Mary's new baby will be a boy.'

Which expression best represents the probability of this event?

- A) very unlikely
- B) a 50/50 chance
- C) very likely
- D) certain

A. Consider the possibilities.

The new baby can either be a boy or a girl so there is a 50/50 chance

⇒ B

a) 'Einstein will be the oldest living person.'

Which expression best represents the probability of this event?

- A) impossible
- B) very unlikely
- C) very likely
- D) certain

A

b) 'It will rain in the Sahara desert tomorrow.'

Which expression best represents the probability of this event?

- A) impossible
- B) very unlikely
- C) very likely
- D) certain

c) 'The football team will win the next game.'

Which expression best represents the probability of this event?

- A) very unlikely
- B) a 50/50 chance
- C) very likely
- D) certain

d) 'The whole class will get 100% in the next Maths test.'

Which expression best represents the probability of this event?

- A) very likely
- B) a 50/50 chance
- C) very unlikely
- D) impossible

e) 'There will be no school holidays next year.'

Which expression best represents the probability of this event?

- A) very unlikely
- B) a 50/50 chance
- C) very likely
- D) certain

f) 'Wednesday comes before Thursday.'

Which expression best represents the probability of this event?

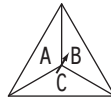
- A) very unlikely
- B) a 50/50 chance
- C) very likely
- D) certain

Skill 30.3 Finding the possible outcomes (sample spaces) of an event by completing tables.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Complete the table to reveal all the possible outcomes (PO) (sample space).
- Count the number of possible outcomes (PO) (sample space).

Q. How many different outcomes are possible when a die is thrown and this spinner is spun? [Complete the table.]



| | | Die | | | | | |
|---------|---|-----|-----|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| Spinner | A | A,1 | A,2 | | | | |
| | B | B,1 | | | | | |
| | C | C,1 | | | | | |

A. $PO = 18$

| Possible outcomes | | Die | | | | | |
|-------------------|---|-----|-----|-----|-----|-----|-----|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| Spinner | A | A,1 | A,2 | A,3 | A,4 | A,5 | A,6 |
| | B | B,1 | B,2 | B,3 | B,4 | B,5 | B,6 |
| | C | C,1 | C,2 | C,3 | C,4 | C,5 | C,6 |

Each space represents 1 outcome

a) A zoo has both male and female primates. There are gorillas and chimpanzees. Find the size of the sample space. [Complete the table.]

| Outcomes (sample space) | | |
|-------------------------|------------|---|
| male | gorilla | 1 |
| male | chimpanzee | 2 |
| female | gorilla | 3 |
| female | chimpanzee | 4 |

Each row represents 1 outcome

b) How many different outcomes are possible choosing a primary colour (red, blue and green) and tossing a coin? [Complete the table.]

| Possible outcomes | | Primary colour | | |
|-------------------|---|----------------|---|---|
| | | R | G | B |
| Coin | H | R,H | | |
| | T | | | |

c) How many different outcomes are possible when rolling a die and flipping a coin? [Complete the table.]

| Possible outcomes | | Die | | | | | |
|-------------------|---|-----|-----|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| Coin | H | H,1 | H,2 | | | | |
| | T | T,1 | | | | | |

d) How many different outcomes are possible when spinning a spinner labelled 1, 2, 3, 4, 5 and flipping a coin? [Complete the table.]

| Possible outcomes | | Spinner | | | | |
|-------------------|---|---------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| Coin | H | 1,H | | | | |
| | T | | | | | |

e) A car comes in silver, red or purple as a convertible or hardtop. Find the size of the sample space. [Complete the table.]

| Outcomes (sample space) | |
|-------------------------|-------------|
| silver | convertible |
| silver | |
| red | |

f) A vendor sells vanilla and chocolate ice cream. Customers can have a waffle or sugar cone and either hot fudge or caramel topping. How many different outcomes are possible when ordering an ice cream in a cone with a single topping? [Complete the table.]

| Outcomes (sample space) | | |
|-------------------------|--------|-----------|
| vanilla | waffle | hot fudge |
| vanilla | | caramel |
| vanilla | | |

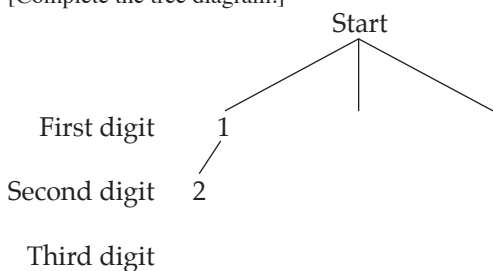
Skill 30.4 Finding the possible outcomes (sample spaces) of an event by completing tree diagrams (1).

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

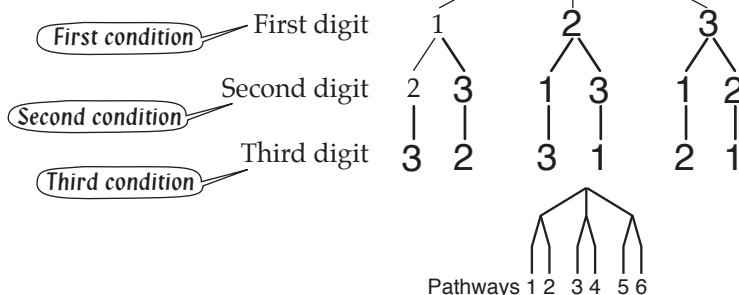
- From the start use the first condition to list all the possible outcomes (PO) on the first set of branches.
- From each of the first outcomes create enough branches to list all the possible outcomes of the second condition.
- Continue in this way until the tree diagram is completed.
- Count the number of pathways from the start to the end of each branch line.
The number of pathways equals the total number of possible outcomes (sample space).

Q. How many different 3-digit numbers can be made using the digits 1, 2 and 3 if the digits can be used only once?

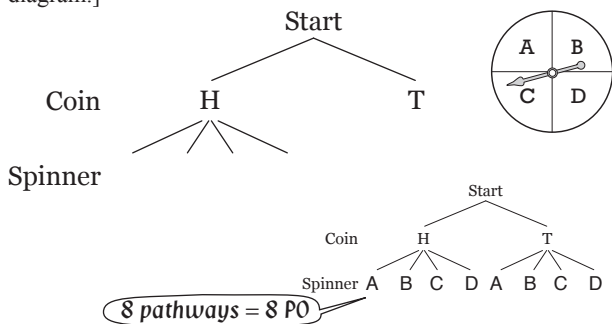
[Complete the tree diagram.]



A. Possible outcomes (PO)
= 123, 132, 213, 231, 312, 321
= 6



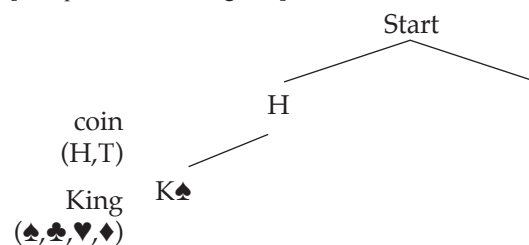
a) How many different outcomes are possible when flipping a coin and spinning this spinner? [Complete the tree diagram.]



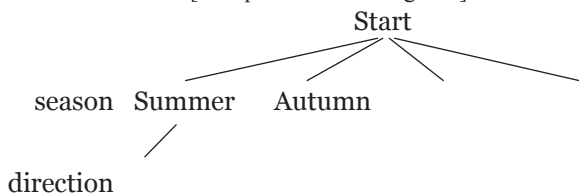
PO = HA, HB, HC, HD, TA, TB, TC, TD =

b) How many different outcomes are possible when flipping a coin and cutting a king from any of the 4 suits in a pack of cards?

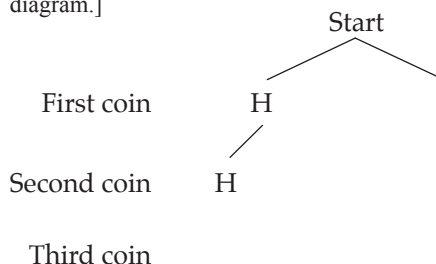
[Complete the tree diagram.]



c) How many different outcomes are possible when choosing a season of the year and one of the 4 point compass directions? [Complete the tree diagram.]



d) How many different outcomes are possible when flipping 3 coins (assuming order matters)? [Complete the tree diagram.]

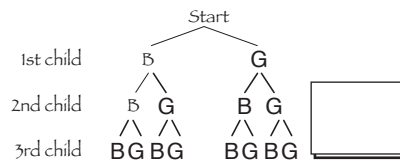
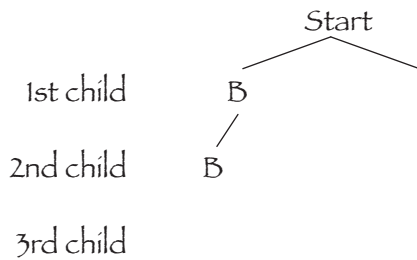


Skill 30.4 Finding the possible outcomes (sample spaces) of an event by completing tree diagrams (2).

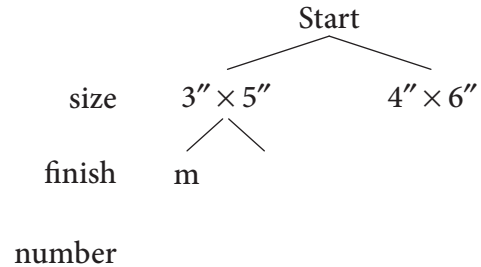
MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- e)** How many different gender combinations are possible if a couple have 3 children and order matters?

[Complete the tree diagram.]

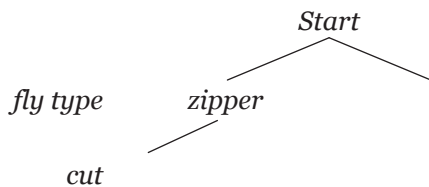


- f)** Photos can be printed in various sizes ($3'' \times 5''$, $4'' \times 6''$) and finishes (matte, gloss) with single or double prints an option. How many choices are possible? [Complete the tree diagram.]

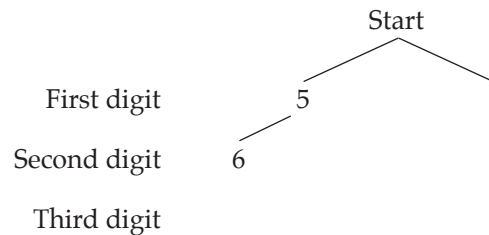


number

- g)** Jeans come with 2 fly types (zipper or button fly) and 5 cuts (boot cut, stove pipe, straight leg, skinny, flared). How many choices of jeans are possible? [Complete the tree diagram.]

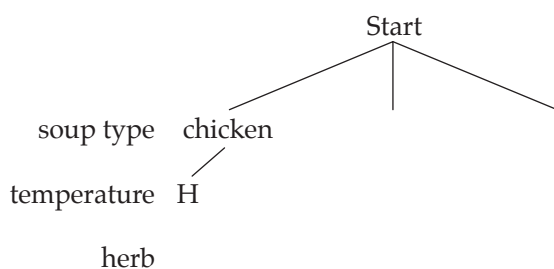


- h)** How many different 3-digit numbers less than 700 can be made using the digits 5, 6, 7 and 8 if the digits can be used only once? [Complete the tree diagram.]



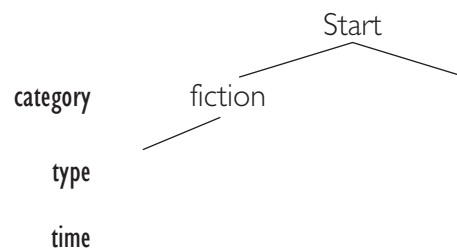
- i)** There are 3 kinds of soup on the menu: chicken, vegetable and pumpkin. They may be served hot or cold and always with a condiment of parsley or basil. How many choices are possible?

[Complete the tree diagram.]



- j)** On a library visit Tara must decide whether to loan a fiction or non-fiction item in one of the available formats (book, movie, tape, large print) for 2 weeks or 4 weeks. How many different options does Tara have?

[Complete the tree diagram.]



Skill 30.5 Calculating the probability of a simple event (1).

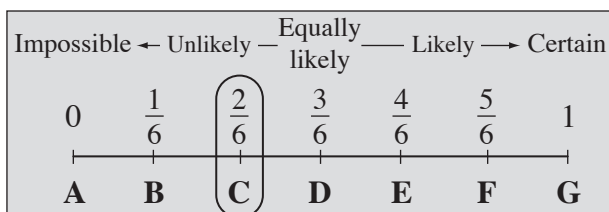
MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Find the number of favourable outcomes for the event.
- Find the total number of possible outcomes.
- Divide the number of favourable outcomes by the number of possible outcomes:

$$\Pr(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{number of possible outcomes}} = \frac{FO}{PO}$$



| | | |
|----------|--------------------------|---|
| Example: | Experiment | throwing a standard die |
| | Event | throwing a number greater than 4 |
| | Possible outcomes (PO) | 6 (throwing a 1, 2, 3, 4, 5 or a 6) |
| | Favourable outcomes (FO) | 2 (throwing a 5 or a 6) |
| | Probability (Pr) | 2 out of 6 = $\frac{2}{6}$ (FO out of PO) |

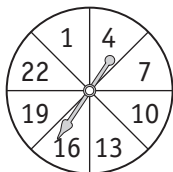


Hints: Probability ranges from 0 to 1.

The closer the probability is to 1, the more likely the event is to happen.

The closer the probability is to 0, the more unlikely the event is to happen.

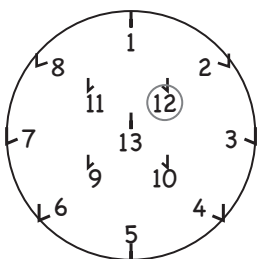
- Q.** When a spinner is spun, what is the probability of spinning a number greater than 10? [Give your answer as a fraction in simplest form.]



- A.** $FO = 4$ (13, 16, 19, 22)
 $PO = 8$ (1, 4, 7, 10, 13, 16, 19, 22)

$$\begin{aligned} \Pr(\text{number} > 10) &= \frac{FO}{PO} \\ &= \frac{4}{8} \\ &= \frac{1}{2} \end{aligned}$$

- a)** A hookey ring is thrown. What is the probability of hooking an even number? [Give your answer as a fraction.]

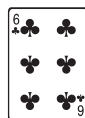


$$FO = 6 \quad (2, 4, 6, 8, 10, 12)$$

$$PO = 13 \quad (1 \text{ to } 13)$$

$$\Pr(\text{even number}) = \frac{FO}{PO} = \boxed{}$$

- b)** A 52 card deck of playing cards is shuffled and one card is dealt from the top of the deck. What is the probability that it will be a black card? [Give your answer as a fraction in simplest form.]



$$FO =$$

$$PO =$$

$$\Pr(\text{black card}) = \frac{FO}{PO} = \boxed{}$$

- c) When a die is rolled, what is the probability of rolling an even number?
[Give your answer as a fraction in simplest form.]

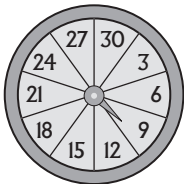


$FO =$

$PO =$

$Pr(\text{even number}) = \frac{FO}{PO} =$

- e) A spinner is divided into 10 equal parts. When it is spun once, what is the probability of spinning an odd number?
[Give your answer as a fraction in simplest form.]



$FO =$

$PO =$

$Pr(\text{odd number}) = \frac{FO}{PO} =$

- g) A 52 card deck of playing cards is shuffled and one card is dealt from the top of the deck. What is the probability that it will be a King? [Give your answer as a fraction in simplest form.]

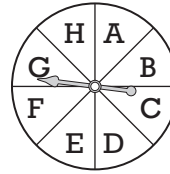


$FO =$

$PO =$

$Pr(\text{king}) = \frac{FO}{PO} =$

- d) When a spinner is spun, what is the probability of spinning a G?
[Give your answer as a fraction.]

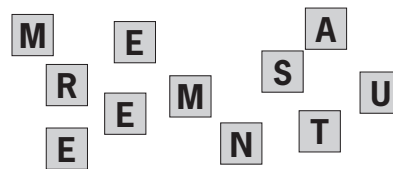


$FO =$

$PO =$

$Pr(\text{spinning a G}) = \frac{FO}{PO} =$

- f) If a letter tile is chosen at random, find the probability of choosing letter M.
[Give your answer as a fraction.]



$FO =$

$PO =$

$Pr(\text{letter M}) = \frac{FO}{PO} =$

- h) A day is randomly selected from the month of November. What is the probability that it will be a holiday?
[Give your answer as a fraction in simplest form.]

| November | | | | | | |
|----------|-----|-----|-----|-----|-----|-----|
| SUN | MON | TUE | WED | THU | FRI | SAT |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | | | | | |

× holiday

$FO =$

$PO =$

$Pr(\text{holiday}) = \frac{FO}{PO} =$

- i) A bag contains 20 keys, one of which opens the door to the prize car. One key is randomly selected from the bag. What is the probability of selecting the winning key? [Give your answer as a fraction.]

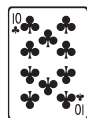


$FO =$
.....

$PO =$
.....

$Pr(\text{winning key}) = \frac{FO}{PO} =$

- j) A 52 card deck of playing cards is shuffled and one card is dealt from the top of the deck. What is the probability that it will be a club? [Give your answer as a fraction in simplest form.]



$FO =$
.....

$PO =$
.....

$Pr(\text{club}) =$ $=$ $=$

- k) A 52 card deck of playing cards is shuffled and one card is dealt from the top of the deck. What is the probability that it will be a red card? [Give your answer as a fraction in simplest form.]

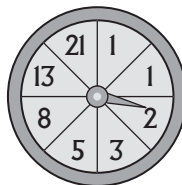


$FO =$
.....

$PO =$
.....

$Pr(\text{red card}) =$ $=$ $=$

- l) A spinner is divided into 8 equal parts. When it is spun once, what is the probability of spinning an even number? [Give your answer as a fraction in simplest form.]

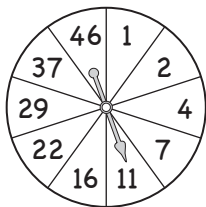


$FO =$
.....

$PO =$
.....

$Pr(\text{even number}) =$ $=$ $=$

- m) When the spinner is spun once, what is the probability of spinning a prime number? [Give your answer as a fraction in simplest form.]

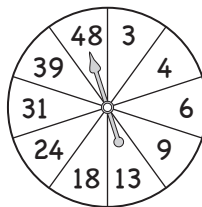


$FO =$
.....

$PO =$
.....

$Pr(\text{prime number}) =$ $=$ $=$

- n) When the spinner is spun once, what is the probability of spinning a composite number? [Give your answer as a fraction.]



$FO =$
.....

$PO =$
.....

$Pr(\text{composite number}) =$ $=$

o) There are 8 horses, 10 dogs, 6 chickens and 12 pigs in a yard. If an animal is selected at random, what is the probability that a chicken is chosen?
[Give your answer as a fraction in simplest form.]

.....
.....
.....

p) Ten balls numbered 1 to 10 are mixed together and then one ball is drawn. Find the probability that a number less than 5 is drawn. [Give your answer as a fraction in simplest form.]

.....
.....
.....

q) There are 7 tomato soup cans, 3 chicken soup cans, 5 vegetable soup cans and 3 pumpkin soup cans in the cupboard. If a can is chosen at random, what is the probability that it is a chicken soup can?
[Give your answer as a fraction in simplest form.]

.....
.....
.....

r) Mia has a bag that contains 7 blue, 5 white, 12 green and 6 yellow marbles. If Mia is randomly selecting a marble, what is the probability that she chooses a green marble? [Give your answer as a fraction in simplest form.]

.....
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.....

Q. Which event is most unlikely to happen?
A) choosing a spade from a deck of 52 playing cards
B) rolling a '4' on a standard die
C) selecting a white marble from a bag of 8 black and 2 white marbles

A. Consider each alternative:
a) 13 spades in 52 cards = $\frac{13}{52} = \frac{1}{4}$ *Simplify: ÷ 13*
b) 1 four on a 6 sided die = $\frac{1}{6}$ *Least likely*
c) 2 white marbles out of 10 = $\frac{2}{10} = \frac{1}{5}$ *Simplify: ÷ 2*
⇒ **B**

s) Which event is most unlikely to happen?
A) rolling a '6' on a standard die
B) drawing a diamond from a deck of 52 playing cards
C) predicting 'boy' for an unborn baby

.....
.....
.....

=

t) Which event is most likely to happen?
A) choosing 'false' as the answer
B) selecting the winner in a 10 horse race
C) scoring the only touchdown in a game of football

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.....
.....

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u) Which event is most likely to happen?

- A) winning the jackpot in a lottery
- B) rolling an odd number on a die
- C) selecting a consonant from the word GEOMETRY

.....

.....

..... =

v) Which event is most likely to happen?

- A) turning 'heads' on a tossed coin
- B) serving an ace ten times in a row
- C) rolling a number greater than 1 on a standard die

.....

.....

..... =

w) Which event is most unlikely to happen?

- A) marking a 'cross' playing *noughts and crosses*
- B) selecting an even number from the numbers 1 to 8
- C) throwing a 13 on a hookey board marked 1 to 13

.....

.....

..... =

x) Which event does **not** have a 50% chance of success?

- A) drawing a red card from a deck of 52 playing cards
- B) throwing a bullseye on a dartboard
- C) marking a 'nought' in *noughts and crosses*

.....

.....

..... =

y) Which event is most likely to happen?

- A) selecting 'red' from the 7 colours of the rainbow
- B) moving a pawn at the start of a chess game
- C) randomly hitting a key on a keyboard and it being the 'tab' key

.....

.....

..... =

z) Which event is most likely to happen?

- A) choosing a prime number from the numbers 2 to 7
- B) winning a car in a raffle
- C) selecting a vowel from the word PROBABILITY

.....

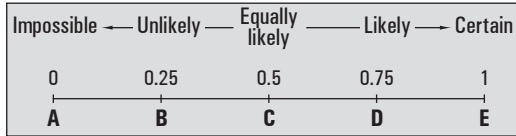
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Skill 30.6 Calculating the probability of a simple event using probability scales.

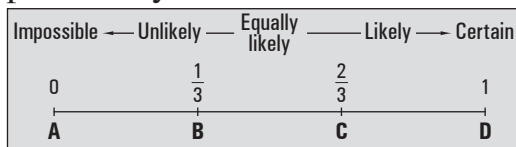
- Divide the number of favourable outcomes (FO) by the number of possible outcomes (PO). (see skill 30.5, page 316)

Q. ‘A coin is tossed and tails comes up.’
Which letter A to E best represents the probability of the event?



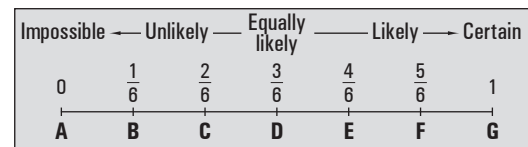
A. $FO = 1$ (tails) $PO = 2$ (heads or tails)
 $Pr(\text{event}) = \frac{FO}{PO}$
 $= \frac{1}{2}$
 $= 0.5$
The answer is **C**

a) ‘A blue tile will be drawn from a box containing 8 black tiles and 4 blue tiles.’
Which letter A to D best represents the probability of the event?



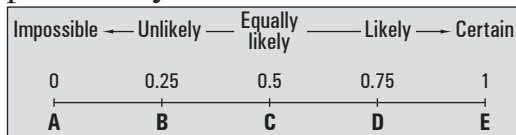
$FO = 4$ $PO = 12$
 $\frac{FO}{PO} = \frac{4}{12} = \frac{1}{3}$ (simplify: $\div 4$) \Rightarrow

b) ‘A die is rolled and a 6 comes up.’
Which letter A to G best represents the probability of the event?



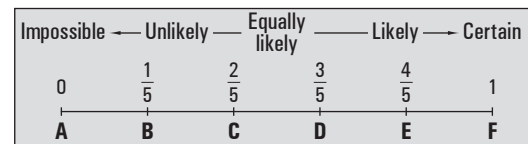
$FO =$ $PO =$
 $\frac{FO}{PO} =$ \Rightarrow

c) ‘A caramel chocolate will be drawn from a box containing 12 caramel and 4 spearmint chocolates.’
Which letter A to E best represents the probability of the event?



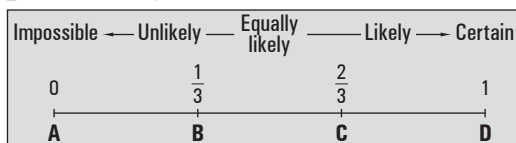
$FO =$ $PO =$
 $=$ \Rightarrow

d) ‘A 5-sided pencil is rolled and the logo, printed on 1 side, comes up.’
Which letter A to F best represents the probability of the event?



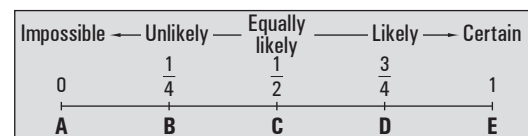
$FO =$ $PO =$
 $=$ \Rightarrow

e) ‘A red marble will be drawn from a bag containing 3 red and 6 blue marbles.’
Which letter A to D best represents the probability of the event?



$FO =$ $PO =$
 $=$ \Rightarrow

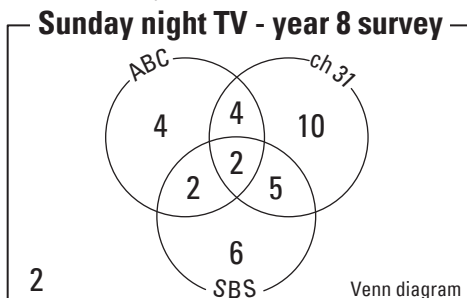
f) ‘A club is drawn from a pack of 52 playing cards.’
Which letter A to E best represents the probability of the event?



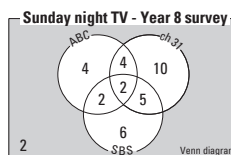
$FO =$ $PO =$
 $=$ \Rightarrow

- Count the total number of possible outcomes.
- Shade the areas inside the Venn diagram that fit the description for favourable outcomes.
- Use the formula for the probability of an event.

Q. What is the probability that a student selected at random from the year 8 class did not watch any Sunday night TV? [Give your answer as a fraction.]

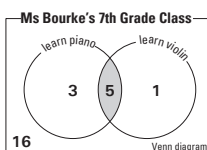
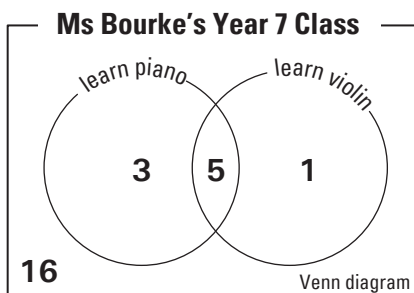


A. $FO = 2$
 $PO = 4 + 4 + 2 + 2 + 10 + 5 + 6 + 2 = 35$
 $Pr(event) = \frac{FO}{PO} = \frac{2}{35}$

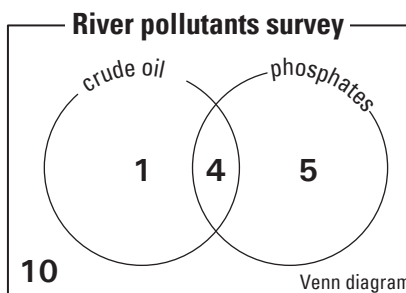


Students who do not watch TV are shown in the shaded area. Students who do watch TV are shown in the white area.

a) What is the probability that a student chosen at random from Ms Bourke's class learns both piano and violin? [Give your answer as a fraction in simplest form.]



b) What is the probability that a surveyed river, visited at random, contained only phosphate pollutants? [Give your answer as a fraction in simplest form.]



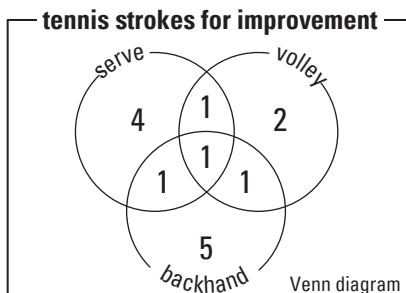
$FO = 5$ $PO = 16 + 3 + 5 + 1 = 25$

$Pr(event) = \frac{FO}{PO} = \frac{5}{25} = \frac{1}{5}$

$FO =$ $PO =$

$Pr(event) = \frac{\quad}{\quad} = \frac{\quad}{\quad}$

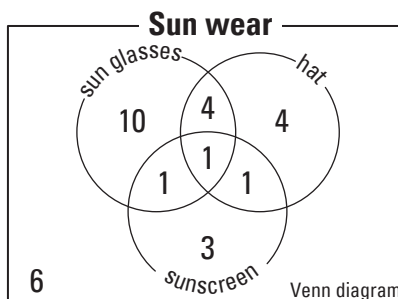
c) What is the probability that a tennis player chosen at random named the serve as the stroke that needs improvement? [Give your answer as a fraction.]



$FO =$ $PO =$

$Pr(event) = \frac{\quad}{\quad} = \frac{\quad}{\quad}$

d) What is the probability that a person chosen at random did not wear sunscreen? [Give your answer as a fraction in simplest form.]



$FO =$ $PO =$

$Pr(event) = \frac{\quad}{\quad} = \frac{\quad}{\quad}$

- Identify and calculate the probability of the event.

$$\Pr(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{number of possible outcomes}} = \frac{FO}{PO}$$

- Identify the complementary events.
- Subtract the probability of the event from 1.

$$\Pr(\text{complementary event}) = 1 - \Pr(\text{event})$$

Hints: The complement of the event “the plane will be on time” is “the plane will not be on time”.
Winning - not winning, voting “yes” - voting “no” are examples of complementary events.

- Q.** A box contains 10 blue, 2 green and 6 white ribbons. If a ribbon is selected at random, find the probability that it is not a green ribbon. [Give your answer as a fraction in simplest form.]

A. *Event = green*
Complementary event = not a green

$$\Pr(\text{green}) = \frac{2}{18}$$

$$\Pr(\text{not green}) = 1 - \frac{2}{18}$$

$$= \frac{18}{18} - \frac{2}{18} = \frac{16}{18} = \frac{8}{9} = 0.\dot{8}$$

- a)** The probability of an earthquake of 7.5 magnitude occurring in San Francisco in any year is 2%. What is the probability of there being no earthquake in San Francisco next year? [Give your answer as a percentage.]

$$\Pr(\text{earthquake}) = 2\%$$

$$\Pr(\text{no earthquake}) = 100\% - 2\% = \boxed{}$$

- b)** The cookie jar contains 12 cookies of which 4 are burnt. What is the probability of Leah choosing a cookie that is not burnt? [Give your answer as a fraction in simplest form.]

$$\Pr(\text{burnt}) =$$

$$\Pr(\text{not burnt}) = = \boxed{}$$

- c)** A bag contains gold and silver discs. The probability of choosing a gold disc is $\frac{2}{5}$. What is the probability of not choosing a gold disc? [Give your answer as a fraction.]

$$\Pr(\text{gold}) =$$

$$\Pr(\text{not gold}) = = \boxed{}$$

- d)** Ten balls numbered 1 to 10 are mixed together and then one ball is drawn. Find the probability that the number drawn is not a perfect square (i.e. 1, 4 or 9). [Give your answer as a fraction.]

$$\Pr(\text{perfect square}) =$$

$$\Pr(\text{not perfect square}) = = \boxed{}$$

- e)** A ballot box contains 20 liberal, 12 green and 18 labor votes. If one vote is picked at random, what is the probability that it is not labor? [Give your answer as a fraction in simplest form.]

$$ = \boxed{}$$

- f)** Of the New Zealand families who have children, 41% have one child and 36% have two children. What is the probability that a New Zealand family with children, when selected at random, has more than two children? [Give your answer as a percentage.]

$$ = \boxed{}$$

Skill 30.9 Calculating the probability of mutually exclusive events.

MM4.2 11 22 33 44
MM5.1 11 22 33 44

- Find the probability of each event.

$$\Pr(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{number of possible outcomes}} = \frac{FO}{PO}$$

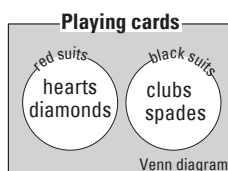
- Add the probabilities of each event in order to find the probability of both events occurring.

$$\Pr(A \text{ and } B) = \Pr(A) + \Pr(B)$$

- Simplify the fraction where necessary.

Hint: Mutually exclusive events cannot occur at the same time.

Example: A card selected from a pack of playing cards can either be red or black, but not both.



- Q.** A stable contains 3 mares, 1 stallion and 8 geldings. If a horse is selected at random, find the probability that it is a mare or a gelding. [Give your answer as a fraction.]

A. $Pr(M) = \frac{3}{12}$
 $Pr(G) = \frac{8}{12}$
 $Pr(M \text{ or } G) = Pr(M) + Pr(G)$
 $= \frac{3}{12} + \frac{8}{12}$
 $= \frac{11}{12}$

- a)** What is the probability of drawing a red card or a club from a pack of cards?

[Give your answer as a fraction in simplest form.]

$$Pr(\text{red}) = \frac{26}{52} \quad Pr(\text{club}) = \frac{13}{52}$$

$$Pr(\text{red or club}) = Pr(\text{red}) + Pr(\text{club})$$

$$= \frac{26}{52} + \frac{13}{52} = \frac{39}{52} = \frac{3}{4}$$

- b)** When a die is rolled, what is the probability of rolling a 5 or a 6?



[Give your answer as a fraction in simplest form.]

$$Pr(5) = \quad Pr(6) =$$

$$Pr(5 \text{ or } 6) = Pr(5) + Pr(6)$$

$$= \quad =$$

- c)** In the lucky dip box there are 5 lolly bags, 4 marble bags and 3 sand bags. If a bag is selected at random, find the probability that it is a lolly or a marble bag. [Give your answer as a fraction in simplest form.]

$$Pr(\text{lolly}) = \quad Pr(\text{marble}) =$$

$$Pr(\text{lolly or marble}) = Pr(\text{lolly}) + Pr(\text{marble})$$

$$= \quad =$$

- d)** When a die is rolled, what is the probability of rolling an odd number or an even number? [Give your answer as a fraction in simplest form.]

.....

$$Pr(\text{odd or even}) = Pr(\text{odd}) + Pr(\text{even})$$

$$= \quad =$$

Skill 30.10 Finding the possible outcomes of an event by applying the counting principle.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

- Multiply the number of possibilities in event 1 by the number of possibilities in event 2.
Hint: The counting principle can be extended to 3 or more events.

Q. Maria chose 1 chemistry class, 1 maths class, 1 history class and 1 English class. According to the schedule she has 2 different chemistry classes, 4 different maths classes, 3 different history classes and 3 different English classes to choose from. If no scheduling conflicts exist, how many different 4-course selections can Maria make?

A. *Number of 4-course selections*
 $= 2 \times 4 \times 3 \times 3$
 $= 72$

a) How many different 3-digit numbers can be made from the digits 4, 5, 6, 7 and 8, if a digit can appear just once?

$$N = 5 \times 4 \times 3 = \boxed{60}$$

5 digits in 1st position, 4 digits in 2nd position, 3 digits in 3rd position

b) In how many ways can a family of five stand in a line for a photograph?

$$N = \dots = \boxed{}$$

c) A coin and a six-sided die are tossed. How many results are possible?

$$N = \dots = \boxed{}$$

d) How many 4-digit numbers can be formed with the digits 1, 2, 3 and 4 if no digit can be used more than once?

$$N = \dots = \boxed{}$$

e) Two coins and one five-sided die are tossed. How many results are possible?

$$N = \dots = \boxed{}$$

f) In how many ways can six books be arranged on a shelf?

$$N = \dots = \boxed{}$$

g) How many possible outfits can be created with 3 different dresses, 5 different vests and 2 different pairs of shoes?

$$N = \dots = \boxed{}$$

h) Using one of each kind of ingredient, how many hamburger combinations can be made with 3 different kinds of bread, 6 different fillings and 2 different sauces?

$$N = \dots = \boxed{}$$

i) In how many ways can a coach select two emergencies from a total of five players?

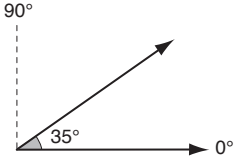
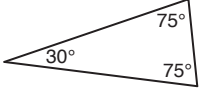

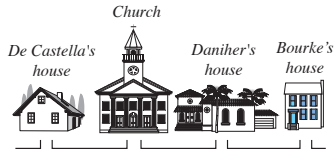


$$N = \dots = \boxed{}$$

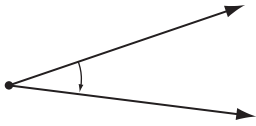


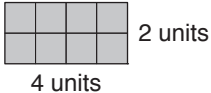
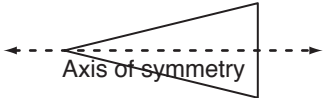
j) In how many ways can any 4 of the vowels be grouped assuming they are not repeated?


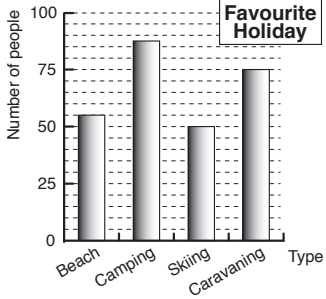
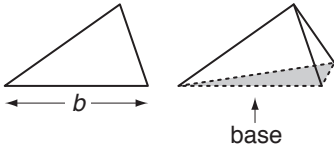
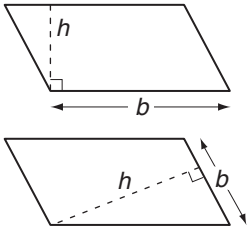
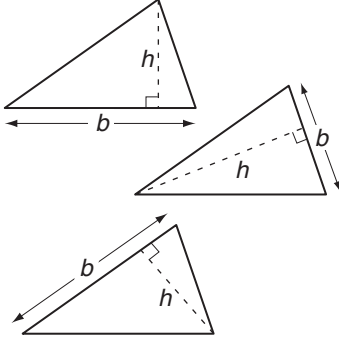


$$N = \dots = \boxed{}$$




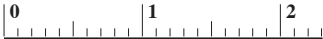
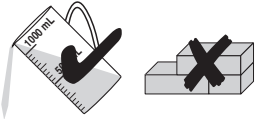

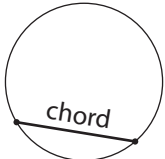

GLOSSARY

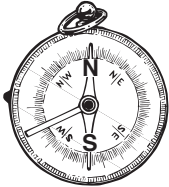
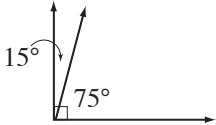
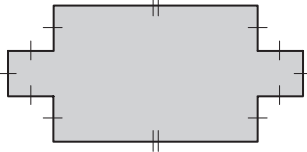

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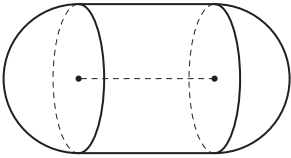
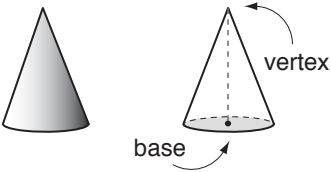
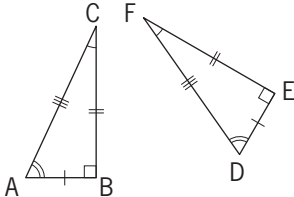

| TERMS | DEFINITIONS | EXAMPLES |
|------------------------------|---|--|
| accuracy | <ul style="list-style-type: none"> A measure of how close the result of a measuring comes to the true value. | 3.14 is a fairly accurate estimation of π . |
| acute angle | <ul style="list-style-type: none"> An <i>angle</i> measuring less than 90°. |  |
| acute-angled triangle | <ul style="list-style-type: none"> A <i>triangle</i> in which every <i>angle</i> measures less than 90°. |  |
| add (+) | <ul style="list-style-type: none"> To join together. | <p>If you add 1 black cow and 2 white cows, there are $1 + 2 = 3$ cows altogether.</p>  |
| addition | <ul style="list-style-type: none"> The <i>operation</i> of finding the total or sum of two or more numbers to make one number. The result is called the <i>sum</i> or <i>total</i>. | <p>Adding 15 and 6 we reach a total (sum) of 21. $15 + 6 = 21$</p> |
| adjacent | <ul style="list-style-type: none"> Immediately next to. | <p>The Daniher's live adjacent to the Bourke's.</p>  |
| algebra | <ul style="list-style-type: none"> A branch of Mathematics where numbers are represented by letters or symbols, called <i>variables</i>. | <p>$x + x = 6$, so x equals 3 $\clubsuit \div 3 = 12$, so \clubsuit equals 36</p> |
| am (ante meridiem) | <ul style="list-style-type: none"> The <i>time</i> from midnight to midday (morning). |  |
| analogue clock | <ul style="list-style-type: none"> A clock or watch that has rotating hands and shows 12 <i>hour time</i>. |  |

| | | |
|---|---|---|
| angle | <ul style="list-style-type: none"> • The amount of turning between two straight <i>lines</i> that are fixed at a <i>point</i>. • An angle is measured in <i>degrees</i>. |  |
| annual | <ul style="list-style-type: none"> • Happening <i>once a year</i>. |  |
| anticlockwise | <ul style="list-style-type: none"> • Moving in the <i>opposite direction</i> to the hands on a clock. |  |
| approximate | <ul style="list-style-type: none"> • Very close to the actual size. • To <i>estimate</i> by <i>rounding off</i>. | <p>If you have \$24.85 in your wallet, you can say you have approximately \$25.00</p> |
| area | <ul style="list-style-type: none"> • The amount of surface covered by a <i>2D shape</i>. • Area is measured in <i>square units</i>, e.g. square centimetres (cm²) or square metres (m²). | <p>The area of a rectangle is calculated by multiplying length (<i>l</i>) by width (<i>w</i>):</p> $A = lw$ $= 4 \times 2$ $= 8$ <p>Area = 8 square units</p>  |
| ascending order | <ul style="list-style-type: none"> • Arranged from smallest to largest. • Becoming larger, greater or higher. | <p>3, 5 and 7 are in ascending order.</p> |
| associative property of addition and multiplication | <ul style="list-style-type: none"> • Rule: When <i>adding</i> or <i>multiplying</i>, no matter how the numbers are grouped, the answers will always be the same. | $a + (b + c) = (a + b) + c$ $1 + (3 + 4) = (1 + 3) + 4$ $8 = 8$ <p style="text-align: right;">“+”</p> $a \times (b \times c) = (a \times b) \times c$ $1 \times (3 \times 4) = (1 \times 3) \times 4$ $12 = 12$ <p style="text-align: right;">“×”</p> |
| average | <ul style="list-style-type: none"> • Or <i>mean</i>, is the total of all scores divided by how many scores there are. • The number that could be used to replace every number in a set of numbers without changing the <i>sum</i> for the <i>set</i>. | <p>The average of 5, 7 and 9 is 7. $5 + 7 + 9 = 21$ and $21 \div 3 = 7$ So $7 + 7 + 7 = 21$</p> |
| average speed | <ul style="list-style-type: none"> • See <i>speed</i>. | |
| axis of symmetry | <ul style="list-style-type: none"> • (pl. axes) See <i>line of symmetry</i>. |  |

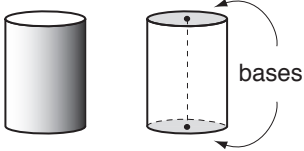
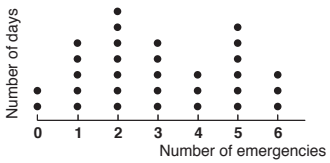

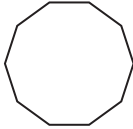
| <p>backwards</p> | <ul style="list-style-type: none"> • Away from your front. • In reverse of the usual way. |  | | | | | | | | | | |
|---------------------------------------|--|--|------|------------------|-------|----|---------|----|--------|----|------------|----|
| <p>balance (money)</p> | <ul style="list-style-type: none"> • The amount of money remaining in a bank account after all transactions have been completed. | <p>The bank account held \$32. After \$12 was withdrawn the balance of the account was \$20.</p> | | | | | | | | | | |
| <p>bar graph</p> | <ul style="list-style-type: none"> • A graph using <i>columns</i> to show quantities or numbers so they can be easily compared. | <p>Camping is the favourite holiday.</p>  <table border="1"> <caption>Favourite Holiday</caption> <thead> <tr> <th>Type</th> <th>Number of people</th> </tr> </thead> <tbody> <tr> <td>Beach</td> <td>55</td> </tr> <tr> <td>Camping</td> <td>85</td> </tr> <tr> <td>Skiing</td> <td>50</td> </tr> <tr> <td>Caravaning</td> <td>75</td> </tr> </tbody> </table> | Type | Number of people | Beach | 55 | Camping | 85 | Skiing | 50 | Caravaning | 75 |
| Type | Number of people | | | | | | | | | | | |
| Beach | 55 | | | | | | | | | | | |
| Camping | 85 | | | | | | | | | | | |
| Skiing | 50 | | | | | | | | | | | |
| Caravaning | 75 | | | | | | | | | | | |
| <p>base</p> | <ul style="list-style-type: none"> • A <i>line</i> or surface on which a figure stands. |  | | | | | | | | | | |
| <p>base of a parallelogram</p> | <ul style="list-style-type: none"> • The base (<i>b</i>) of a <i>parallelogram</i> is the <i>length</i> of any of its <i>sides</i>. |  | | | | | | | | | | |
| <p>base of a triangle</p> | <ul style="list-style-type: none"> • The base (<i>b</i>) of a <i>triangle</i> is the <i>length</i> of any of its <i>sides</i>. |  | | | | | | | | | | |
| <p>between</p> | <ul style="list-style-type: none"> • At a place bounded by two or more places. | <p>The child is between her parents.</p>  | | | | | | | | | | |
| <p>bi</p> | <ul style="list-style-type: none"> • (or di) Prefix meaning two. | <p>A bicycle has 2 wheels.</p>  | | | | | | | | | | |

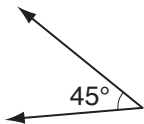
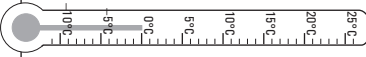
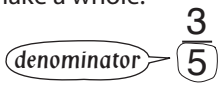
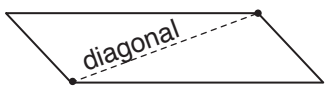
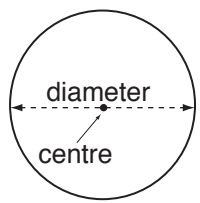
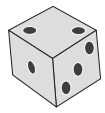
| | | |
|------------------------|---|---|
| bisect | <ul style="list-style-type: none"> To split into two <i>equal</i> parts. | $AM = MB$  |
| brackets () | <ul style="list-style-type: none"> A <i>pair</i> of symbols used to enclose a mathematical <i>expression</i>. | $(12 - 4) \div 2 = 4$ Brackets group 12 take away 4. |
| calculate | <ul style="list-style-type: none"> To find the exact value of mathematical operations. | $3 + 5 + 6 = 14$  |
| calendar | <ul style="list-style-type: none"> A <i>time</i> chart that tells us what <i>day</i>, <i>week</i>, <i>month</i> and <i>year</i> it is. |  |
| calibration | <ul style="list-style-type: none"> A mark on a <i>scale</i>. |  |
| cancel | <ul style="list-style-type: none"> To strike out an <i>equal term</i> on each side of an <i>equation</i>. | $x - 3 = 6$ cancel -3 by adding 3 to both sides of the equation $x - \cancel{3} + \cancel{3} = 6 + 3$ $-3 + 3 = 0$ $x = 9$ |
| capacity | <ul style="list-style-type: none"> Or <i>volume</i>, is the measure of the amount of liquid a container can hold. | A jug has capacity because it can hold liquid, a brick does not.  |
| Cartesian plane | <ul style="list-style-type: none"> See <i>coordinate plane</i>. | |
| chance | <ul style="list-style-type: none"> The likelihood that a particular result or <i>outcome</i> will occur. | The chance of rolling a 2 with a standard die is 1 in 6.  |
| chord | <ul style="list-style-type: none"> A <i>line segment</i> on the <i>interior</i> of a <i>circle</i>. A chord has both end points on the <i>circumference</i> of the circle. |  |
| closest | <ul style="list-style-type: none"> Nearest to. | The son is closest to the mother.  |
| coefficient | <ul style="list-style-type: none"> The number which multiplies a <i>variable</i>. | 3 is the coefficient of $3x$ 6 is the coefficient of $6y^4$ |


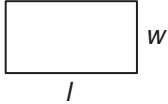
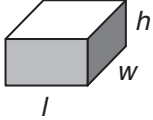

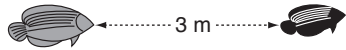
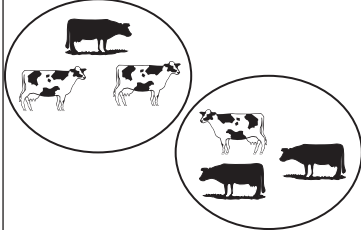
| column | <ul style="list-style-type: none"> • A <i>vertical</i> line of <i>data</i> in a table. | <p>Medal Tally - Beijing Olympics 2008</p> <table border="1"> <thead> <tr> <th>COUNTRY</th> <th>Gold</th> <th>Silver</th> <th>Bronze</th> </tr> </thead> <tbody> <tr> <td>China</td> <td>51</td> <td>21</td> <td>28</td> </tr> <tr> <td>United States</td> <td>36</td> <td>38</td> <td>36</td> </tr> <tr> <td>Russia</td> <td>23</td> <td>21</td> <td>28</td> </tr> <tr> <td>Great Britain</td> <td>19</td> <td>13</td> <td>15</td> </tr> <tr> <td>Germany</td> <td>16</td> <td>10</td> <td>15</td> </tr> <tr> <td>Australia</td> <td>14</td> <td>15</td> <td>17</td> </tr> </tbody> </table> <p style="text-align: center;">↑</p> | COUNTRY | Gold | Silver | Bronze | China | 51 | 21 | 28 | United States | 36 | 38 | 36 | Russia | 23 | 21 | 28 | Great Britain | 19 | 13 | 15 | Germany | 16 | 10 | 15 | Australia | 14 | 15 | 17 |
|-------------------------------|--|---|---------|------|--------|--------|-------|----|----|----|---------------|----|----|----|--------|----|----|----|---------------|----|----|----|---------|----|----|----|-----------|----|----|----|
| COUNTRY | Gold | Silver | Bronze | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| China | 51 | 21 | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| United States | 36 | 38 | 36 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Russia | 23 | 21 | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Great Britain | 19 | 13 | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Germany | 16 | 10 | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Australia | 14 | 15 | 17 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| combinations | <ul style="list-style-type: none"> • A selection of objects from a collection. Order is irrelevant. | A class committee is a combination of 2 boys and 2 girls chosen from a total of 12 boys and 15 girls. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| common factor | <ul style="list-style-type: none"> • A <i>whole number</i> that is a <i>factor</i> of two or more non-zero whole numbers. | The common factors of 18 and 24 are 1, 2, 3 and 6. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| common multiple | <ul style="list-style-type: none"> • A <i>whole number</i> that is a <i>multiple</i> of two or more non-zero <i>whole numbers</i>. | The common multiples of 5 and 6 are 30, 60, 90, | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| compass | <ul style="list-style-type: none"> • An instrument that shows <i>direction</i>. |  | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| complement of an angle | <ul style="list-style-type: none"> • An <i>angle</i> that, when added to the first angle, makes a <i>right angle</i> (or 90° in total). | <p>75° is the complement of 15°, because $75^\circ + 15^\circ = 90^\circ$</p>  | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| complementary event | <ul style="list-style-type: none"> • The <i>opposite</i> of an event. All of the outcomes that are not included in the <i>event</i>. | If the event is "raining" then the complementary event is "not raining". | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| composite number | <ul style="list-style-type: none"> • A <i>positive integer</i> that has <i>factors</i> other than just 1 and the number itself. | <p>12 is a composite number. $12 = 1 \times 12 = 2 \times 6 = 3 \times 4$ The factors of 12 are: 1, 2, 3, 4, 6, 12</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| composite shapes | <ul style="list-style-type: none"> • A combination of two or more <i>2D</i> shapes into one figure. |  <p>The above diagram is the composite of 3 rectangular shapes.</p>  | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

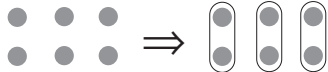
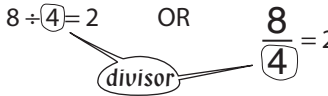
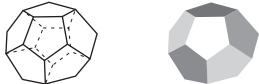
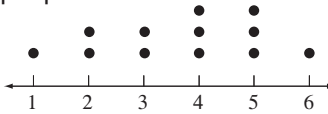
| | | |
|--------------------------------|---|---|
| composite space figures | <ul style="list-style-type: none"> • A combination of two or more <i>3D</i> shapes into one object. |  |
| cone | <ul style="list-style-type: none"> • A <i>solid</i> with one circular base and one <i>vertex</i>. |  |
| congruent shapes | <ul style="list-style-type: none"> • Have exactly the same size and shape. | <p>Triangles ABC and DEF are congruent.</p>  <p>Sides Corresponding sides are congruent: $\overline{AB} \cong \overline{DE}$, $\overline{BC} \cong \overline{EF}$, $\overline{AC} \cong \overline{DF}$</p> <p>Angles Corresponding angles are congruent: $\angle A \cong \angle D$, $\angle B \cong \angle E$, $\angle C \cong \angle F$</p> |
| consecutive numbers | <ul style="list-style-type: none"> • Numbers that follow each other. | <p>4 and 5 are consecutive numbers.</p>  |
| constant term | <ul style="list-style-type: none"> • A <i>term</i> that has a fixed value and does not contain a <i>variable</i>. | <p>In $y = x + 5$ 5 is constant x and y are variables.</p> <p>The speed of light in a vacuum (c) is a constant. $c = 299\,792\,458$ m/s</p> |
| conversion factor | <ul style="list-style-type: none"> • The amount by which you <i>multiply</i> or <i>divide</i> a number to change it to a different <i>unit of measurement</i>. | <p>1 m = 100cm The conversion factor for changing metres to centimetres is 100</p> |
| convert | <ul style="list-style-type: none"> • Change from a <i>unit</i> to another. | <p>25 kg can be converted to 25 000 g.</p> |

| | | |
|--------------------------------|---|--|
| <p>coordinate plane</p> | <ul style="list-style-type: none"> • A <i>plane</i> divided into four <i>quadrants</i> by a <i>horizontal line</i> called the <i>x-axis</i> and a <i>vertical line</i> called the <i>y-axis</i>. | |
| <p>coordinates</p> | <ul style="list-style-type: none"> • An <i>ordered pair</i> of numbers that locate a <i>point</i> on a <i>coordinate plane</i>. • The <i>first</i> number tells you how far from the <i>origin</i> to move along the <i>x-axis</i>. The <i>second</i> tells you how far from the origin to move along the <i>y-axis</i>. • They are written in <i>brackets</i> with a <i>comma</i> in between. | <p>(4,2) are the coordinates of a point located 4 units to the right and 2 units upward from the origin (0,0).</p> |
| <p>counting number</p> | <ul style="list-style-type: none"> • Any of the <i>whole numbers</i> from zero onwards. | <p>0, 1, 2, 3, 4, 5..... are counting numbers.</p> |
| <p>cross multiply</p> | <ul style="list-style-type: none"> • To simplify a <i>proportion</i>, written as two <i>equal fractions</i> OR • To <i>multiply</i> each <i>numerator</i> by the <i>denominator</i> of the fraction across from it. | $a : b = c : d$ $\frac{a}{b} \times \frac{c}{d}$ $a \times d = b \times c$ $ad = bc$ |
| <p>cross section</p> | <ul style="list-style-type: none"> • The <i>shape</i> of the <i>face</i> that results when an object is cut through. | |
| <p>cross simplify</p> | <ul style="list-style-type: none"> • To <i>divide</i> the <i>diagonal numbers</i> (when <i>multiplying two fractions</i>) by the same number to reduce their value before multiplying. | $\frac{3}{4} \times \frac{8}{9} = \frac{\overset{+3}{\cancel{3}} \times \overset{+4}{\cancel{8}}}{\underset{+4}{\cancel{4}} \times \underset{+3}{\cancel{9}}} = \frac{1 \times 2}{1 \times 3} = \frac{2}{3}$ |
| <p>cube</p> | <ul style="list-style-type: none"> • A <i>solid</i> with six identical <i>square</i> faces. | |
| <p>cubed</p> | <ul style="list-style-type: none"> • A number cubed is the third <i>power</i> of the number. | <p>5 cubed = $5^3 = 5 \times 5 \times 5 = 125$</p> |
| <p>cubic unit</p> | <ul style="list-style-type: none"> • A unit of <i>volume</i> expressed in cubic form. | <p>The volume of a solid is measured in the appropriate cubic units, e.g. cm^3 or m^3.</p> |



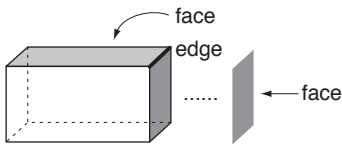
| <p>cylinder</p> | <ul style="list-style-type: none"> • A <i>solid</i> with two <i>parallel</i> circular <i>bases</i> of the same size. |  | | | | | | | | | | | | |
|------------------------------------|---|---|-------------|------------|-------------|---|---|---|---|--|--|--|---|---|
| <p>data</p> | <ul style="list-style-type: none"> • Collection of information that can include facts, numbers or measurements. | <p>HOSPITAL EMERGENCIES (MAY)</p>  | | | | | | | | | | | | |
| <p>day</p> | <ul style="list-style-type: none"> • A <i>unit</i> of <i>time</i> equal to 24 <i>hours</i>. | <p>A day starts and ends at midnight.</p>  | | | | | | | | | | | | |
| <p>daylight saving time</p> | <ul style="list-style-type: none"> • Use of fictitious time in the summer months that prolongs light in the evening hours. | <p>During daylight saving clocks are one hour ahead of real time.</p> | | | | | | | | | | | | |
| <p>deca</p> | <ul style="list-style-type: none"> • Prefix meaning ten. | <p>Decathlon is an athletics contest with ten events.</p> | | | | | | | | | | | | |
| <p>decade</p> | <ul style="list-style-type: none"> • A <i>unit</i> of <i>time</i> equal to 10 <i>years</i>. | <p>2011 to 2020 make a decade.</p> | | | | | | | | | | | | |
| <p>decagon</p> | <ul style="list-style-type: none"> • A shape with 10 <i>sides</i>. |  | | | | | | | | | | | | |
| <p>decimal number</p> | <ul style="list-style-type: none"> • A number based on the ten <i>place value</i> system where a <i>decimal point</i> separates the <i>units</i> and <i>tenths</i>. | <p>The decimal number 4.3 represents: 4 - ones 3 - tenths OR 4 and 3 tenths.</p> | | | | | | | | | | | | |
| <p>decimal place</p> | <table border="1" data-bbox="395 1532 683 1686"> <thead> <tr> <th>units</th> <th>tenths</th> <th>hundredths</th> <th>thousandths</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>.</td> <td>7</td> <td>6</td> </tr> <tr> <td></td> <td></td> <td></td> <td>3</td> </tr> </tbody> </table> | units | tenths | hundredths | thousandths | 0 | . | 7 | 6 | | | | 3 | <p>7 is in the tenths place. 6 is in the hundredths place. 3 is in the thousandths place.</p> |
| units | tenths | hundredths | thousandths | | | | | | | | | | | |
| 0 | . | 7 | 6 | | | | | | | | | | | |
| | | | 3 | | | | | | | | | | | |
| <p>decimal point (.)</p> | <ul style="list-style-type: none"> • A point that separates the <i>units</i> and <i>tenths</i> in a <i>decimal number</i>. | <p>2.5 is a decimal number where the 2 and the 5 are separated by a decimal point.</p> | | | | | | | | | | | | |
| <p>decrease</p> | <ul style="list-style-type: none"> • To make smaller. | <p>8 must decrease by 5 to become 3.</p> | | | | | | | | | | | | |
| <p>deduct</p> | <ul style="list-style-type: none"> • To take away. | <p>If you deduct 1 from 3 there are 2 left. $3 - 1 = 2$</p> | | | | | | | | | | | | |

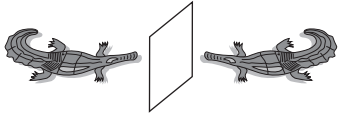

| | | |
|-----------------------------|---|--|
| degree (°) | <ul style="list-style-type: none"> A <i>unit</i> used to measure the amount of turn in an <i>angle</i>. | <p>Angle measures 45°.</p>  |
| degrees Celsius (°C) | <ul style="list-style-type: none"> A <i>unit</i> used to measure temperature on the Celsius scale, used in the metric system. The Celsius (or centigrade) thermometer was invented by Swedish astronomer Anders Celsius in 1742. | <p>0°C = freezing point of water 100°C = boiling point of water 37°C = human body temperature</p>  |
| denominator | <ul style="list-style-type: none"> The number below the fraction bar in a <i>fraction</i>. The number of equal parts in one whole. | <p>Considering fifths, 5 parts would make a whole.</p>  |
| deposit (money) | <ul style="list-style-type: none"> To pay an amount of money into a bank account. | <p>A deposit of \$15 into a bank account with a balance of \$25 will increase the account balance to \$40.</p> |
| descending order | <ul style="list-style-type: none"> Arranged from largest to smallest. Becoming smaller, lesser or lower. | <p>8, 6 and 2 are in descending order.</p> |
| diagonal | <ul style="list-style-type: none"> A straight <i>line</i> inside a <i>polygon</i> joining any two <i>vertices</i> that are not next to each other. |  |
| diameter of a circle | <ul style="list-style-type: none"> A <i>segment</i> that passes through the <i>centre</i> of a <i>circle</i> and has both endpoints on the circle. The diameter of a circle is twice the length of its <i>radius</i>. |  |
| die | <ul style="list-style-type: none"> (pl. dice) A numbered <i>cube</i> that is used in games. A standard die has 1 to 6 pips (dots) on each <i>face</i> with <i>opposite</i> faces adding to 7. |  |
| difference | <ul style="list-style-type: none"> The result when a number is <i>subtracted</i> from another number. The amount by which one number is bigger or smaller than another number. | <p>The difference between 5 and 3 is 2. $5 - 3 = 2$</p> |
| digit | <ul style="list-style-type: none"> Any of the first ten <i>whole numbers</i> from 0 to 9. | <p>There are 10 digits: 0, 1, 2, 3, 4, 5, 6, 7, 8 or 9</p> |
| digit sum | <ul style="list-style-type: none"> The <i>sum</i> of the <i>digits</i> in a number. | <p>124 has a digit sum of 7. $1 + 2 + 4 = 7$</p> |




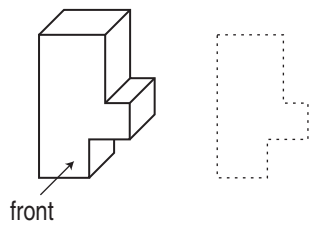
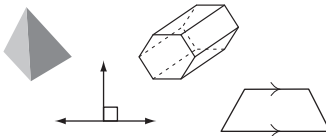

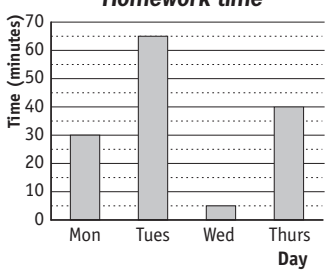
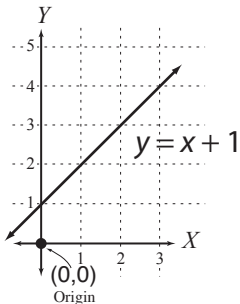
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|--------------------------|---|---|
| digital clock | <ul style="list-style-type: none"> • A clock that uses only numbers to show the <i>time</i>. (No hands!) |  |
| dimension | <ul style="list-style-type: none"> • A measure of size. A <i>two-dimensional</i> shape (2D shape) has <i>length</i> and <i>width</i>. A <i>three-dimensional</i> shape (3D shape) has <i>length</i>, <i>width</i> and <i>height</i>. | <p>2D shape </p> <p>3D shape </p> |
| direction | <ul style="list-style-type: none"> • The way something is placed, pointing or moving. | <p>North, east, south, west, up, down, sideways, backwards and forwards.</p>  |
| discount (money) | <ul style="list-style-type: none"> • An amount <i>subtracted</i> from the regular price of an item to get the sale price. | <p>When \$80 track shoes are on sale at 25% off \Rightarrow discount = 25% of \$80 = \$20.</p> |
| distance | <ul style="list-style-type: none"> • The <i>length</i> between two <i>points</i>. | <p>The distance between the fish is 3 metres.</p>  |
| divide (\div) | <ul style="list-style-type: none"> • To share into groups. | <p>These 6 cows are divided into 2 groups.</p>  <p>$6 \div 2 = 3$ in each group</p> |
| dividend | <ul style="list-style-type: none"> • The first number written in a division. It is the number being divided. In a <i>fraction</i> the dividend is the <i>numerator</i>. | <p>In the division: $144 \div 9 = 16$ the number 144 is called the dividend.</p> |
| divisible | <ul style="list-style-type: none"> • Can be divided without a <i>remainder</i>. | <p>$20 \div 2 = 10$ with 0 remainder. So 20 is divisible by 2 and 10.</p> |

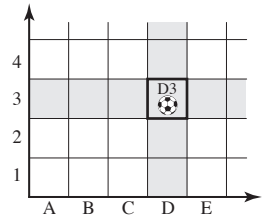



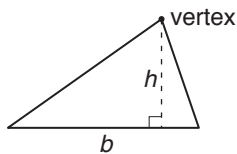

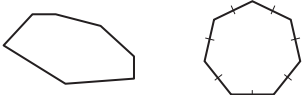
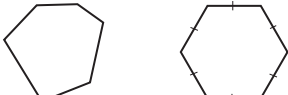
| <p>divisibility tests</p> | <ul style="list-style-type: none"> • Checks performed to help find the <i>factors</i> of a number. | |
|---|---|--|
| <p>Divisibility tests (factor tricks)</p> | | <p>Examples</p> |
| <p>2 is a factor of all even numbers.</p> | | <p>Numbers that end with 0, 2, 4, 6 and 8, e.g. 754, 120</p> |
| <p>3 is a factor of all numbers with a digit sum that is divisible by 3.</p> | | <p>252 has 3 as a factor because $2 + 5 + 2 = 9$ and 9 is divisible by 3.</p> |
| <p>4 is a factor of all numbers where the last two digits are divisible by 4.</p> | | <p>1532 has 4 as a factor because 32 is divisible by 4.</p> |
| <p>5 is a factor of all numbers whose last digit is a 5 or a 0.</p> | | <p>120 and 4935 both have 5 as a factor.</p> |
| <p>6 is a factor of all numbers that have both 2 and 3 as factors.</p> | | <p>102 has 6 as a factor because 2 and 3 are both factors.</p> |
| <p>9 is a factor of all numbers with a digit sum that is divisible by 9.</p> | | <p>1764 has 9 as a factor because $1 + 7 + 6 + 4 = 18$ and 18 is divisible by 9.</p> |
| <p>For 11 to be a factor of a number, the difference between the sum of the even placed digits and the sum of the odd placed digits must be divisible by 11.</p> | | <p>81917 has 11 as a factor because $1 + 1 = 2$ $8 + 9 + 7 = 24$ and $24 - 2 = 22$ which is divisible by 11.</p> |
| <p>For 10, 100, 1000 to be a factor of a number, that number must end in one 0 or two 0's or three 0's, etc.</p> | | <p>270 has 10 as a factor, 1400 has 100 as a factor etc.</p> |
| <p>division</p> | <ul style="list-style-type: none"> • The <i>operation</i> of sharing or grouping a number into <i>equal</i> parts. | <p>The division $6 \div 2 = 3$ means: How many groups of 2 can 6 be divided into? OR How many groups of 2 can be taken from 6 before none remain? \Rightarrow 3 groups of 2.</p>  |
| <p>divisor</p> | <ul style="list-style-type: none"> • The <i>second</i> number written in a <i>division</i>. • It is the number that will divide the <i>dividend</i>. <p>In a <i>fraction</i> the divisor is the <i>denominator</i>.</p> | <p>$8 \div 4 = 2$ OR $\frac{8}{4} = 2$</p>  |
| <p>dodecahedron</p> | <ul style="list-style-type: none"> • A regular <i>solid</i> in which all twelve <i>faces</i> are <i>regular pentagons</i>. |  |
| <p>dot plot</p> | <ul style="list-style-type: none"> • A <i>graph</i> showing the frequency of data, using a <i>number line</i>. • The number line has all the numbers in the <i>sample</i>. Each observation is marked with a point above the <i>line</i>. | <p>A graph using dots to show how many hours are dedicated to sport by 12 people.</p>  <p style="text-align: center;"><i>Hours playing sport</i></p> |

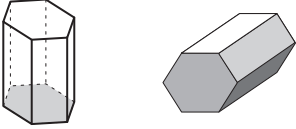
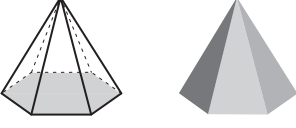

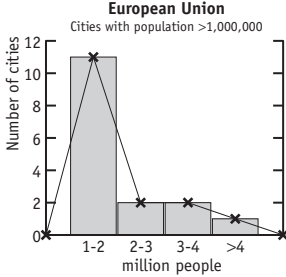

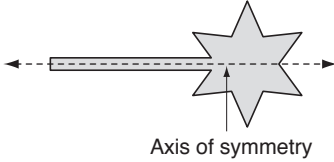
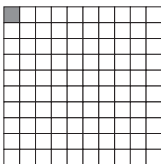
| <p>double</p> | <ul style="list-style-type: none"> • <i>Twice</i> as much. • <i>Multiplied</i> by two. | <p>Double 4 is: $4 + 4 = 8$ OR $4 \times 2 = 8$.</p> | | | | | | | | | | | | | | | | | | |
|------------------------------------|---|---|----------|---------------------|-----------|---------|-------|----|---------|------|-----|--------|------|-----|---------|------|-----|--------|------|-----|
| <p>double bar graph</p> | <ul style="list-style-type: none"> • A <i>bar graph</i> that shows two sets of <i>data</i> on the same graph. | <p>Officially Spoken Languages</p> <table border="1"> <caption>Officially Spoken Languages Data</caption> <thead> <tr> <th>Language</th> <th>Speakers (millions)</th> <th>Countries</th> </tr> </thead> <tbody> <tr> <td>CHINESE</td> <td>~1200</td> <td>~1</td> </tr> <tr> <td>SPANISH</td> <td>~450</td> <td>~20</td> </tr> <tr> <td>ARABIC</td> <td>~300</td> <td>~25</td> </tr> <tr> <td>ENGLISH</td> <td>~350</td> <td>~55</td> </tr> <tr> <td>FRENCH</td> <td>~250</td> <td>~60</td> </tr> </tbody> </table> | Language | Speakers (millions) | Countries | CHINESE | ~1200 | ~1 | SPANISH | ~450 | ~20 | ARABIC | ~300 | ~25 | ENGLISH | ~350 | ~55 | FRENCH | ~250 | ~60 |
| Language | Speakers (millions) | Countries | | | | | | | | | | | | | | | | | | |
| CHINESE | ~1200 | ~1 | | | | | | | | | | | | | | | | | | |
| SPANISH | ~450 | ~20 | | | | | | | | | | | | | | | | | | |
| ARABIC | ~300 | ~25 | | | | | | | | | | | | | | | | | | |
| ENGLISH | ~350 | ~55 | | | | | | | | | | | | | | | | | | |
| FRENCH | ~250 | ~60 | | | | | | | | | | | | | | | | | | |
| <p>east</p> | <ul style="list-style-type: none"> • A <i>compass direction</i>. | <p>The sun rises in the east.</p> | | | | | | | | | | | | | | | | | | |
| <p>edges of a solid</p> | <ul style="list-style-type: none"> • The <i>segment</i> (line part) where two <i>faces of a solid</i> meet. | <p>A rectangular prism has 12 edges.</p> | | | | | | | | | | | | | | | | | | |
| <p>eighth</p> | <ul style="list-style-type: none"> • The position after <i>seventh</i>. | <p>1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th.....</p> | | | | | | | | | | | | | | | | | | |
| <p>elapsed time</p> | <ul style="list-style-type: none"> • The amount of <i>time</i> between the start time and the finish time. | <p>The amount of elapsed time from 2:15 pm to 3:00 pm is 45 minutes.</p> | | | | | | | | | | | | | | | | | | |
| <p>ellipse</p> | <ul style="list-style-type: none"> • A curved shape that looks like a squashed <i>circle</i>. | <p>The orbit of the Earth around the Sun is approximately an ellipse.</p> | | | | | | | | | | | | | | | | | | |
| <p>enlargement</p> | <ul style="list-style-type: none"> • To reproduce and make bigger. | <p>The second object is an enlargement of the first.</p> | | | | | | | | | | | | | | | | | | |
| <p>equal (=)</p> | <ul style="list-style-type: none"> • Exactly the same in value or size. | <p>$7 + 2 = 9$ 100 centimetres is equal to 1 metre: $100 \text{ cm} = 1 \text{ m}$</p> | | | | | | | | | | | | | | | | | | |
| <p>equation</p> | <ul style="list-style-type: none"> • A mathematical sentence formed by placing an <i>equals</i> sign (=) between two <i>expressions</i>. | <p>$6 \times 2 = 9 + 3$ $4x - 5 = 0$ $2y^2 - 2 = 0$ are examples of equations.</p> | | | | | | | | | | | | | | | | | | |
| <p>equilateral triangle</p> | <ul style="list-style-type: none"> • A <i>triangle</i> with all three <i>sides</i> of equal <i>length</i>. | | | | | | | | | | | | | | | | | | | |

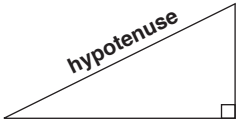

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| equivalent fractions | <ul style="list-style-type: none"> • <i>Fractions</i> that represent the same number. | $\frac{2}{16}$ and $\frac{8}{64}$ are equivalent fractions. They both equal $\frac{1}{8}$. | |
| error | <ul style="list-style-type: none"> • The variation of a measurement. It may be contributed to by the <i>precision</i> of the instrument or the <i>accuracy</i> of the measured value. | "My measuring may be off by 1%!" | |
| estimate | <ul style="list-style-type: none"> • To make a close guess based on <i>rounding</i>. | $48 + 21 = ?$ By rounding to $50 + 20$, the estimation of the sum is 70. | |
| evaluate | <ul style="list-style-type: none"> • To work out the value. | Evaluate: $7 \times 3 - 10 = 21 - 10$ $= 11$ | |
| even numbers | <ul style="list-style-type: none"> • A <i>whole number</i> that can be <i>divided</i> by two. • Even numbers end with 0, 2, 4, 6 or 8. | 134 is an even number. 134 ✓ 431 is not an even number. 431 ✗ | |
| event | <ul style="list-style-type: none"> • Possible <i>outcomes</i> resulting from a particular <i>experiment</i>. | Experiment: A die is rolled. Possible outcomes: Either a 5 or a 6 may result  | |
| expense (money) | <ul style="list-style-type: none"> • The cost involved. | You buy 3 CDs at \$15 each. Your expense is \$45. | |
| experiment | <ul style="list-style-type: none"> • A controlled, repeatable process carried out in the study of <i>probability</i>. | Tossing a coin is an experiment.  | |
| expression | <ul style="list-style-type: none"> • A <i>sequence</i> of numbers and/or <i>variables</i> (letters) connected by <i>operation</i> signs. | $42 \div 3 - 10$ $x + 2y$ $2x^2 - 2$ | are examples of expressions |
| faces of a solid | <ul style="list-style-type: none"> • <i>Polygons</i> that join on their <i>edges</i> to form a <i>solid</i>. | A rectangular prism has 6 rectangular faces.  | |

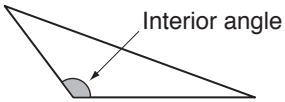
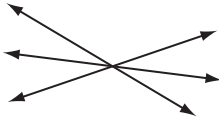

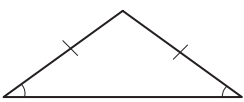

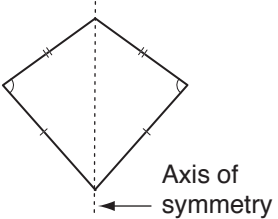
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| <p>factor</p> | <ul style="list-style-type: none"> • When <i>whole numbers</i>, other than zero, are multiplied together, each number is a factor of the <i>product</i>. OR A whole number that divides exactly into another number. See <i>divisibility tests</i>. • To write a number as a <i>product</i> of its <i>factors</i>. • To write an <i>expression</i> as a product of two or more expressions. | <p>Because $1 \times 12 = 12$ $2 \times 6 = 12$ and $3 \times 4 = 12$</p> <p>1, 2, 3, 4, 6 and 12 are all factors of 12.</p> <p>Factor: $3x + 15 = 3(x + 5)$ because $3 = 3 \times 1$ and $15 = 3 \times 5$</p> |
| <p>factor tree</p> | <ul style="list-style-type: none"> • A diagram that shows all possible <i>factors</i> on the different branches of a ‘tree’. It is used to find the <i>prime factors</i> of a number. | <p>The prime factors of 12 are 2 and 3.</p> $ \begin{array}{c} 12 \\ / \quad \backslash \\ 2 \quad \times \quad 6 \\ / \quad \backslash \quad / \quad \backslash \\ 2 \quad \times \quad 2 \quad \times \quad 3 \end{array} $ |
| <p>favourable outcome</p> | <ul style="list-style-type: none"> • The result that you are hoping or testing for. | <p>Experiment: A die is rolled. Event: A number > 2 comes up Favourable outcomes: 3, 4, 5 or 6.</p> |
| <p>fifth</p> | <ul style="list-style-type: none"> • The position after <i>fourth</i>. | <p>1st, 2nd, 3rd, 4th, 5th.....</p> |
| <p>finite</p> | <ul style="list-style-type: none"> • With limits. Able to be counted. | <p>There are a finite number (12) of months in the year.</p> |
| <p>first</p> | <ul style="list-style-type: none"> • Placed before anything else. | <p>The first athlete to cross the finish line won the gold medal.</p> |
| <p>flip</p> | <ul style="list-style-type: none"> • To turn across a line so the result is a mirror image. See <i>reflection</i>. |  |
| <p>formula</p> | <ul style="list-style-type: none"> • (pl. formulae) A mathematical <i>rule</i>, usually an <i>equation</i>, describing a relationship between two or more quantities. For example, the formula describing the area of a circle is $A = \pi r^2$ where A is the symbol for the area and r is the symbol for the <i>radius</i>. | <p>Find the area of a circle of radius 10 cm, using $\pi \approx 3.14$</p> <p>Use the formula $A = \pi r^2$ and substitute $r = 10$ $A = 3.14 \times 10^2$ $= 3.14 \times 100$ $= 314 \text{ cm}^2$</p> |
| <p>fortnight</p> | <ul style="list-style-type: none"> • A <i>unit</i> of <i>time</i> equal to 2 whole <i>weeks</i> or 14 <i>days</i>. |  |


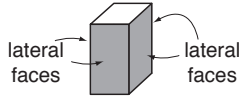
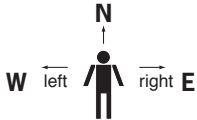
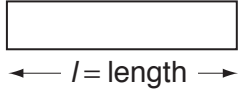
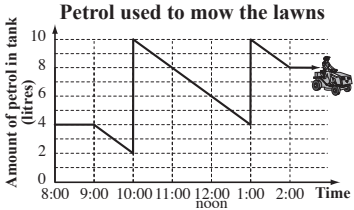
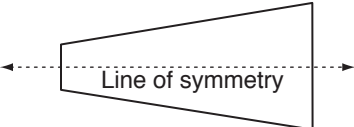
| forwards | <ul style="list-style-type: none"> In the <i>direction</i> of your front. The usual way. |  | | | | | | | | | | |
|------------------------|--|---|-----|----------------|-----|----|------|----|-----|---|-------|----|
| fourth | <ul style="list-style-type: none"> The position after <i>third</i>. | 1st, 2nd, 3rd, 4th | | | | | | | | | | |
| fraction | <ul style="list-style-type: none"> Part of a group. Part of a whole. A number in the form $\frac{a}{b}$ ($b \neq 0$) where a is the <i>numerator</i> and b is the <i>denominator</i>. Fractions can be <i>proper fractions</i> or <i>improper fractions</i>. | <p>5 out of 8 dots are circled.</p>  $\frac{5}{8}$ <p>1 half of a whole orange.</p>  $\frac{1}{2}$ | | | | | | | | | | |
| front view | <ul style="list-style-type: none"> What you see of an object looking from a frontal perspective. <i>Three-dimensional</i> objects have 3 views: front, top and side. |  <p>front</p> | | | | | | | | | | |
| function (f) | <ul style="list-style-type: none"> A relationship or correspondence in which values of one <i>variable</i> determine the values of another: $f(x) = \text{rule}$ or $y = \text{rule}$. | $f(x) = x^2 - 4$ or $y = x^2 - 4$ See rule and linear function. | | | | | | | | | | |
| geometry | <ul style="list-style-type: none"> A branch of Mathematics studying the properties and relations of <i>lines</i>, surfaces and <i>solids</i>. |  | | | | | | | | | | |
| gram (g) | <ul style="list-style-type: none"> A <i>unit</i> of measurement for mass equal to 1000 <i>milligrams</i>. | 250 g of butter.  | | | | | | | | | | |
| graph | <ul style="list-style-type: none"> A diagram that shows a collection of <i>data</i>. | <p>Homework time</p>  <table border="1"> <caption>Homework time data</caption> <thead> <tr> <th>Day</th> <th>Time (minutes)</th> </tr> </thead> <tbody> <tr> <td>Mon</td> <td>30</td> </tr> <tr> <td>Tues</td> <td>65</td> </tr> <tr> <td>Wed</td> <td>5</td> </tr> <tr> <td>Thurs</td> <td>40</td> </tr> </tbody> </table> | Day | Time (minutes) | Mon | 30 | Tues | 65 | Wed | 5 | Thurs | 40 |
| Day | Time (minutes) | | | | | | | | | | | |
| Mon | 30 | | | | | | | | | | | |
| Tues | 65 | | | | | | | | | | | |
| Wed | 5 | | | | | | | | | | | |
| Thurs | 40 | | | | | | | | | | | |
| graph of a rule | <ul style="list-style-type: none"> The picture obtained by plotting all the points of the <i>rule</i>. |  <p>$y = x + 1$</p> <p>Origin (0,0)</p> | | | | | | | | | | |

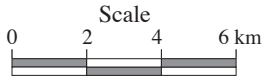



| | | |
|-----------------------------|---|--|
| greater than (>) | <ul style="list-style-type: none"> An <i>inequality symbol</i> showing which is bigger. | $10 > 2$ means 10 is greater than 2. |
| grid reference | <ul style="list-style-type: none"> A pair of letters and/or numbers that describe <i>location</i> within a grid. See also <i>coordinates</i>. | The grid reference for the ball is D3.  |
| half | <ul style="list-style-type: none"> (pl. halves) One of two <i>equal</i> parts expressed as a fraction. | One half is 1 of 2 parts of one whole pizza:  |
| hedron | <ul style="list-style-type: none"> (pl. hedra) Face. | Polyhedron - A solid object that has multiple (poly) faces.  |
| height | <ul style="list-style-type: none"> The <i>vertical</i> distance from top to bottom. | The height of the Taj Mahal is 76 m.  |
| height of a triangle | <ul style="list-style-type: none"> The height (<i>h</i>) is the <i>distance</i> from the <i>vertex</i> to the <i>opposite</i> side of the <i>triangle</i>. |  |
| hemisphere | <ul style="list-style-type: none"> One half of a <i>sphere</i>. |  |
| hepta | <ul style="list-style-type: none"> Prefix meaning seven. | See <i>heptagon</i> |
| heptagon | <ul style="list-style-type: none"> A <i>polygon</i> with 7 sides. |  Heptagon Regular heptagon |
| hexa | <ul style="list-style-type: none"> Prefix meaning six. | See <i>hexagon</i> |
| hexagon | <ul style="list-style-type: none"> A <i>polygon</i> with 6 sides. |  Hexagon Regular hexagon |



| | | | | | | | | | | | | | | | | |
|---|---|---|-----------|----------|------------|-------------|--------|------------|-------------|---|---|---|---|---|---|---|
| <p>hexagonal prism</p> | <ul style="list-style-type: none"> • A <i>three-dimensional</i> shape. Two identical <i>bases</i> are <i>hexagons</i>. Six <i>faces</i> are <i>rectangles</i>. |  | | | | | | | | | | | | | | |
| <p>hexagonal pyramid</p> | <ul style="list-style-type: none"> • A <i>three-dimensional</i> shape. The <i>base</i> is a <i>hexagon</i>. Six <i>faces</i> are <i>triangles</i>. |  | | | | | | | | | | | | | | |
| <p>hexahedron</p> | <ul style="list-style-type: none"> • A <i>regular solid</i>. Six <i>faces</i> are <i>square</i> (<i>cube</i>). |  | | | | | | | | | | | | | | |
| <p>highest common factor (HCF)</p> | <ul style="list-style-type: none"> • The largest number that is a <i>factor</i> of all the given numbers. | <p>Factors of 12: 1, 2, 3, 4, 6, 12 Factors of 30: 1, 2, 3, 5, 6, 10, 15, 30 The HCF of 12 and 30 is 6.</p> | | | | | | | | | | | | | | |
| <p>histogram</p> | <ul style="list-style-type: none"> • A <i>vertical bar graph</i> used to represent the <i>frequency</i> of individual scores. |  | | | | | | | | | | | | | | |
| <p>horizontal line</p> | <ul style="list-style-type: none"> • <i>Parallel</i> to the horizon. |  | | | | | | | | | | | | | | |
| <p>horizontal symmetry</p> | <ul style="list-style-type: none"> • A shape has horizontal symmetry if an <i>axis of symmetry</i> is horizontal. |  | | | | | | | | | | | | | | |
| <p>hour (h)</p> | <ul style="list-style-type: none"> • A <i>unit of time equal</i> to 60 <i>minutes</i>. | <p>One hour is the amount of time between 1 o'clock and 2 o'clock.</p> | | | | | | | | | | | | | | |
| <p>hundreds</p> | <ul style="list-style-type: none"> • The <i>place value</i> between <i>tens</i> and <i>thousands</i>. | <p>1825.763 has 8 hundreds.</p> <table border="1" data-bbox="1182 1738 1538 1883"> <tr> <td>thousands</td> <td>hundreds</td> <td>tens</td> <td>units</td> <td>tenths</td> <td>hundredths</td> <td>thousandths</td> </tr> <tr> <td>1</td> <td>8</td> <td>2</td> <td>5</td> <td>7</td> <td>6</td> <td>3</td> </tr> </table> | thousands | hundreds | tens | units | tenths | hundredths | thousandths | 1 | 8 | 2 | 5 | 7 | 6 | 3 |
| thousands | hundreds | tens | units | tenths | hundredths | thousandths | | | | | | | | | | |
| 1 | 8 | 2 | 5 | 7 | 6 | 3 | | | | | | | | | | |
| <p>hundredth</p> | <ul style="list-style-type: none"> • One part out of 100 parts of one whole. |  | | | | | | | | | | | | | | |







| <p>hundredths</p> | <ul style="list-style-type: none"> The <i>place value</i> between <i>tenths</i> and <i>thousandths</i>. | <p>1825.763 has 6 hundredths.</p> <table border="1" data-bbox="1114 141 1465 286"> <thead> <tr> <th>thousands</th> <th>hundreds</th> <th>tens</th> <th>units</th> <th>tenths</th> <th>hundredths</th> <th>thousandths</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>8</td> <td>2</td> <td>5</td> <td>7</td> <td>6</td> <td>3</td> </tr> </tbody> </table> | thousands | hundreds | tens | units | tenths | hundredths | thousandths | 1 | 8 | 2 | 5 | 7 | 6 | 3 |
|---|--|---|-----------|----------|------------|-------------|--------|------------|-------------|---|---|---|---|---|---|---|
| thousands | hundreds | tens | units | tenths | hundredths | thousandths | | | | | | | | | | |
| 1 | 8 | 2 | 5 | 7 | 6 | 3 | | | | | | | | | | |
| <p>hypotenuse</p> | <ul style="list-style-type: none"> The side <i>opposite</i> the <i>right angle</i> of a <i>right-angled triangle</i>. The longest side of a right-angled triangle. |  | | | | | | | | | | | | | | |
| <p>icosahedron</p> | <ul style="list-style-type: none"> A <i>regular solid</i> in which all twenty <i>faces</i> are <i>equilateral triangles</i>. |  | | | | | | | | | | | | | | |
| <p>improper fraction</p> | <ul style="list-style-type: none"> Any <i>fraction</i> in which the <i>numerator</i> is greater than or equal to the <i>denominator</i>. | <p>$\frac{9}{8}$ the numerator is 9 the denominator is 8. $9 \geq 8$ so $\frac{9}{8}$ is an improper fraction.</p> | | | | | | | | | | | | | | |
| <p>increase</p> | <ul style="list-style-type: none"> To make larger or grow in size. | <p>8 must increase by 5 to get to 13.</p> | | | | | | | | | | | | | | |
| <p>index</p> | <ul style="list-style-type: none"> (pl. indices) A number placed to the upper right of a base number, showing how many times the base number is multiplied by itself. | <p>$7^4 = 7 \times 7 \times 7 \times 7 = 2401$ The index is 4. It is read as 'seven to the power of four'.</p> | | | | | | | | | | | | | | |
| <p>index notation</p> | <ul style="list-style-type: none"> Quantities in the form of a <i>base</i> number and an <i>index</i>. Index notation indicates what <i>power</i> is to be used and makes it easier to use multiple <i>factors</i>. | <p>$3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$ can be more easily written using index notation as 3^7.</p> | | | | | | | | | | | | | | |
| <p>inequality symbols</p> | <ul style="list-style-type: none"> Symbols that tell us how the two objects or <i>expressions</i> in a mathematical sentence are not <i>equal</i>. | <p>$<$, $>$, \leq and \geq are inequality symbols.</p> | | | | | | | | | | | | | | |
| <p>infinite (∞)</p> | <ul style="list-style-type: none"> Has no limits. Unable to be counted. The symbol for infinity is (∞). | <p>There are an infinite number of integers: $-3, -2, -1, 0, 1, 2, 3$</p> | | | | | | | | | | | | | | |
| <p>integer (\mathbb{Z})</p> | <ul style="list-style-type: none"> Any <i>negative number</i>, zero or <i>positive number</i>. | <p>$-3, -2, -1, 0, 1, 2, 3$ are integers. 3.5 and $5\frac{2}{3}$ are not integers.</p> | | | | | | | | | | | | | | |

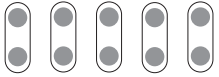

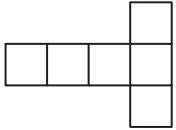




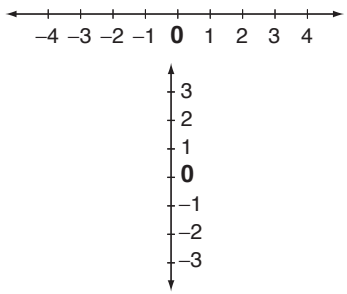
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|---|---|---|--|----------------|------------------------|----------------|------------------------|
| interior angle | <ul style="list-style-type: none"> An <i>angle</i> inside a <i>polygon</i>. |  | | | | | |
| intersecting lines | <ul style="list-style-type: none"> <i>Lines</i> that meet at a <i>point</i>. |  | | | | | |
| inverse of an operation | <ul style="list-style-type: none"> The <i>opposite</i> operation. Operations that undo each other. | + is opposite – × is opposite ÷ | | | | | |
| Operation + | Inverse Operation – | Operation – | Inverse Operation + | Operation × | Inverse Operation ÷ | Operation ÷ | Inverse Operation × |
| $x + 3 = 6$ $x + 3 - 3 = 6 - 3$ $x = 3$ | $x - 3 = 6$ $x - 3 + 3 = 6 + 3$ $x = 9$ | $3x = 6$ $\frac{3x}{3} = \frac{6}{3}$ $x = 2$ | $\frac{x}{3} = 6$ $\frac{x}{3} \times 3 = 6 \times 3$ $x = 18$ | | | | |
| invest (money) | <ul style="list-style-type: none"> To put some form of money at risk to make a <i>profit</i>. | It is common to invest in shares. | | | | | |
| investment (money) | <ul style="list-style-type: none"> The act of laying out some form of money in an enterprise to make a <i>profit</i>. |  | | | | | |
| irrational number | <ul style="list-style-type: none"> A <i>real number</i> that can be written as an infinite non-repeating decimal, but not as a <i>fraction</i>. Not a <i>rational number</i>. | $\pi, \phi, e, \sqrt{2}, \sqrt{3}, \sqrt{5},$ $2.6293045632\dots$ $\cos 30^\circ$ $\tan 60^\circ$ | | | | | |
| isosceles triangle | <ul style="list-style-type: none"> A <i>triangle</i> with two sides of equal length. |  | | | | | |
| kilogram (kg) | <ul style="list-style-type: none"> A <i>unit of weight equal to 1000 grams</i>. | My father weighs 75 kg. | | | | | |
| kilometre (km) | <ul style="list-style-type: none"> A <i>unit of distance equal to 1000 metres</i>. | The distance from Melbourne to Sydney is 925 km.  | | | | | |
| kite | <ul style="list-style-type: none"> A <i>quadrilateral</i> where one <i>diagonal</i> is an <i>axis of symmetry</i>. |  | | | | | |

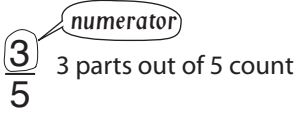

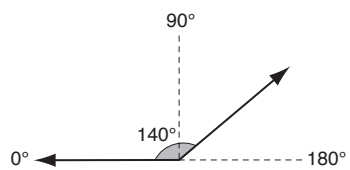
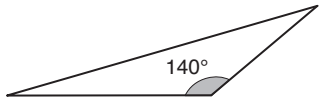

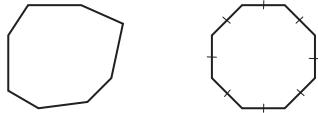
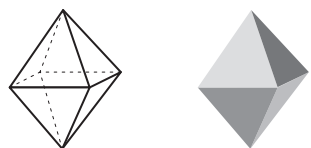
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| <p>largest to smallest</p> | <ul style="list-style-type: none"> • Ranking in order from the biggest to the littlest. |  |
| <p>lateral area</p> | <ul style="list-style-type: none"> • The <i>sum</i> of the area of the <i>lateral faces</i> of a solid. | <p>A rectangular prism has 4 lateral faces.</p> |
| <p>lateral faces</p> | <ul style="list-style-type: none"> • The <i>vertical</i> surfaces on a solid. | <p>A rectangular prism has 4 lateral faces.</p>  |
| <p>leap year</p> | <ul style="list-style-type: none"> • A <i>year</i> with 366 <i>days</i> that falls every <i>fourth</i> year and includes the 29th of February as the extra day. | <p>A leap year is divisible by 4. 2012 is a leap year.</p> |
| <p>left</p> | <ul style="list-style-type: none"> • The <i>direction</i> to the <i>west</i> of your body if you are facing <i>north</i>. |  |
| <p>length</p> | <ul style="list-style-type: none"> • The <i>distance</i> from one end to the other. • How long a shape is. |  |
| <p>less than (<)</p> | <ul style="list-style-type: none"> • An <i>inequality symbol</i> showing which is smaller. | <p>$2 < 10$ means that 2 is less than 10.</p> |
| <p>like terms</p> | <ul style="list-style-type: none"> • <i>Terms</i> that contain the same <i>variables</i> raised to the same <i>power</i>. Only the number parts of like terms can be different. Like terms may be added, subtracted, multiplied or divided. <i>Unlike terms</i> may not be added or subtracted. However, they may be multiplied and divided. | <ul style="list-style-type: none"> • $7, \frac{6}{9}$ and -18 are like terms. • $6a, a$ and $-3a$ are like terms. • $xy^2, 5xy^2$ and $-3xy^2$ are like terms. • $7, 6a$ and $-4y^3$ are not like terms. • $5w, \frac{6}{w}$ and $-18w^2$ are not like terms. |
| <p>line graph</p> | <ul style="list-style-type: none"> • A <i>graph</i> in which <i>points</i> representing <i>data</i> pairs are connected by <i>line segments</i>. It shows how quantities change over <i>time</i>. | <p>Petrol used to mow the lawns</p>  |
| <p>line of symmetry</p> | <ul style="list-style-type: none"> • A <i>line</i> that divides a shape so that one <i>side</i> is a mirror image of the other. Both sides match exactly when folded. |  |

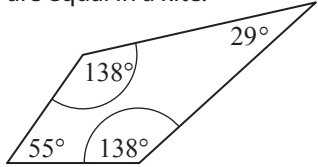
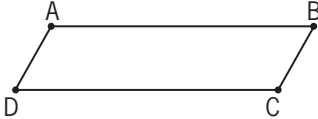
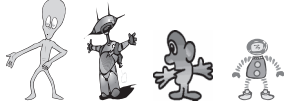
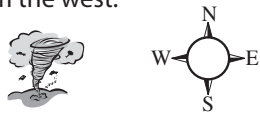
| | | |
|--------------------------------------|---|--|
| linear equation | <ul style="list-style-type: none"> An algebraic <i>expression</i> in which the <i>variable</i> is in the first <i>power</i>. It can be solved for x and the value of x for which the <i>equation</i> is true is called the <i>solution</i>. <p>The <i>graph</i> of a linear equation is always a straight <i>line</i>. See <i>linear rule</i>.</p> | $4x - 2 = x$ is a linear equation. |
| linear rule (linear function) | <ul style="list-style-type: none"> A <i>rule</i> in which the <i>variable</i> is only in the first <i>power</i> and has no <i>products</i>. It can be represented by an <i>equation</i> in the form of $y = ax + b$ where a and b are <i>real numbers</i>. <p>The <i>graph</i> of this rule is a straight line.</p> | <p>Used to describe things like the movement of a car travelling at a constant speed.</p> $y = x + 4$ $y = -4$ $3x - 4y = 0.5$ are linear rules. |
| linear scale | <ul style="list-style-type: none"> A <i>scale</i> shown on a line. <p>Compares the dimensions on a map to real life.</p> | <p>Every cm on the map represents 2 km in real life.</p>  |
| litre (L) | <ul style="list-style-type: none"> A <i>unit of capacity</i> equal to 1000 millilitres. | <p>1 litre of milk.</p>  |
| location | <ul style="list-style-type: none"> The exact place, where something is situated. |  |
| longest | <ul style="list-style-type: none"> Having the biggest <i>length</i>. | <p>The record length for the reticulated python of S-E Asia is 10 m. The specimen was found in Celebes, Indonesia in 1912.</p>  |
| loss (money) | <ul style="list-style-type: none"> A reduction in the value of an investment. Expenses > Revenue | <p>Revenue from a business activity is \$20. If the expenses are \$25 then the loss would be \$5.</p> |
| lowest common denominator | <ul style="list-style-type: none"> The <i>lowest common multiple</i> of the <i>denominators</i> of two or more <i>fractions</i>. | <p>The lowest common denominator of $\frac{2}{3}$ and $\frac{4}{5}$ is the lowest common multiple of 3 and 5, which is 15.</p> |
| lowest common multiple (LCM) | <ul style="list-style-type: none"> The smallest of the common <i>multiples</i> of two or more non-zero <i>whole numbers</i>. | <p>The lowest common multiple of 6 and 9 is the smallest of their common multiples 18, 36, 54 ..., so the LCM of 6 and 9 is 18.</p> |

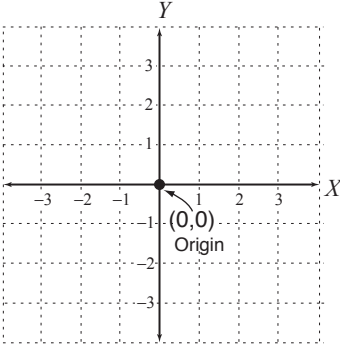

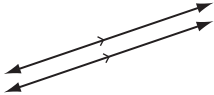


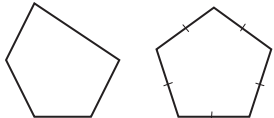
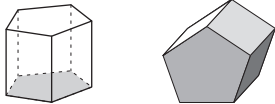

| | | | | | | | | | | | | |
|-------------------------------|--|---|---|-----------------|---|-------------|---|------------|------------|---------------------|----|--|
| <p>magic square</p> | <ul style="list-style-type: none"> • A square grid filled with numbers. • The <i>sum</i> of the numbers in every <i>row</i>, <i>column</i> and <i>diagonal</i> is the same. | <table border="1" style="display: inline-table; vertical-align: top;"> <tr><td>4</td><td>9</td><td>2</td></tr> <tr><td>3</td><td>5</td><td>7</td></tr> <tr><td>8</td><td>1</td><td>6</td></tr> </table> <p>Rows: $4 + 9 + 2 = 15$ $3 + 5 + 7 = 15$ $8 + 1 + 6 = 15$</p> <p>Columns: $4 + 3 + 8 = 15$ $9 + 5 + 1 = 15$ $2 + 7 + 6 = 15$</p> <p>Diagonals: $4 + 5 + 6 = 15$ $2 + 5 + 8 = 15$</p> | 4 | 9 | 2 | 3 | 5 | 7 | 8 | 1 | 6 | |
| 4 | 9 | 2 | | | | | | | | | | |
| 3 | 5 | 7 | | | | | | | | | | |
| 8 | 1 | 6 | | | | | | | | | | |
| <p>map</p> | <ul style="list-style-type: none"> • A diagram of a region showing its position in the world. | <p style="text-align: center;">Europe</p>  | | | | | | | | | | |
| <p>mass</p> | <ul style="list-style-type: none"> • The amount of matter that an object contains. It is measured in <i>units</i> like grams (g) and kilograms (kg). Often called weight, but not the same. | <p>The mass of the block of butter is 250 g. The weight of an object changes according to the gravity. A packet of butter would be weightless in space, even though it still has the same mass as on earth.</p> | | | | | | | | | | |
| <p>maximum</p> | <ul style="list-style-type: none"> • The highest value. | <p>The maximum speed in a residential area is 60 km per hour.</p>  | | | | | | | | | | |
| <p>mean</p> | <ul style="list-style-type: none"> • Or <i>average</i>, is the total of all scores divided by how many scores there are. • To calculate the mean: <ol style="list-style-type: none"> 1) <i>Add</i> up the values. 2) <i>Divide</i> the total by the number of values. | <table style="border-collapse: collapse;"> <tr><td style="padding-right: 20px;">4</td><td>$24 \div 4 = 6$</td></tr> <tr><td>6</td><td>The average</td></tr> <tr><td>5</td><td>or mean of</td></tr> <tr><td><u>+ 9</u></td><td>4, 6, 5 and 9 is 6.</td></tr> <tr><td style="border-top: 1px solid black;">24</td><td></td></tr> </table> | 4 | $24 \div 4 = 6$ | 6 | The average | 5 | or mean of | <u>+ 9</u> | 4, 6, 5 and 9 is 6. | 24 | |
| 4 | $24 \div 4 = 6$ | | | | | | | | | | | |
| 6 | The average | | | | | | | | | | | |
| 5 | or mean of | | | | | | | | | | | |
| <u>+ 9</u> | 4, 6, 5 and 9 is 6. | | | | | | | | | | | |
| 24 | | | | | | | | | | | | |
| <p>median</p> | <ul style="list-style-type: none"> • The middle value of an ordered <i>set</i> of values. • If there is an <i>even number</i> of values then the median is the <i>average</i> of the two middle numbers. | <p>Data: 2, 5, <u>6</u>, 8, 9 Median is 6</p> <p>Data: 2, 3, <u>5</u>, <u>6</u>, 8, 8 Average the two middle values: $5 + 6 = 11$ $11 \div 2 = 5.5$ Median is 5.5</p> | | | | | | | | | | |
| <p>metre (m)</p> | <ul style="list-style-type: none"> • A <i>unit of length equal</i> to 100 centimetres. | <p>Track distances are measured in metres.</p> | | | | | | | | | | |
| <p>millilitre (mL)</p> | <ul style="list-style-type: none"> • A <i>unit of capacity</i>. • 1000 millilitres is <i>equal</i> to 1 <i>litre</i>. | <p>Medicines are measured in mL.</p> | | | | | | | | | | |

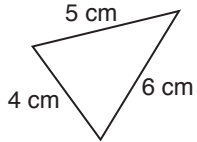
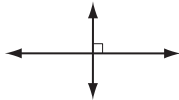
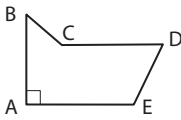











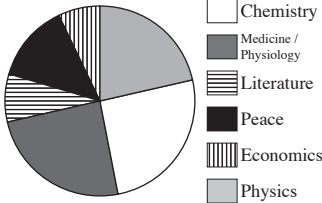
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------|---|---|-------|-------|---|-------|-------|--|--|--|---|---|---|---|---|---|---------|---|-------|-------|-------|-------|-------|-------|---|-------|-------|-------|-------|-------|-------|---|-------|-------|-------|-------|-------|-------|
| millimetre (mm) | <ul style="list-style-type: none"> • A <i>unit</i> of <i>length</i>. • 1000 millimetres is <i>equal</i> to 1 <i>metre</i>. | Timber length is measured in millimetres. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| million | <ul style="list-style-type: none"> • A thousand thousands. |  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| minimum | <ul style="list-style-type: none"> • The lowest value. | The minimum temperature reached yesterday was 10°C. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| minus (-) | <ul style="list-style-type: none"> • Another word for <i>subtract</i>. To take away. | \$20 minus \$5 is \$15. $20 - 5 = 15$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| minute (min) | <ul style="list-style-type: none"> • A <i>unit</i> of <i>time</i> equal to 60 <i>seconds</i>. | One minute has 60 seconds. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| mixed number | <ul style="list-style-type: none"> • The <i>sum</i> of a <i>whole number</i> and a <i>fraction</i> less than one. | $3\frac{5}{7}$ is a mixed number. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| mode | <ul style="list-style-type: none"> • The most frequent score in a set of <i>data</i>. | Data: 2, 3, 5, 7, 7, 7, 8, 8, 9 The mode is 7 as 7 occurs three times. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| month | <ul style="list-style-type: none"> • A <i>unit</i> of <i>time</i> equal to 28, 29, 30 or 31 <i>days</i>. | There are 12 months in a year starting with January.  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| morning | <ul style="list-style-type: none"> • The early part of the <i>day</i> ending at 12 noon. |  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| multiple | <ul style="list-style-type: none"> • A multiple of a <i>whole number</i> is the <i>product</i> of that number with any non-zero whole number. | The multiples of 2 are 2, 4, 6, 8, 10, $2 \times 1 = 2$ $2 \times 2 = 4$ $2 \times 3 = 6$ etc. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| multiple events | <ul style="list-style-type: none"> • More than one <i>event</i>, where their individual results are totally unaffected by whether or not the other event does or does not occur. | <table border="1"> <tr> <td colspan="2" rowspan="2"></td> <td colspan="6">Die </td> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td rowspan="3">Spinner</td> <td>1</td> <td>(1,1)</td> <td>(1,2)</td> <td>(1,3)</td> <td>(1,4)</td> <td>(1,5)</td> <td>(1,6)</td> </tr> <tr> <td>2</td> <td>(2,1)</td> <td>(2,2)</td> <td>(2,3)</td> <td>(2,4)</td> <td>(2,5)</td> <td>(2,6)</td> </tr> <tr> <td>3</td> <td>(3,1)</td> <td>(3,2)</td> <td>(3,3)</td> <td>(3,4)</td> <td>(3,5)</td> <td>(3,6)</td> </tr> </table> | | | Die  | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | Spinner | 1 | (1,1) | (1,2) | (1,3) | (1,4) | (1,5) | (1,6) | 2 | (2,1) | (2,2) | (2,3) | (2,4) | (2,5) | (2,6) | 3 | (3,1) | (3,2) | (3,3) | (3,4) | (3,5) | (3,6) |
| | | Die  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spinner | 1 | (1,1) | (1,2) | (1,3) | (1,4) | (1,5) | (1,6) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 | (2,1) | (2,2) | (2,3) | (2,4) | (2,5) | (2,6) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 3 | (3,1) | (3,2) | (3,3) | (3,4) | (3,5) | (3,6) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

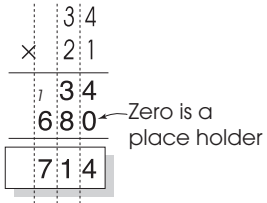

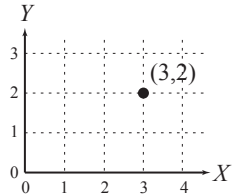
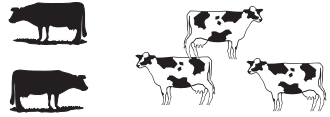


| | | |
|----------------------------------|--|--|
| <p>multiplication</p> | <ul style="list-style-type: none"> • An <i>operation</i> where a number is added to itself a number of times. | <p>$2 + 2 + 2 + 2 + 2 = 10$ or $5 \times 2 = 10$</p>  |
| <p>multiply (×)</p> | <ul style="list-style-type: none"> • To find total in a number of groups. | <p>Three lots of 2 cows is 6. $3 \times 2 = 6$ or $2 + 2 + 2 = 6$</p>  |
| <p>natural number (N)</p> | <ul style="list-style-type: none"> • A counting number from 1 to <i>infinity</i>. | <p>1, 2, 3, 4, 5.....∞</p> |
| <p>negative number</p> | <ul style="list-style-type: none"> • A number that is <i>less than</i> zero. | <p>-1, -2, -3, -4, -5, ... are negative numbers.</p> |
| <p>net</p> | <ul style="list-style-type: none"> • The pattern cut out to form a <i>3D</i> shape. | <p>Possible net of a cube.</p>  |
| <p>ninth</p> | <ul style="list-style-type: none"> • The <i>position</i> after <i>eighth</i>. | <p>1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th.....</p> |
| <p>nona</p> | <ul style="list-style-type: none"> • Prefix meaning nine. | <p>See nonagon</p> |
| <p>nonagon</p> | <ul style="list-style-type: none"> • A <i>polygon</i> with 9 sides. |  <p>Nonagon Regular nonagon</p> |
| <p>north</p> | <ul style="list-style-type: none"> • A <i>compass direction</i>. |  |
| <p>north-east</p> | <ul style="list-style-type: none"> • A <i>compass direction</i>. |  |
| <p>north-west</p> | <ul style="list-style-type: none"> • A <i>compass direction</i>. |  |
| <p>number line</p> | <ul style="list-style-type: none"> • An evenly marked <i>line</i> that shows position of numbers. • <i>Points</i> are marked with numbers in <i>ascending order</i> from left to right (horizontal number line) or from bottom to top (vertical number line). • Zero represents the <i>origin</i> of a number line. |  |

| | | |
|-------------------------------|--|---|
| number sentence | <ul style="list-style-type: none"> A sentence using numbers and operations instead of words. | <p>"Mary had four cats and two dogs. How many pets did she have?"</p> <p>Number sentence: $4 + 2 = 6$</p> |
| numeral | <ul style="list-style-type: none"> A symbol used to represent a number. | <p>Arabic numerals: 1, 2, 3, 4, 5</p> <p>Roman numerals: I, II, III, IV, V</p> |
| numerator | <ul style="list-style-type: none"> The number above the fraction bar in a <i>fraction</i>. The number of parts that are counted. |  |
| oblique line | <ul style="list-style-type: none"> A line at an <i>angle</i> to the horizon. |  |
| obtuse angle | <ul style="list-style-type: none"> An <i>angle</i> measuring greater than 90° and less than 180°. |  |
| obtuse-angled triangle | <ul style="list-style-type: none"> A triangle with one <i>angle</i> measuring greater than 90° and less than 180°. |  |
| octa | <ul style="list-style-type: none"> Prefix meaning eight. | <p>An octopus has 8 legs.</p>  |
| octagon | <ul style="list-style-type: none"> A <i>polygon</i> with 8 sides. |  <p>Octagon Regular octagon</p> |
| octahedron | <ul style="list-style-type: none"> A <i>solid</i> with eight <i>faces</i>. A regular octahedron has faces that are all <i>equilateral triangles</i>. |  |
| odd numbers | <ul style="list-style-type: none"> A <i>whole number</i> that is not <i>divisible</i> by 2. | <p>Odd numbers end with 1, 3, 5, 7 or 9.</p> |
| of | <ul style="list-style-type: none"> Seen in context like 'a <i>fraction of</i> a number', it means to <i>multiply</i>. | <p>A quarter of 100 means $\frac{1}{4}$ of 100, or $\frac{1}{4} \times 100 = 25$</p> |

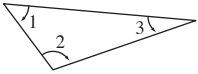







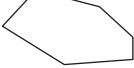







| | | |
|----------------------------|--|---|
| once | <ul style="list-style-type: none"> On one occasion. | Just this time! |
| operation | <ul style="list-style-type: none"> A mathematical process performed according to certain <i>rules</i>. | <p>There are four basic operations in arithmetic:</p> <p>addition $3 + 12$ subtraction $3 - 1$ multiplication 1×5 division $6 \div 3$</p> <p>There are many complex operations like: $\sin 30^\circ, \sqrt{9}$ and $\log_{10} 100, 5^4$.</p> |
| opposite angles | <ul style="list-style-type: none"> Angles across from each other in a shape. | <p>One pair of opposite angles are equal in a kite.</p>  |
| opposite sides | <ul style="list-style-type: none"> Sides across from each other in a shape. | <p>Side \overline{AB} is opposite to side \overline{CD} Side \overline{AD} is opposite to side \overline{BC}</p>  |
| opposites | <ul style="list-style-type: none"> Two <i>numbers</i> with the same <i>absolute value</i> but different <i>signs</i>. | The opposite of +4 is -4. |
| order | <ul style="list-style-type: none"> Placing a group in a special arrangement. | <p>The aliens are arranged in order of height.</p>  |
| order of operations | <ul style="list-style-type: none"> The order of doing <i>operations</i> is: <ol style="list-style-type: none"> <i>Simplify</i> inside all <i>brackets</i>. <i>Evaluate powers</i> and <i>square roots</i>. Calculate \times and \div from left to right. Calculate $+$ and $-$ from left to right. | <p>Calculate $4 + 3^2 \times (6 - 2)$ by</p> <ol style="list-style-type: none"> $4 + 3^2 \times (6 - 2)$ $= 4 + 3^2 \times 4$ $= 4 + 9 \times 4$ $= 4 + 36$ $= 40$ |
| ordered pair | <ul style="list-style-type: none"> See <i>coordinates</i>. | |
| ordinal numbers | <ul style="list-style-type: none"> A <i>whole number</i> that shows position. | 1st, 2nd, 3rd, 4th, 5th..... are ordinal numbers. |
| orientation | <ul style="list-style-type: none"> Position relative to <i>direction</i>. | <p>The tornado is coming from the west.</p>  |

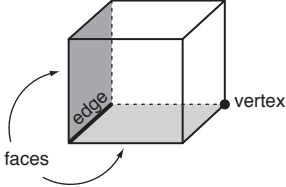
| | | |
|----------------------------------|---|---|
| <p>origin</p> | <ul style="list-style-type: none"> The point of <i>coordinates</i> (0,0) on a <i>coordinate plane</i>. |  |
| <p>outcome</p> | <ul style="list-style-type: none"> Result of an event. | <p>The outcome (result) of tossing a coin was to turn up a head.</p> |
| <p>pair</p> | <ul style="list-style-type: none"> Two together. |  |
| <p>palindrome</p> | <ul style="list-style-type: none"> A number with 2 or more digits that reads the same <i>forwards</i> and <i>backwards</i>. | <p>44 or 6116 are palindromic numbers.</p> |
| <p>parallel lines</p> | <ul style="list-style-type: none"> <i>Lines</i> in the same <i>plane</i> that never cross over. They are marked with matching arrows. |  |
| <p>parallelogram</p> | <ul style="list-style-type: none"> A special <i>quadrilateral</i>. <i>Opposite sides are parallel lines.</i> <i>Opposite sides are equal in length.</i> |  |
| <p>pattern</p> | <ul style="list-style-type: none"> Numbers or objects that are arranged following a <i>rule</i>. |  |
| <p>penta</p> | <ul style="list-style-type: none"> Prefix meaning five. | <p>See <i>pentagon</i></p> |
| <p>pentagon</p> | <ul style="list-style-type: none"> A <i>polygon</i> with 5 sides. |  <p>Pentagon Regular pentagon</p> |
| <p>pentagonal prism</p> | <ul style="list-style-type: none"> A <i>three-dimensional</i> shape. Two identical, <i>parallel bases</i> are <i>pentagons</i>. Five <i>faces</i> are <i>rectangles</i>. |  |
| <p>pentagonal pyramid</p> | <ul style="list-style-type: none"> A <i>three-dimensional</i> shape. <i>Base</i> is a <i>pentagon</i>. Five <i>faces</i> are <i>triangles</i>. |  |

| | | | | | | | | |
|------------------------------|---|---|------|---|------|---|------|---|
| per | <ul style="list-style-type: none"> • For each. • Can be written as a forward slash (/). | 20 kilometres per hour or 20 km/h means 20 kilometres travelled for each hour. | | | | | | |
| percentage | <ul style="list-style-type: none"> • Out of 100. • ‘Per’ means for each, ‘cent’ means 100. | $59\% = \frac{59}{100} = 0.59$ | | | | | | |
| perfect square | <ul style="list-style-type: none"> • Any number that is the result of multiplying two <i>rational numbers</i> together. | 0, 1, 4, 9, 16, 25, $\frac{1}{25}$, $\frac{4}{9}$ etc. are all perfect squares. | | | | | | |
| perimeter | <ul style="list-style-type: none"> • The <i>distance</i> around the outside of a <i>shape</i>. | <p>Add the length of all sides. Perimeter = 4 + 5 + 6 = 15 cm</p>  | | | | | | |
| perpendicular lines | <ul style="list-style-type: none"> • Lines on a <i>plane</i> that <i>intersect</i> to form a <i>right angle</i>. |  | | | | | | |
| perpendicular sides | <ul style="list-style-type: none"> • Sides on a <i>shape</i> that are at <i>right angles</i> to each other. | <p>\overline{AB} is perpendicular to \overline{AE}.</p>  | | | | | | |
| perspective | <ul style="list-style-type: none"> • The appearance of objects affected by size and <i>position</i>. |  | | | | | | |
| pi (π) | <ul style="list-style-type: none"> • The <i>ratio</i> of the <i>circumference</i> of a <i>circle</i> to its <i>diameter</i>. <p>The diameter of a circle wraps around the circle approximately 3.14 times.</p> | <p>3.14 or $\frac{22}{7}$ is the approximate value of π. Pi is an infinite number. $\pi = 3.14159\ 26535\ 89793\dots$</p> | | | | | | |
| pictograph | <ul style="list-style-type: none"> • A <i>graph</i> that uses pictures or symbols to represent <i>data</i>. | <p>Toy Sales in Winter  = 50 toys</p> <table border="1"> <tr> <td>June</td> <td></td> </tr> <tr> <td>July</td> <td></td> </tr> <tr> <td>Aug.</td> <td></td> </tr> </table> | June |  | July |  | Aug. |  |
| June |  | | | | | | | |
| July |  | | | | | | | |
| Aug. |  | | | | | | | |
| pie graph | <ul style="list-style-type: none"> • A <i>graph</i> that represents <i>data</i> as a <i>sector</i> of a <i>circle</i>. | <p>Nobel Prizes Won by the UK up to 2004 (Total of 98)</p>  <ul style="list-style-type: none"> Chemistry Medicine / Physiology Literature Peace Economics Physics | | | | | | |

| <p>place holder</p> | <ul style="list-style-type: none"> Minds a spot in a number. | <p>Zeros are used as place holders in long multiplication algorithms.</p>  | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------------------|--|---|-----------|-----------------------|-------------------|-----------|---------------|----------------|-----------------|------------------|--------|------------|-------------|-----------|---------|--------|-------|-----|----|---|---|----------------|-----------------|------------------|
| <p>place value</p> | <ul style="list-style-type: none"> Value according to position in a number. | <p>954 5 is in the tens place 5 has a value of 50.</p> <table border="1" data-bbox="331 584 1476 739"> <thead> <tr> <th>millions</th> <th>hundreds of thousands</th> <th>tens of thousands</th> <th>thousands</th> <th>hundreds</th> <th>tens</th> <th>units</th> <th>decimal point</th> <th>tenths</th> <th>hundredths</th> <th>thousandths</th> </tr> </thead> <tbody> <tr> <td>1 000 000</td> <td>100 000</td> <td>10 000</td> <td>1 000</td> <td>100</td> <td>10</td> <td>1</td> <td>•</td> <td>$\frac{1}{10}$</td> <td>$\frac{1}{100}$</td> <td>$\frac{1}{1000}$</td> </tr> </tbody> </table> | millions | hundreds of thousands | tens of thousands | thousands | hundreds | tens | units | decimal point | tenths | hundredths | thousandths | 1 000 000 | 100 000 | 10 000 | 1 000 | 100 | 10 | 1 | • | $\frac{1}{10}$ | $\frac{1}{100}$ | $\frac{1}{1000}$ |
| millions | hundreds of thousands | tens of thousands | thousands | hundreds | tens | units | decimal point | tenths | hundredths | thousandths | | | | | | | | | | | | | | |
| 1 000 000 | 100 000 | 10 000 | 1 000 | 100 | 10 | 1 | • | $\frac{1}{10}$ | $\frac{1}{100}$ | $\frac{1}{1000}$ | | | | | | | | | | | | | | |
| <p>plane</p> | <ul style="list-style-type: none"> A flat surface. |  | | | | | | | | | | | | | | | | | | | | | | |
| <p>plot</p> | <ul style="list-style-type: none"> To mark a <i>point</i> on a <i>coordinate plane</i>. | <p>The point of coordinate (3,2)</p>  | | | | | | | | | | | | | | | | | | | | | | |
| <p>plus (+)</p> | <ul style="list-style-type: none"> Another word for <i>addition</i>. To add. | <p>2 cows plus 3 cows gives you 5 cows.</p> <p>$2 + 3 = 5$</p>  | | | | | | | | | | | | | | | | | | | | | | |
| <p>pm (post meridiem)</p> | <ul style="list-style-type: none"> The <i>time</i> from midday to midnight. | <p>Every night Jimmy starts reading at 9 pm.</p>  | | | | | | | | | | | | | | | | | | | | | | |
| <p>point</p> | <ul style="list-style-type: none"> A position in space represented by a dot. |  | | | | | | | | | | | | | | | | | | | | | | |

| | | |
|----------------|--|--|
| polygon | <ul style="list-style-type: none"> A closed <i>two-dimensional</i> shape for which all sides are line segments. 3 or more <i>sides</i> and <i>angles</i>. | 'Poly' means many and 'gon' means angle. Example: A triangle has 3 angles. |
|----------------|--|--|


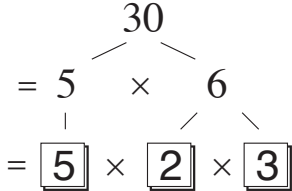
| polygon (many angles) | regular polygon (all sides and all angles are equal) | Number of Sides | Number of Interior angles |
|---|---|-----------------|---------------------------|
| <u>Triangle</u> 3 angles  | <u>Equilateral triangle</u>  | 3 | 3 |
| <u>Quadrilateral</u> 4 angles  | <u>Square</u>  | 4 | 4 |
| <u>Pentagon</u> 5 angles  | <u>Regular pentagon</u>  | 5 | 5 |
| <u>Hexagon</u> 6 angles  | <u>Regular hexagon</u>  | 6 | 6 |
| <u>Heptagon</u> 7 angles  | <u>Regular heptagon</u>  | 7 | 7 |
| <u>Octagon</u> 8 angles  | <u>Regular octagon</u>  | 8 | 8 |
| <u>Nonagon</u> 9 angles  | <u>Regular nonagon</u>  | 9 | 9 |
| <u>Decagon</u> 10 angles  | <u>Regular decagon</u>  | 10 | 10 |


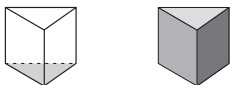
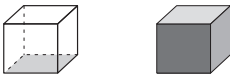
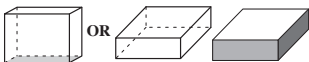
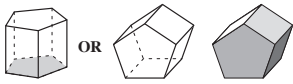
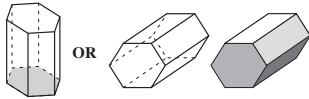
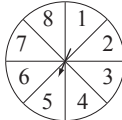
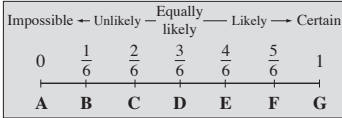

| | | |
|-------------------|---|--|
| polyhedron | <ul style="list-style-type: none"> A <i>three-dimensional</i> shape. Four or more <i>faces</i>. Described by their <i>faces</i>, <i>edges</i> and <i>vertices</i>. | 'Poly' means many and 'hedron' means faces. Example: A hexahedron has 6 faces.  |
|-------------------|---|--|

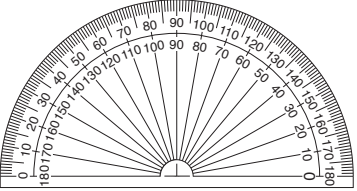


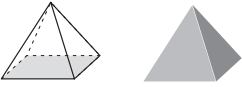



| | | |
|-------------------|---|--|
| population | <ul style="list-style-type: none"> The entire group under consideration in a statistical analysis. | The population of a country is every person who lives in that country. |
|-------------------|---|--|

| | | |
|-----------------|---|---------------------------------|
| position | <ul style="list-style-type: none"> Where something is in relation to things around it. | In, on, under, behind, next to. |
|-----------------|---|---------------------------------|

| | | |
|-------------------------|--|---|
| positive numbers | <ul style="list-style-type: none"> A number that is <i>greater than zero</i>. | +1, +2, +3, +4, +5, are positive numbers. |
|-------------------------|--|---|

| | | |
|-----------------------------------|---|--|
| possible outcomes | <ul style="list-style-type: none"> The total number of result options. | When you toss a coin there are 2 possible results: heads or tails. |
| power | <ul style="list-style-type: none"> An <i>expression</i>, such as 4^3, in which the base (4) is <i>multiplied</i> by itself a number of times equal to the <i>index</i> (3). | 4^3 or 4 to the power of 3 is $4 \times 4 \times 4 = 64$ |
| precision of an instrument | <ul style="list-style-type: none"> Considered to be the size of the smallest <i>unit</i> on the <i>scale</i> of the instrument. | The ruler has a precision of 0.1 cm.  |
| previous | <ul style="list-style-type: none"> The one before. | If the current year is 2011, the previous year was 2010. |
| prime factor | <ul style="list-style-type: none"> A <i>factor</i> that is also a <i>prime number</i>. <i>Factor trees</i> can help to determine a number's prime factors. | The prime factors of 30 are 2, 3 and 5.  |
| prime factorisation | <ul style="list-style-type: none"> Writing a <i>whole number</i> as the <i>product</i> of its <i>prime factors</i>. | Prime factorisation of 30: $30 = 2 \times 3 \times 5$ |
| prime number | <ul style="list-style-type: none"> A <i>whole number</i> that has exactly two <i>factors</i>, 1 and itself. 1 is not a prime number. | 59 is a prime number as its only factors are 1 and 59. The prime numbers between 0 and 100 are: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89 and 97. |

| prism | <ul style="list-style-type: none"> • A <i>three-dimensional</i> shape. Two <i>parallel bases</i> are the same. | | | |  |
|--------------------------|--|-----------|-------|----------|---|
| prism | Properties | Number of | | | Examples |
| | | Faces | Edges | Vertices | |
| <i>Triangular Prism</i> | Bases are triangles Lateral faces are rectangles | 5 | 9 | 6 |  |
| <i>Square Prism</i> | Bases are squares Lateral faces are rectangles | 6 | 12 | 8 |  |
| <i>Rectangular Prism</i> | Bases are rectangles Lateral faces are rectangles | 6 | 12 | 8 |  |
| <i>Pentagonal Prism</i> | Bases are pentagons Lateral faces are rectangles | 7 | 15 | 10 |  |
| <i>Hexagonal Prism</i> | Bases are hexagons Lateral faces are rectangles | 8 | 18 | 12 |  |
| probability | <ul style="list-style-type: none"> • The likelihood that an event will happen, measured as a <i>fraction</i> of the total of possible outcomes. See <i>chance</i>. | | | | The probability of spinning the number 5 is $\frac{1}{8}$.  |
| probability scale | <ul style="list-style-type: none"> • A measure, from 0 (no chance) to 1 (will happen), of the likelihood of an event occurring. | | | |  |
| product | <ul style="list-style-type: none"> • The result when two or more numbers are <i>multiplied</i>. | | | | The product of 4 and 5 is 20: $4 \times 5 = 5 \times 4 = 20$ |
| profit (money) | <ul style="list-style-type: none"> • What is gained, less any <i>expenses</i>. Profit = Revenue – Expense. | | | | Revenue from a business activity is \$20. If the expenses are \$15 then the profit would be \$5. |
| proper fraction | <ul style="list-style-type: none"> • Any <i>fraction</i> in which the <i>numerator</i> is <i>less than</i> the <i>denominator</i>. | | | | $\frac{5}{8}$ the numerator is 5 the denominator is 8. $5 < 8$ so $\frac{5}{8}$ is a proper fraction.  |
| proportion | <ul style="list-style-type: none"> • A comparative <i>ratio</i>, showing that two ratios are equivalent. | | | | $\frac{2}{3} = \frac{6}{9}$ is a proportion. 2 : 3 is the same ratio as 6 : 9 2 : 3 is in proportion with 6 : 9 |

| <p>protractor</p> | <ul style="list-style-type: none"> • A <i>semi-circular</i> tool used to measure <i>degrees</i>. There are 180° on a protractor. |  | | | |
|-----------------------------------|---|---|--------------|-----------------|---|
| <p>pyramid</p> | <ul style="list-style-type: none"> • A <i>three-dimensional</i> shape. One <i>base</i> is a <i>polygon</i>. All other <i>faces</i> are <i>triangles</i> that meet at one point called <i>vertex</i>. A pyramid is named for the shape of its base. |  | | | |
| <p>pyramid</p> | <p>Properties</p> | <p>Number of</p> | | | <p>Examples</p> |
| | | <p>Faces</p> | <p>Edges</p> | <p>Vertices</p> | |
| <p><i>Triangular Pyramid</i></p> | <p>Base is a triangle Lateral faces are triangles</p> | <p>4</p> | <p>6</p> | <p>4</p> |  |
| <p><i>Square Pyramid</i></p> | <p>Base is a square Lateral faces are triangles</p> | <p>5</p> | <p>8</p> | <p>5</p> |  |
| <p><i>Rectangular Pyramid</i></p> | <p>Base is a rectangle Lateral faces are triangles</p> | <p>5</p> | <p>8</p> | <p>5</p> |  |
| <p><i>Pentagonal Pyramid</i></p> | <p>Base is a pentagon Lateral faces are triangles</p> | <p>6</p> | <p>10</p> | <p>6</p> |  |
| <p><i>Hexagonal Pyramid</i></p> | <p>Base is a hexagon Lateral faces are triangles</p> | <p>7</p> | <p>12</p> | <p>7</p> |  |
| | | | | | |

quadrilateral

- A *polygon* with 4 *sides*.

'Quad' means 4 and 'lateral' means side.

| quadrilateral | Sides | Interior angles | Diagonals | Axes of symmetry | Diagram |
|----------------------|---|-----------------------------------|---|------------------|---------|
| Square | 4 sides of equal length | 4 right angles | 2 diagonals equal in length and bisecting at right angles | 4 | |
| Rectangle | Opposite sides of equal length | 4 right angles | 2 diagonals equal in length and bisecting each other | 2 | |
| Trapezium | 2 opposite sides parallel | | 2 diagonals | 0 | |
| Rhombus | 4 sides of equal length and opposite sides parallel | Opposite angles equal | 2 diagonals bisecting at right angles | 2 | |
| Parallelogram | Opposite sides of equal length and parallel | Opposite angles equal | 2 diagonals bisecting each other | 0 | |
| Kite | 4 sides, two each of equal length | One pair of opposite angles equal | 2 diagonals bisecting each other | 1 | |

quarter

- One of four *equal* parts of a group or object.
- Written as the *fraction* $\frac{1}{4}$.


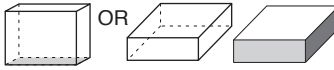
radius of a circle

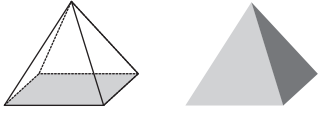
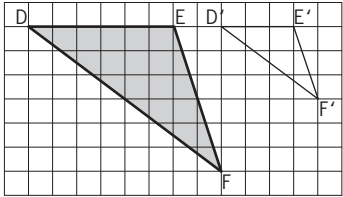
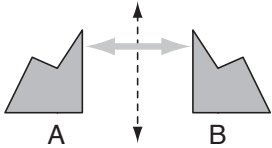
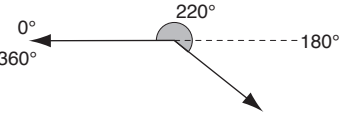
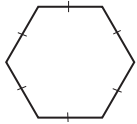
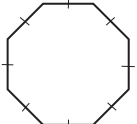
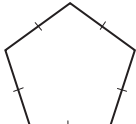
- (pl. **radii**) The distance from the *centre* to any *point* on the *circle*.

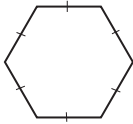
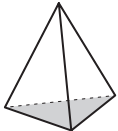

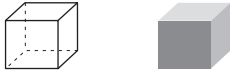
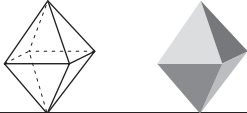
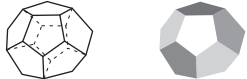

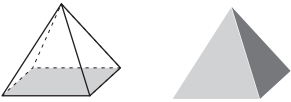

random sample

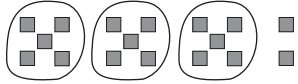

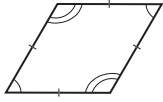
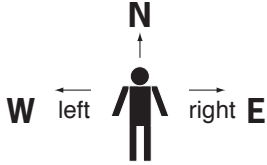
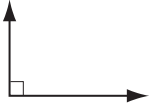
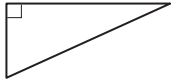
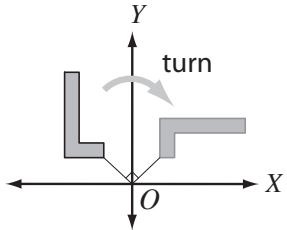

- A selection taken from a group without method or conscious choice.

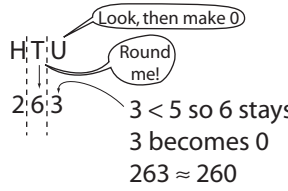
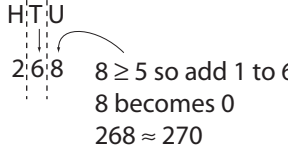
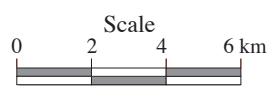


Drawing out of a hat is a random selection.

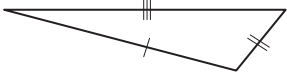
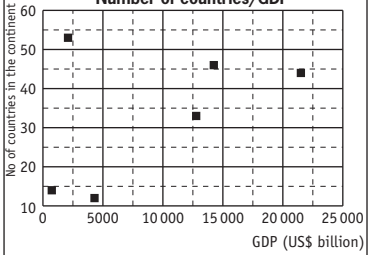
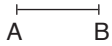
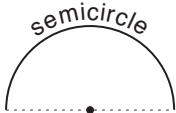
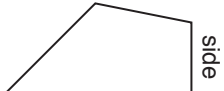
| | | | | | | |
|--|---|--|--|--|---|---|
| range | <ul style="list-style-type: none"> The <i>difference</i> between the greatest and the smallest value. | For the data: 21, 24, 25, 27, 27 and 28 the range is $28 - 21 = 7$ | | | | |
| rate | <ul style="list-style-type: none"> The <i>ratio</i> of two measures that have different <i>units</i>. | When running, calories burn at a rate of 14 cal/min. | | | | |
| ratio | <ul style="list-style-type: none"> The ratio of a number (<i>a</i>) to a non-zero number (<i>b</i>) is the result when <i>a</i> is <i>divided</i> by <i>b</i>. The ratio of <i>a</i> to <i>b</i> can be written as: $\frac{a}{b}$, <i>a</i> : <i>b</i> or '<i>a</i> to <i>b</i>'. A ratio is made by comparing quantities using the same <i>unit</i> e.g. parts, buckets or litres. | <p>If the ratio of cordial to water is 3 : 1 then that would mean 3 parts cordial to 1 part water! Agh, the order of the ratio matters.</p> <p>Map scales are an example of a ratio. See also <i>ratio scale</i> and <i>scale</i>.</p> | | | | |
| ratio scale | <ul style="list-style-type: none"> A <i>scale</i> written as a <i>ratio</i>. Compares the dimensions on a <i>map</i> or model (first number) to real life (second number). | <p>If the scale on a map is 1 : 10 000 1 cm represents 10 000 cm. 1 cm represents 100 m. Every cm on the drawing represents 100 m in real life.</p> | | | | |
| rational number (Q) | <ul style="list-style-type: none"> All <i>positive</i> and <i>negative fractions</i>, including <i>integers</i> and <i>improper fractions</i>. Not an <i>irrational number</i>. | $-2\frac{3}{7}$, 3.010101..., $\frac{4}{10}$, 0.56, $\sqrt{\frac{4}{9}}$ | | | | |
| real number (R) | <ul style="list-style-type: none"> Any number on the <i>number line</i>. Includes all <i>rational</i> and <i>irrational numbers</i>. <p style="text-align: center;">\mathbb{R} REAL NUMBERS</p> | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; padding: 10px;"> <p style="text-align: center;">IRRATIONAL</p> <p>π, ϕ, e, $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$, 2.6293045632.... $\cos 30^\circ$</p> </td> <td style="width: 25%; padding: 10px;"> <p style="text-align: center;">\mathbb{Q} RATIONAL</p> <p>$-2\frac{3}{7}$, 3.010101..., $\frac{4}{10}$, 0.56, $\sqrt{\frac{4}{9}}$</p> </td> <td style="width: 25%; padding: 10px;"> <p style="text-align: center;">\mathbb{Z} Integers</p> <p>..., -3, -2, -1, 0, 1, 2, 3, ...</p> </td> <td style="width: 25%; padding: 10px;"> <p style="text-align: center;">\mathbb{N} Natural (Whole Numbers)</p> <p>0, 1, 2, 3, 4, 5, 6,</p> </td> </tr> </table> | | | <p style="text-align: center;">IRRATIONAL</p> <p>π, ϕ, e, $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$, 2.6293045632.... $\cos 30^\circ$</p> | <p style="text-align: center;">\mathbb{Q} RATIONAL</p> <p>$-2\frac{3}{7}$, 3.010101..., $\frac{4}{10}$, 0.56, $\sqrt{\frac{4}{9}}$</p> | <p style="text-align: center;">\mathbb{Z} Integers</p> <p>..., -3, -2, -1, 0, 1, 2, 3, ...</p> | <p style="text-align: center;">\mathbb{N} Natural (Whole Numbers)</p> <p>0, 1, 2, 3, 4, 5, 6,</p> |
| <p style="text-align: center;">IRRATIONAL</p> <p>π, ϕ, e, $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$, 2.6293045632.... $\cos 30^\circ$</p> | <p style="text-align: center;">\mathbb{Q} RATIONAL</p> <p>$-2\frac{3}{7}$, 3.010101..., $\frac{4}{10}$, 0.56, $\sqrt{\frac{4}{9}}$</p> | <p style="text-align: center;">\mathbb{Z} Integers</p> <p>..., -3, -2, -1, 0, 1, 2, 3, ...</p> | <p style="text-align: center;">\mathbb{N} Natural (Whole Numbers)</p> <p>0, 1, 2, 3, 4, 5, 6,</p> | | | |
| reciprocal | <ul style="list-style-type: none"> One of two numbers whose <i>product</i> is 1. Also called the multiplicative <i>inverse</i>. | <p>The reciprocal of $\frac{3}{5}$ is $\frac{5}{3}$.</p> $\frac{3}{5} \times \frac{5}{3} = 1$ | | | | |
| rectangle | <ul style="list-style-type: none"> A special <i>parallelogram</i>. Four <i>right angles</i>. |  | | | | |
| rectangular prism | <ul style="list-style-type: none"> A <i>three-dimensional</i> shape. Six rectangular faces. |  | | | | |

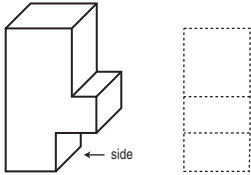


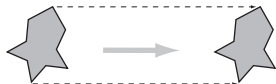

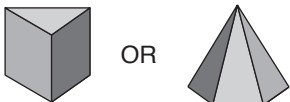


| | | |
|----------------------------|--|--|
| rectangular pyramid | <ul style="list-style-type: none"> • A <i>three-dimensional</i> shape. One <i>rectangular</i> base. All the other <i>faces</i> are <i>triangles</i>. |  |
| recurring decimal | <ul style="list-style-type: none"> • A <i>decimal</i> that has a repeating <i>digit</i> or a repeating pattern of digits. • A repeating digit/s is marked with a dot (•) or a bar (—). | $\frac{2}{9} = 0.22222222 = 0.\dot{2}$ $\frac{1}{6} = 0.16666666 = 0.1\bar{6}$ <p>are repeating decimals, where 2 and 6 are the repeating digits respectively.</p> $\frac{1}{11} = 0.09090909 = 0.0\bar{09}$ <p>is a repeating decimal, where 09 is the repeating pattern of digits.</p> |
| reduction | <ul style="list-style-type: none"> • Make smaller or decrease. | <p>$\triangle DEF$ was reduced to $\triangle D'E'F'$ by a scale factor of 2.</p>  |
| reflection | <ul style="list-style-type: none"> • A movement that <i>flips</i> a figure across a <i>line</i> so that the figure is in the mirror image <i>position</i>. | <p>Shape B is a reflection of shape A.</p>  |
| reflex angle | <ul style="list-style-type: none"> • An <i>angle</i> measuring greater than 180° and less than 360°. |  |
| regular hexagon | <ul style="list-style-type: none"> • A <i>polygon</i> with six sides of equal length and six equal angles. |  <p>Regular hexagon</p> |
| regular octagon | <ul style="list-style-type: none"> • A <i>polygon</i> with eight sides of equal length and eight equal angles. |  <p>Regular octagon</p> |
| regular pentagon | <ul style="list-style-type: none"> • A <i>polygon</i> with five sides of equal length and five equal angles. |  <p>Regular pentagon</p> |


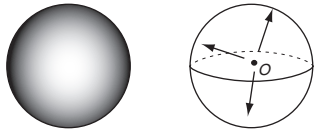
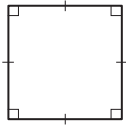
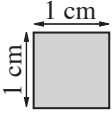
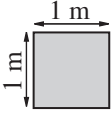
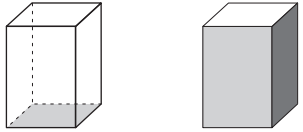
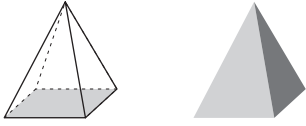
| regular polygon | <ul style="list-style-type: none"> A shape with all <i>sides</i> and all <i>angles equal</i>. | <p>A regular hexagon has 6 equal sides and 6 equal angles.</p>  <p>Regular hexagon</p> | | | |
|-------------------------------|--|---|-------|----------|---|
| regular prism | <ul style="list-style-type: none"> A <i>three-dimensional</i> shape with <i>bases</i> that are <i>regular polygons</i> and all the other faces that are rectangles. | <p>A regular hexagonal prism has regular hexagons as its bases.</p> | | | |
| regular pyramid | <ul style="list-style-type: none"> A <i>three-dimensional</i> shape with only one <i>base</i> which is a <i>regular polygon</i> and all the other <i>faces</i> that are <i>isosceles triangles</i>. The base gives the pyramid its name, e.g. regular 'triangular' pyramid. | <p>This regular triangular pyramid has an equilateral triangle as its base.</p>  | | | |
| regular solid | <ul style="list-style-type: none"> A <i>three-dimensional</i> shape that encloses a part of space, with all faces being <i>regular polygons</i>. | | | | |
| regular solid | Properties All faces are regular polygons | In any polyhedron: $E = F + V - 2$ | | | Examples |
| | | Faces | Edges | Vertices | |
| Tetrahedron | All faces are equilateral triangles | 4 | 6 | 4 |  |
| Hexahedron | All faces are squares | 6 | 12 | 8 |  |
| Octahedron | All faces are equilateral triangles | 8 | 12 | 6 |  |
| Dodecahedron | All faces are regular pentagons | 12 | 30 | 20 |  |
| Icosahedron | All faces are equilateral triangles | 20 | 38 | 20 |  |
| regular square pyramid | <ul style="list-style-type: none"> A <i>pyramid</i> whose <i>base</i> is a <i>square</i> and whose <i>height</i> intersects the base at its centre. All 4 <i>slant heights</i> and 4 vertical edges are congruent. | | | |  |
| regular tetrahedron | <ul style="list-style-type: none"> A <i>triangular pyramid</i> whose four <i>faces</i> are equal <i>equilateral triangles</i>. | | | |  |


| | | |
|-------------------------------------|---|---|
| <p>remainder</p> | <ul style="list-style-type: none"> The amount left over when one number cannot be <i>divided</i> exactly by another. | <p>$17 \div 5 = 3$ with 2 remainder.</p>  |
| <p>reversible</p> | <ul style="list-style-type: none"> Able to be turned in the <i>opposite</i> way. | <p>The process of freezing the water is reversible: water → ice → water</p> |
| <p>revolution</p> | <ul style="list-style-type: none"> A complete turn. An <i>angle</i> measuring 360°. |  |
| <p>rhombus</p> | <ul style="list-style-type: none"> (pl. rhombi) A special <i>parallelogram</i>. Four <i>equal</i> sides. <i>Opposite angles equal</i>. |  |
| <p>right</p> | <ul style="list-style-type: none"> The <i>direction</i> to the <i>east</i> of your body if you are facing <i>north</i>. |  |
| <p>right angle</p> | <ul style="list-style-type: none"> An <i>angle</i> measuring exactly 90°. It is marked with a corner. |  |
| <p>right-angled triangle</p> | <ul style="list-style-type: none"> A <i>triangle</i> with one <i>right angle</i>. |  |
| <p>Roman numerals</p> | <ul style="list-style-type: none"> Number system invented by the ancient Romans. | <p>I = 1 V = 5 X = 10 L = 50 C = 100 D = 500 M = 1000</p> |
| <p>rotation</p> | <ul style="list-style-type: none"> A movement that turns a shape about a fixed <i>point</i> (the centre of rotation) by a given <i>angle</i> (the angle of rotation). | <p>The centre of rotation is the origin <i>O</i> and the angle of rotation is 90°.</p>  |
| <p>rotational symmetry</p> | <ul style="list-style-type: none"> A shape has rotational symmetry if a <i>rotation</i> of 180° or less produces an image that fits exactly on the original shape. | <p>This shape has rotational symmetry, because after a rotation of 120° it looks identical to the original.</p>  |

| <p>round</p> | <ul style="list-style-type: none"> To <i>approximate</i> a number to a given <i>place value</i>. <p>Look at the next <i>digit</i> after the given place value you are rounding to.</p> <p>If this digit is less than 5, keep the digit in the given place value the same.</p> <p>If this digit is greater than or equal to 5, add 1 to the digit in the given place value.</p> <p>Then make the <i>digit</i> you were looking at, zero.</p> | <p>Round 263 to the nearest 10:</p>  <p>Round 268 to the nearest 10:</p>  | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------------|--|--|----------------------------------|------|--------|--------|-------|----|--------|----|---------------|-----|----|-----|--------|----|----|----|---------------|----|----|----|---------|----|----|----|-----------|----|----|----|
| <p>row of a table</p> | <ul style="list-style-type: none"> A <i>horizontal</i> line of <i>data</i> in a table. | <p><i>Medal Tally - Beijing Olympics 2008</i></p> <table border="1" data-bbox="1212 593 1532 817"> <thead> <tr> <th>COUNTRY</th> <th>Gold</th> <th>Silver</th> <th>Bronze</th> </tr> </thead> <tbody> <tr> <td>China</td> <td>51</td> <td>21</td> <td>28</td> </tr> <tr> <td>United States</td> <td>36</td> <td>38</td> <td>36</td> </tr> <tr> <td>Russia</td> <td>23</td> <td>21</td> <td>28</td> </tr> <tr> <td>Great Britain</td> <td>19</td> <td>13</td> <td>15</td> </tr> <tr> <td>Germany</td> <td>16</td> <td>10</td> <td>15</td> </tr> <tr> <td>Australia</td> <td>14</td> <td>15</td> <td>17</td> </tr> </tbody> </table> | COUNTRY | Gold | Silver | Bronze | China | 51 | 21 | 28 | United States | 36 | 38 | 36 | Russia | 23 | 21 | 28 | Great Britain | 19 | 13 | 15 | Germany | 16 | 10 | 15 | Australia | 14 | 15 | 17 |
| COUNTRY | Gold | Silver | Bronze | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| China | 51 | 21 | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| United States | 36 | 38 | 36 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Russia | 23 | 21 | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Great Britain | 19 | 13 | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Germany | 16 | 10 | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Australia | 14 | 15 | 17 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>rule</p> | <ul style="list-style-type: none"> A relationship or correspondence in which values of one <i>variable</i> determine the values of another: $y = \text{rule}$. | <p>$y = x^2 - 4$</p> <p>See <i>linear rule</i>.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>sample</p> | <ul style="list-style-type: none"> A selection taken from a group or <i>population</i>. | <p>See <i>random sample</i>.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>sample space</p> | <ul style="list-style-type: none"> The <i>set</i> of all possible <i>outcomes</i> of an <i>experiment</i>. | <p>A coin is flipped - Sample space = {HH, HT, TH, TT}</p> <table border="1" data-bbox="1189 1243 1532 1433"> <thead> <tr> <th colspan="2" rowspan="2">Possible outcomes (sample space)</th> <th colspan="2">Coin 1</th> </tr> <tr> <th>H</th> <th>T</th> </tr> </thead> <tbody> <tr> <th rowspan="2">Coin 2</th> <th>H</th> <td>H,H</td> <td>H,T</td> </tr> <tr> <th>T</th> <td>T,H</td> <td>T,T</td> </tr> </tbody> </table> | Possible outcomes (sample space) | | Coin 1 | | H | T | Coin 2 | H | H,H | H,T | T | T,H | T,T | | | | | | | | | | | | | | | |
| Possible outcomes (sample space) | | Coin 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | H | T | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Coin 2 | H | H,H | H,T | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | T | T,H | T,T | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>scale</p> | <ul style="list-style-type: none"> A key on a <i>scale drawing</i>/map that tells how the drawing's <i>dimensions</i> and life size dimensions are related. <p>Can be written as:</p> <ol style="list-style-type: none"> A <i>ratio scale</i> with the first number referring to the map distance and the second number referring to the real distance. <p>OR</p> <ol style="list-style-type: none"> A <i>linear scale</i> with a set of marks on a line. | <p>On a map with a ratio scale of 1 : 10 000 1 cm represents 10 000 cm or 100 m. Every centimetre on the drawing represents 100 m in real life.</p>  <p>On a map with this linear scale, every highlighted segment represents 2 km in real life.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>scale drawing</p> | <ul style="list-style-type: none"> Changing the size of an object but not the shape. | <p>A life size staple. </p> <p>The staple scaled by 50%. </p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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| <p>scale factor</p> | <ul style="list-style-type: none"> The amount used to <i>enlarge</i>, <i>reduce</i> or find the original size of an object. | <p>To make an object 2 times bigger or 200% of the original size, enlarge the object by a scale factor 2 : 1 To do this multiply each dimension by the fraction $\frac{2}{1}$.</p> <p>To make an object 2 times smaller or 50% of the original size, reduce the object by a scale factor 1 : 2 To do this multiply each dimension by the fraction $\frac{1}{2}$.</p> |
| <p>scalene triangle</p> | <ul style="list-style-type: none"> A <i>triangle</i> in which all three sides are a different length. |  |
| <p>scatter plot</p> | <ul style="list-style-type: none"> A <i>graph</i> in which two sets of data are plotted as ordered pairs in a <i>coordinate plane</i>. | <p>Continental facts (no Antarctica) Number of countries/GDP</p>  |
| <p>second (s)</p> | <ul style="list-style-type: none"> A very short unit of <i>time</i>. | <p>There are 60 seconds in 1 minute.</p> |
| <p>second</p> | <ul style="list-style-type: none"> The <i>position</i> after <i>first</i>. | <p>1st, 2nd.....</p> |
| <p>segment</p> | <ul style="list-style-type: none"> Two <i>points</i> and all points on the <i>line</i> between the two points. Part of a line. | <p>Segment \overline{AB}</p>  |
| <p>semicircle</p> | <ul style="list-style-type: none"> Half of a circle. |  |
| <p>sequence of numbers</p> | <ul style="list-style-type: none"> A list of numbers that follows a certain <i>rule</i>. Each number is called a <i>term</i>. | <p>35, 30, 25, 20, ... In this sequence of numbers, the next three are 15, 10 and 5.</p> |
| <p>seventh</p> | <ul style="list-style-type: none"> The <i>position</i> after <i>sixth</i>. | <p>1st, 2nd, 3rd, 4th, 5th, 6th, 7th.....</p> |
| <p>shortest</p> | <ul style="list-style-type: none"> Having the smallest <i>length</i>. | <p>Sam is the shortest in the class.</p> |
| <p>side</p> | <ul style="list-style-type: none"> One of the lines that form a <i>polygon</i>. |  |

| | | |
|---|--|---|
| <p>side view</p> | <ul style="list-style-type: none"> • What you see of an object looking from a <i>side perspective</i>. • <i>Three-dimensional</i> objects have 3 views: front, top and side. |  |
| <p>sign</p> | <ul style="list-style-type: none"> • The <i>positive</i> or <i>negative</i> indicator attached to any <i>real number</i> that is <i>greater than</i> or <i>less than</i> zero respectively. | <p>⊕ positive sign ⊖ negative sign</p> |
| <p>similar shapes</p> | <ul style="list-style-type: none"> • Shapes that are identical but not necessarily in size. | <p>These stars are similar.</p>  |
| <p>simplest form of a fraction</p> | <ul style="list-style-type: none"> • A <i>fraction</i> is in simplest form when the only number that divides into both the <i>numerator</i> and the <i>denominator</i> is 1. | <p>The simplest form of $\frac{6}{9}$ is $\frac{2}{3}$ (Divide 6 and 9 by 3. 2 and 3 can only be divided by 1 so they cannot be reduced.)</p> |
| <p>simplify</p> | <ul style="list-style-type: none"> • To reduce to the <i>simplest form</i>. | <p>To simplify the ratio 14 : 6 divide both sides by 2. 14 : 6 simplified is 7 : 3.</p> |
| <p>sixth</p> | <ul style="list-style-type: none"> • The <i>position</i> after <i>fifth</i>. | <p>1st, 2nd, 3rd, 4th, 5th, 6th.....</p> |
| <p>size</p> | <ul style="list-style-type: none"> • How big an object is. | <p>The size of the wave is 2 m.</p>  |
| <p>slide</p> | <ul style="list-style-type: none"> • Move without changing <i>direction</i>. See <i>translation</i>. |  |
| <p>smallest to largest</p> | <ul style="list-style-type: none"> • Ranking in order from the <i>littlest</i> to the <i>biggest</i>. |  |
| <p>solid</p> | <ul style="list-style-type: none"> • A <i>three-dimensional</i> shape that encloses a part of space. |  |
| <p>south</p> | <ul style="list-style-type: none"> • A <i>compass direction</i>. |  |
| <p>south-east</p> | <ul style="list-style-type: none"> • A <i>compass direction</i>. |  |

| | | |
|---|---|---|
| <p>south-west</p> | <ul style="list-style-type: none"> • A <i>compass direction</i>. |  |
| <p>speed</p> | <ul style="list-style-type: none"> • The <i>rate</i> at which an object moves. Speed is worked out by dividing the distance traveled by the time taken. <p>We call this average speed $v = \frac{d}{t}$</p> | <p>The average speed for a car which travels 150 km in 3 hours is:</p> $v = \frac{\text{distance}}{\text{time}} = \frac{150}{3} = 50 \text{ km/h}$ |
| <p>sphere</p> | <ul style="list-style-type: none"> • A <i>set of points</i> in space of equal distance from the central point. |  |
| <p>square</p> | <ul style="list-style-type: none"> • A <i>rectangle</i> with all <i>sides</i> of equal length. |  |
| <p>square centimetre (cm²)</p> | <ul style="list-style-type: none"> • A <i>unit of area</i> equal to 1 <i>centimetre</i> by 1 centimetre. |  |
| <p>square metre (m²)</p> | <ul style="list-style-type: none"> • A <i>unit of area</i> equal to 1 <i>metre</i> by 1 metre. |  |
| <p>square number</p> | <ul style="list-style-type: none"> • A number that results from multiplying another number by itself. | <p>9, 6.25 and $\frac{4}{9}$ are all square numbers.</p> $9 = 3 \times 3$ $6.25 = 2.5 \times 2.5$ $\frac{4}{9} = \frac{2}{3} \times \frac{2}{3}$ |
| <p>square prism</p> | <ul style="list-style-type: none"> • A <i>three-dimensional</i> shape. Two identical square <i>bases</i>. All the other faces are <i>rectangles</i>. |  |
| <p>square pyramid</p> | <ul style="list-style-type: none"> • A <i>three-dimensional</i> shape. One square <i>base</i>. All the other faces are <i>triangles</i>. |  |
| <p>square root of a number ($\sqrt{\quad}$)</p> | <ul style="list-style-type: none"> • A <i>number</i> which, when <i>multiplied</i> by itself, gives the original number. Finding the square root of a number is the <i>inverse operation</i> of squaring that number. | $\sqrt{900} = 30$ <p>Square root of 900 is 30, because</p> $30 \times 30 = 900 \text{ or } 30^2 = 900$ |


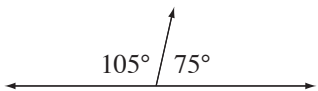
| | | |
|---------------------------|---|---|
| square units | <ul style="list-style-type: none"> A <i>unit</i> of <i>area</i> equal to the area of a square with side lengths of 1 unit. | $A = lw$ $= 3 \times 2$ $= 6$  2 units 3 units Area = 6 square units |
| squared | <ul style="list-style-type: none"> Multiplied by itself. A number raised to the second <i>power</i>. | 4 squared is written as 4^2 $4^2 = 4 \times 4 = 16$ |
| statistics | <ul style="list-style-type: none"> Numerical facts systematically collected, organised and analysed. | Data is collected from a sample of the population, organised into a graph and interpreted to summarise some characteristic. |
| stem-and-leaf plot | <ul style="list-style-type: none"> A diagram displaying <i>data</i> by <i>place value</i>. The data is in order from lowest to highest. | |

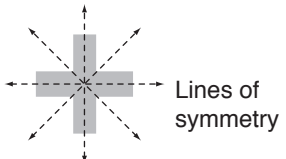
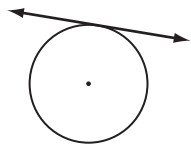
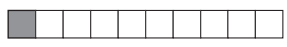
Data set of 13 elements: { 13, 18, 18, 19, 20, 21, 21, 22, 22, 22, 29, 30, 31 }

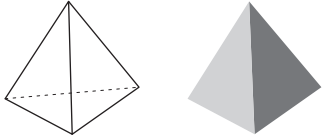

mode = 22
median (7th element) = 21
range

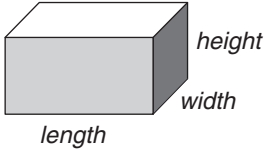
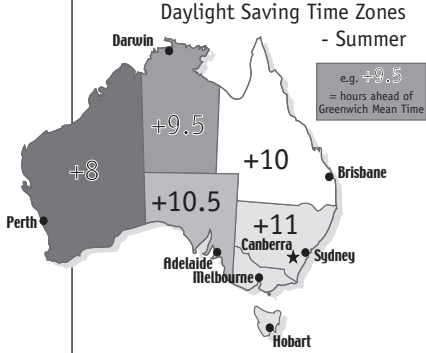
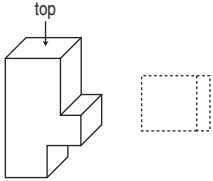
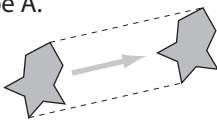
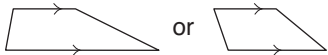
| stem | leaves | lowest value = 13 |
|------|---------------|--------------------|
| 1 | 3 8 8 9 | median = 21 |
| 2 | 0 1 1 2 2 2 9 | mode = 22 |
| 3 | 0 1 | highest value = 31 |

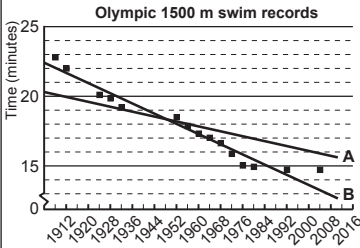



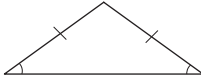

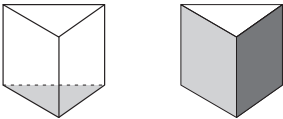
range = high - low
 $= 31 - 13$
 $= 18$
 mean = $286 \div 13$
 $= 22$

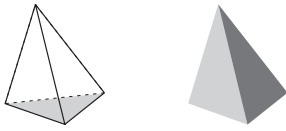
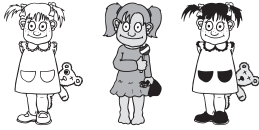
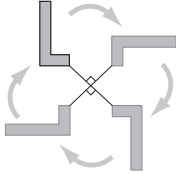
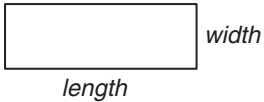

| | | |
|-------------------------------|--|---|
| straight angle | <ul style="list-style-type: none"> An <i>angle</i> measuring 180°. |  |
| substitute | <ul style="list-style-type: none"> To replace a number or function with another. Often used in <i>algebra</i> when a <i>variable</i> (letter) is replaced by a number. | If $x = 4$, the value of $x + x$ is found by replacing the letter x with 4: $4 + 4 = 8$ |
| subtract | <ul style="list-style-type: none"> To take away or <i>minus</i>. | If you subtract 10 from 15 you are left with 5: $15 - 10 = 5$ |
| sum | <ul style="list-style-type: none"> The result when two or more numbers are added. | The sum of 20 and 6 is 26: $20 + 6 = 6 + 20 = 26$ |
| supplement of an angle | <ul style="list-style-type: none"> An <i>angle</i> that, when added to an <i>adjacent</i> angle, makes a <i>straight angle</i> (or 180° in total). | 75° is the supplement of 105° , because $75^\circ + 105^\circ = 180^\circ$  |

| <p>survey</p> | <ul style="list-style-type: none"> • A method of collecting a <i>sample</i> of <i>data</i> by getting people's responses. | <p>TV ratings are determined by surveying viewers.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------------|---|--|-----------|-------------|------------|-------------|-------------|------------|-------------|-------------|---------------|----|-------------|----|--------|-------------|----|----|---------------|----|----|--------------|---------|----|----|----|-----------|----|----|----|
| <p>symmetry</p> | <ul style="list-style-type: none"> • A shape has a <i>line of symmetry</i> when a line can be drawn through the shape so that one side of the shape is the mirror image of the other. | <p>There are 3 kinds of symmetry: horizontal symmetry vertical symmetry rotational symmetry</p>  | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>table</p> | <ul style="list-style-type: none"> • <i>Data</i> organised in <i>columns</i> and <i>rows</i>. | <p>Medal Tally - Beijing Olympics 2008</p> <table border="1" data-bbox="1125 593 1444 817"> <thead> <tr> <th>COUNTRY</th> <th>Gold</th> <th>Silver</th> <th>Bronze</th> </tr> </thead> <tbody> <tr> <td>China</td> <td>51</td> <td>21</td> <td>28</td> </tr> <tr> <td>United States</td> <td>36</td> <td>38</td> <td>36</td> </tr> <tr> <td>Russia</td> <td>23</td> <td>21</td> <td>28</td> </tr> <tr> <td>Great Britain</td> <td>19</td> <td>13</td> <td>15</td> </tr> <tr> <td>Germany</td> <td>16</td> <td>10</td> <td>15</td> </tr> <tr> <td>Australia</td> <td>14</td> <td>15</td> <td>17</td> </tr> </tbody> </table> | COUNTRY | Gold | Silver | Bronze | China | 51 | 21 | 28 | United States | 36 | 38 | 36 | Russia | 23 | 21 | 28 | Great Britain | 19 | 13 | 15 | Germany | 16 | 10 | 15 | Australia | 14 | 15 | 17 |
| COUNTRY | Gold | Silver | Bronze | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| China | 51 | 21 | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| United States | 36 | 38 | 36 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Russia | 23 | 21 | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Great Britain | 19 | 13 | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Germany | 16 | 10 | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Australia | 14 | 15 | 17 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>table of values</p> | <ul style="list-style-type: none"> • A list of numbers that are used to <i>substitute</i> one <i>variable</i> (<i>x</i>) in a <i>rule</i> or <i>function</i>, to find the <i>value</i> of the other variable (<i>y</i>). | <p>$y = x + 4$</p> <table border="1" data-bbox="1157 929 1428 1153"> <thead> <tr> <th><i>x</i></th> <th>$y = x + 4$</th> <th><i>y</i></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>$1 + 4 = 5$</td> <td>5</td> </tr> <tr> <td>2</td> <td>$2 + 4 = 6$</td> <td>6</td> </tr> <tr> <td>3</td> <td>$3 + 4 = 7$</td> <td>7</td> </tr> <tr> <td>4</td> <td>$4 + 4 = 8$</td> <td>8</td> </tr> <tr> <td>5</td> <td>$5 + 4 = 9$</td> <td>9</td> </tr> <tr> <td>6</td> <td>$6 + 4 = 10$</td> <td>10</td> </tr> </tbody> </table> | <i>x</i> | $y = x + 4$ | <i>y</i> | 1 | $1 + 4 = 5$ | 5 | 2 | $2 + 4 = 6$ | 6 | 3 | $3 + 4 = 7$ | 7 | 4 | $4 + 4 = 8$ | 8 | 5 | $5 + 4 = 9$ | 9 | 6 | $6 + 4 = 10$ | 10 | | | | | | | |
| <i>x</i> | $y = x + 4$ | <i>y</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | $1 + 4 = 5$ | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | $2 + 4 = 6$ | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | $3 + 4 = 7$ | 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | $4 + 4 = 8$ | 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | $5 + 4 = 9$ | 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | $6 + 4 = 10$ | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>tangent to a circle</p> | <ul style="list-style-type: none"> • A <i>line</i> that touches the <i>circle</i> at a <i>point</i> without crossing over. |  | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>tax</p> | <ul style="list-style-type: none"> • A financial charge imposed by the state often calculated as a <i>percentage</i>. | <p>If a sales tax of 6% is applied on a purchase of \$100, the total amount that must be paid is \$106.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>temperature</p> | <ul style="list-style-type: none"> • How hot or cold a thing is. • Temperature is measured in <i>degrees Celsius</i> ($^{\circ}\text{C}$) with a <i>thermometer</i>. | <p>99.97$^{\circ}\text{C}$ is the temperature at which water boils.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>tens</p> | <ul style="list-style-type: none"> • The <i>place value</i> between the <i>units</i> and <i>hundreds</i>. | <p>1825.763 has 2 tens.</p> <table border="1" data-bbox="1109 1848 1468 2004"> <thead> <tr> <th>thousands</th> <th>hundreds</th> <th>tens</th> <th>units</th> <th>tenths</th> <th>hundredths</th> <th>thousandths</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>8</td> <td>2</td> <td>5</td> <td>7</td> <td>6</td> <td>3</td> </tr> </tbody> </table> | thousands | hundreds | tens | units | tenths | hundredths | thousandths | 1 | 8 | 2 | 5 | 7 | 6 | 3 | | | | | | | | | | | | | | |
| thousands | hundreds | tens | units | tenths | hundredths | thousandths | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 8 | 2 | 5 | 7 | 6 | 3 | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>tenth</p> | <ul style="list-style-type: none"> • One part out of 10 parts of one whole. |  | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

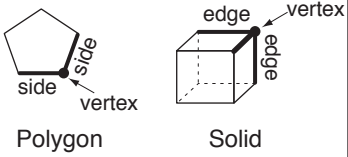
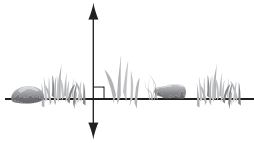
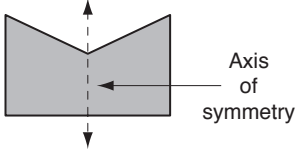
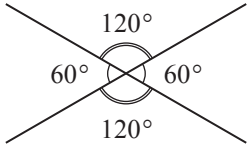
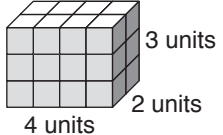

| | | | | | | | | | | | | | | | | |
|-----------------------------------|--|---|-----------|----------|------------|-------------|--------|------------|-------------|---|---|---|---|---|---|---|
| <p>tenths</p> | <ul style="list-style-type: none"> The <i>place value</i> after the decimal point between the <i>units</i> and <i>hundredths</i>. | <p>1825.763 has 7 tenths.</p> <table border="1" data-bbox="1182 125 1532 271"> <tr> <td>thousands</td> <td>hundreds</td> <td>tens</td> <td>units</td> <td>tenths</td> <td>hundredths</td> <td>thousandths</td> </tr> <tr> <td>1</td> <td>8</td> <td>2</td> <td>5</td> <td>7</td> <td>6</td> <td>3</td> </tr> </table> | thousands | hundreds | tens | units | tenths | hundredths | thousandths | 1 | 8 | 2 | 5 | 7 | 6 | 3 |
| thousands | hundreds | tens | units | tenths | hundredths | thousandths | | | | | | | | | | |
| 1 | 8 | 2 | 5 | 7 | 6 | 3 | | | | | | | | | | |
| <p>term</p> | <ul style="list-style-type: none"> Any part of an expression separated by “+” or “-” signs. A term can be a: <ol style="list-style-type: none"> constant (<i>number</i>) single letter or <i>variable</i> <i>product</i> of a number and a variable product of a number and two or more variables <div style="display: flex; justify-content: space-around;"> <div data-bbox="466 689 783 880" style="border: 1px solid black; padding: 5px;"> $a + a + a + a + a = \text{Five lots of } a$ $= 5 \times a$ $= 5a$ <p>We simplify the writing by removing the "x" sign. We read this as "five a".</p> </div> <div data-bbox="799 689 1106 880" style="border: 1px solid black; padding: 5px;"> $a = \text{One lot of } a$ $= 1 \times a$ $= 1a$ $= a$ <p>We simplify the writing by removing the "1" and the "x" sign. We read this as "a".</p> </div> </div> | <ol style="list-style-type: none"> $7, \frac{1}{3}$ or -18 a, b or $-c$ $7a, \frac{1}{b}, -18g$ or $3x^2$ $7ab, 5mn^3$ or $-3jk^2$ <p>A term that has both numerals and variables is always written with the number before the variable.</p> <p>If there is more than one variable in the term then they are usually written in alphabetical order.</p> | | | | | | | | | | | | | | |
| <p>terminating decimal</p> | <ul style="list-style-type: none"> A <i>decimal</i> whose <i>digits</i> end. Every terminating decimal can be written as a <i>fraction</i> with a <i>denominator</i> of 10, 100 or 1000 etc. | $0.765 = \frac{765}{1000}$ | | | | | | | | | | | | | | |
| <p>tetrahedron</p> | <ul style="list-style-type: none"> A <i>triangular pyramid</i>. <p>See also regular tetrahedron.</p> |  | | | | | | | | | | | | | | |
| <p>thermometer</p> | <ul style="list-style-type: none"> An instrument used to measure <i>temperature</i>. |  | | | | | | | | | | | | | | |
| <p>third</p> | <ul style="list-style-type: none"> The <i>position</i> after <i>second</i>. | <p>1st, 2nd, 3rd.....</p> | | | | | | | | | | | | | | |
| <p>thousands</p> | <ul style="list-style-type: none"> The <i>place value</i> between <i>hundreds</i> and tens of thousands. | <p>1825.763 has 1 thousand.</p> <table border="1" data-bbox="1182 1592 1532 1738"> <tr> <td>thousands</td> <td>hundreds</td> <td>tens</td> <td>units</td> <td>tenths</td> <td>hundredths</td> <td>thousandths</td> </tr> <tr> <td>1</td> <td>8</td> <td>2</td> <td>5</td> <td>7</td> <td>6</td> <td>3</td> </tr> </table> | thousands | hundreds | tens | units | tenths | hundredths | thousandths | 1 | 8 | 2 | 5 | 7 | 6 | 3 |
| thousands | hundreds | tens | units | tenths | hundredths | thousandths | | | | | | | | | | |
| 1 | 8 | 2 | 5 | 7 | 6 | 3 | | | | | | | | | | |
| <p>thousandth</p> | <ul style="list-style-type: none"> One part out of 1000 parts of one whole. | <p>One gram is a thousandth of a kilogram.</p> | | | | | | | | | | | | | | |
| <p>thousandths</p> | <ul style="list-style-type: none"> The <i>place value</i> after <i>hundredths</i>. | <p>1825.763 has 3 thousandths.</p> <table border="1" data-bbox="1182 1955 1532 2101"> <tr> <td>thousands</td> <td>hundreds</td> <td>tens</td> <td>units</td> <td>tenths</td> <td>hundredths</td> <td>thousandths</td> </tr> <tr> <td>1</td> <td>8</td> <td>2</td> <td>5</td> <td>7</td> <td>6</td> <td>3</td> </tr> </table> | thousands | hundreds | tens | units | tenths | hundredths | thousandths | 1 | 8 | 2 | 5 | 7 | 6 | 3 |
| thousands | hundreds | tens | units | tenths | hundredths | thousandths | | | | | | | | | | |
| 1 | 8 | 2 | 5 | 7 | 6 | 3 | | | | | | | | | | |

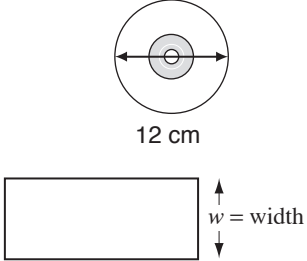
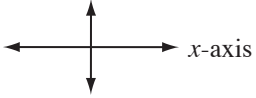
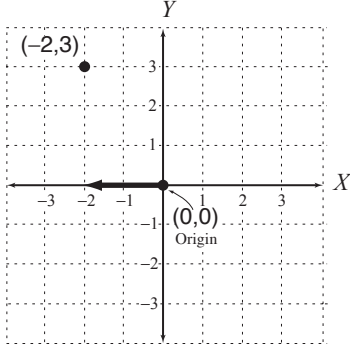
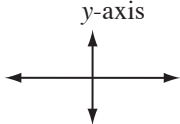
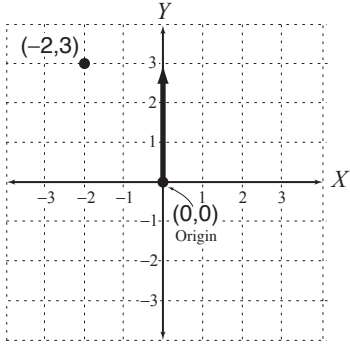
| | | |
|-------------------------------|---|--|
| three-dimensional (3D) | <ul style="list-style-type: none"> • Able to be measured in three directions namely <i>length</i>, <i>width</i> and <i>height</i>. |  |
| time | <ul style="list-style-type: none"> • The continuum from past to present to future. | The time is 9:25 am. |
| time zone | <ul style="list-style-type: none"> • Regions of different <i>times</i> around the world. Based on Greenwich Mean Time (GMT), each 15° of longitude away from Greenwich, England represents 1 hour of time. | NSW time is 3 hours ahead of WA time during daylight saving. Daylight Saving Time Zones - Summer  |
| tip | <ul style="list-style-type: none"> • Optional payment given in addition to a required payment, usually to express appreciation for excellent service. | The tip added an extra 5% to the cost of the meal. |
| tonne (t) | <ul style="list-style-type: none"> • A <i>unit of measurement for mass equal to 1000 kilograms</i>. | The humpback whale can weigh 58 tonnes. |
| top view | <ul style="list-style-type: none"> • What you see of an object looking from a top <i>perspective</i>. • <i>Three-dimensional</i> objects have 3 views: front, top and side. |  |
| total | <ul style="list-style-type: none"> • The whole lot. • The <i>sum</i> of two or more quantities. | The total of 2 and 7 and 3 is 12: $2 + 7 + 3 = 12$ |
| transformation | <ul style="list-style-type: none"> • A movement of a shape in a <i>coordinate plane</i>. Types of transformations are <i>translations</i>, <i>reflections</i> and <i>rotations</i>. | See <i>translation</i> , <i>reflection</i> and <i>rotation</i> . |
| translation | <ul style="list-style-type: none"> • A movement that <i>slides</i> a shape. Each <i>point</i> of the shape is moved the same distance, in the same direction, to produce a shape that is <i>congruent</i> to the original one. | Shape B is a translation of shape A.  |
| trapezium | <ul style="list-style-type: none"> • A <i>quadrilateral</i>. Two <i>opposite sides</i> are <i>parallel</i>. |  |

| | | | |
|-------------------------------------|--|---|---|
| <p>tree diagram</p> | <ul style="list-style-type: none"> • A tree diagram displays all the possible <i>outcomes</i> of an <i>event</i>. | <p>Event: Tossing 2 coins</p> <pre> / \ / \ / \ / \ / \ / \ 1st Coin H T / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ / \ 2nd coin H T H T </pre> <p>When tossing 2 coins there are 4 possible outcomes (branches): HH, HT, TH, TT - sample space</p> | |
| <p>trend line</p> | <ul style="list-style-type: none"> • A straight or curved <i>line</i> which is closest to all the <i>data points</i> in a <i>scatter plot</i> and gives the best approximation to the trend of the <i>set</i> of data. • A line which goes through the ‘middle’ of the data points so that the <i>sums</i> of the distances from the points above and below the line, to the line, are <i>approximately equal</i>. | <p>Line B is a line of best fit, being closest to all the data points.</p>  | |
| <p>tri</p> | <ul style="list-style-type: none"> • Prefix meaning three. | <p>A tricycle has 3 wheels.</p>  | |
| <p>trial and error</p> | <ul style="list-style-type: none"> • To try repeatedly and learn from mistakes. | <p>This sum can be solved using trial and error.</p> $\begin{array}{r} \text{TWO} \\ + \text{TWO} \\ \hline \text{FOUR} \end{array}$ | |
| <p>triangle</p> | <ul style="list-style-type: none"> • A <i>polygon</i> with 3 straight <i>sides</i>. | | |
| <p>triangle</p> | <p><i>Interior angles</i></p> | <p><i>Sides</i></p> | <p><i>Diagram</i></p> |
| <p><i>Right-angled triangle</i></p> | <p>1 right angle</p> | |  |
| <p><i>Scalene triangle</i></p> | <p>0 equal angles</p> | <p>0 sides of equal length</p> |  |
| <p><i>Isosceles triangle</i></p> | <p>2 equal angles</p> | <p>2 sides of equal length</p> |  |
| <p><i>Equilateral triangle</i></p> | <p>3 equal angles</p> | <p>3 sides of equal length</p> |  |
| <p>triangular prism</p> | <ul style="list-style-type: none"> • A <i>three-dimensional</i> shape. Two identical triangular <i>bases</i>. Three rectangular faces. |  | |

| <p>triangular pyramid</p> | <ul style="list-style-type: none"> • A <i>three-dimensional</i> shape. One triangular <i>base</i>. The other three faces are <i>triangles</i>. |  | | | | | | | | | | | | | | | | | | | | | |
|-------------------------------------|---|---|-----------|----------|------------|-------------|--------|------------|-------------|---|---|---|------|---|-----|-----|-----|-----|---|-----|-----|-----|-----|
| <p>triple</p> | <ul style="list-style-type: none"> • Multiply by three. | <p>Children $\times 3 =$ triplets!</p>  | | | | | | | | | | | | | | | | | | | | | |
| <p>turn</p> | <ul style="list-style-type: none"> • To <i>rotate</i> about a point. |  | | | | | | | | | | | | | | | | | | | | | |
| <p>twenty-four hour time</p> | <ul style="list-style-type: none"> • Time told in 24 hour lots using 4 <i>digits</i>. | <p>Nine thirty am is 0930 or 09:30 Two thirty pm is 1430 or 14:30</p> | | | | | | | | | | | | | | | | | | | | | |
| <p>twice</p> | <ul style="list-style-type: none"> • Two times. | <p>Sam has \$5 and Jo has \$10. Jo has twice as much as Sam.</p> | | | | | | | | | | | | | | | | | | | | | |
| <p>two-dimensional (2D)</p> | <ul style="list-style-type: none"> • Able to be measured in 2 <i>directions</i> (<i>length</i> and <i>width</i>). |  | | | | | | | | | | | | | | | | | | | | | |
| <p>two-way table</p> | <ul style="list-style-type: none"> • A table that shows the combinations of possible outcomes and their values. | <p>Possible outcomes when spinning a spinner labelled 1, 2, 3, 4 and flipping a coin.</p>  <table border="1" data-bbox="979 1469 1469 1637"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Spinner</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <th rowspan="2">Coin</th> <th>H</th> <td>H,1</td> <td>H,2</td> <td>H,3</td> <td>H,4</td> </tr> <tr> <th>T</th> <td>T,1</td> <td>T,2</td> <td>T,3</td> <td>T,4</td> </tr> </tbody> </table> | | | Spinner | | | | 1 | 2 | 3 | 4 | Coin | H | H,1 | H,2 | H,3 | H,4 | T | T,1 | T,2 | T,3 | T,4 |
| | | Spinner | | | | | | | | | | | | | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | | | | | | | | | | | | | | | | | | |
| Coin | H | H,1 | H,2 | H,3 | H,4 | | | | | | | | | | | | | | | | | | |
| | T | T,1 | T,2 | T,3 | T,4 | | | | | | | | | | | | | | | | | | |
| <p>unit</p> | <ul style="list-style-type: none"> • One. | <p>The unit of measurement for length is metre (m).</p> | | | | | | | | | | | | | | | | | | | | | |
| <p>units</p> | <ul style="list-style-type: none"> • The <i>place value</i> before the decimal point between the <i>tens</i> and <i>tenths</i>. | <p>1825.763 has 5 units.</p> <table border="1" data-bbox="1110 1933 1469 2078"> <thead> <tr> <th>thousands</th> <th>hundreds</th> <th>tens</th> <th>units</th> <th>tenths</th> <th>hundredths</th> <th>thousandths</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>8</td> <td>2</td> <td>5</td> <td>7</td> <td>6</td> <td>3</td> </tr> </tbody> </table> | thousands | hundreds | tens | units | tenths | hundredths | thousandths | 1 | 8 | 2 | 5 | 7 | 6 | 3 | | | | | | | |
| thousands | hundreds | tens | units | tenths | hundredths | thousandths | | | | | | | | | | | | | | | | | |
| 1 | 8 | 2 | 5 | 7 | 6 | 3 | | | | | | | | | | | | | | | | | |

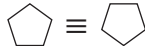


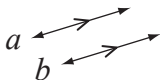
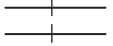


| | | | |
|-----------------------------|--|--------------------------------|--|
| units of measurement | • Standard amount or quantity. | | See <i>cubic unit</i> and <i>square unit</i> . |
| metric units | <i>Abbreviation</i> | <i>Examples</i> | <i>Used for measuring.....</i> |
| • millimetre | mm | thickness of a plank of wood | LENGTH distance - length, width, height, diameter, perimeter |
| • centimetre | cm | width of a photo frame | |
| • metre | m | length of a lap of a stadium | |
| • kilometre | km | distance between two cities | |
| • gram | g | weight of an egg | MASS weight - people, animals, objects |
| • kilogram | kg | weight of a bag of apples | |
| • tonne | t | weight of an elephant | |
| • millilitre | mL | liquid in a can | CAPACITY (Liquid Volume) quantity - liquids |
| • litre | L | liquid in a bucket | |
| • square centimetre | cm ² | area of a Math book cover | |
| • square metre | m ² | area of the gym floor | AREA surface - objects, territories (countries, continents, oceans) |
| • square kilometre | km ² | area of Texas | |
| • cubic centimetre | cm ³ | volume of water in a fish tank | |
| • cubic metre | m ³ | volume of air in a warehouse | VOLUME quantity - air, water |
| unlike terms | • Are <i>terms</i> that contain different <i>variables</i> raised to the different <i>powers</i> . Unlike terms cannot be <i>added</i> or <i>subtracted</i> however they may be <i>multiplied</i> and <i>divided</i> . | | Opposite to <i>like terms</i> . 7, 6a and -4y ³ are not like terms. 5w, $\frac{6}{w}$ and -18w ² are not like terms. |
| valid | • Grounded in <i>logic</i> or truth. | | If A causes B and B causes C then it is valid to propose that A may cause C. |
| variable | • A letter of the alphabet which stands in for a number. A variable takes the place of: an unknown value or a value which may change (vary) in different situations. | | Opposite to a <i>constant</i> . In $y = x + 5$ 5 is constant x and y are variables. |
| Venn diagram | • A diagram using circles to show the relationship between <i>sets</i> of objects. | | |

| | | |
|-----------------------------------|--|--|
| vertex | <ul style="list-style-type: none"> • (pl. vertices) The point at which two <i>sides</i> (of a <i>polygon</i>) or three <i>edges</i> (of a <i>solid</i>) meet. |  <p>Polygon Solid</p> |
| vertical line | <ul style="list-style-type: none"> • A <i>line</i> at a <i>right angle</i> to the horizon. |  |
| vertical symmetry | <ul style="list-style-type: none"> • A shape has vertical symmetry if an <i>axis of symmetry</i> is vertical. |  |
| vertically opposite angles | <ul style="list-style-type: none"> • <i>Angles</i> on opposite sides of a <i>pair of intersecting lines</i>. • Vertical angles are <i>congruent</i>. | <p>All vertical angles are equal in a pair of intersecting lines.</p>  |
| volume | <ul style="list-style-type: none"> • The amount of space that a <i>solid</i> occupies. Volume is measured in <i>cubic units</i>. e.g. cubic centimetres (cm³) or cubic metres (m³). | <p>Volume of a rectangular prism is calculated by multiplying length by width by height:</p> $V = lwh$ $= 4 \times 2 \times 3$ $= 24$ <p>Volume = 24 cubic units</p>  |
| week | <ul style="list-style-type: none"> • A <i>unit</i> of <i>time</i> equal to 7 days; Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday. | <p>Roger was on holidays for one week (seven days).</p> |
| weight | <ul style="list-style-type: none"> • The heaviness of an object. Equals the <i>mass</i> of an object times the force of gravity. This means that weight changes with any change in gravity. | <p>A 3 kg brick weighs: 3 kg on Earth, about 0.5 kg on the moon, 0 kg in outer space.</p> |
| west | <ul style="list-style-type: none"> • A <i>compass direction</i>. | <p>The sun sets in the west.</p>  |
| whole numbers | <ul style="list-style-type: none"> • The <i>counting numbers</i> from zero to <i>infinity</i>. | <p>0, 1, 2, 3, 4, 5, are whole numbers.</p> |

| | | |
|---------------------|--|--|
| width | <ul style="list-style-type: none"> • How wide an object is. The sideways <i>dimension</i>. | <p>The width of the CD is 12 cm.</p>  |
| x-axis | <ul style="list-style-type: none"> • The <i>horizontal</i> axis. |  |
| x-coordinate | <ul style="list-style-type: none"> • The <i>first</i> number in an ordered pair. The position of a <i>point</i> along the <i>x-axis</i>. | <p>The x-coordinate of the ordered pair $(-2,3)$ is -2.</p>  |
| y-axis | <ul style="list-style-type: none"> • The <i>vertical</i> axis. |  |
| y-coordinate | <ul style="list-style-type: none"> • The <i>second</i> number in an ordered pair. The position of a <i>point</i> along the <i>y-axis</i>. | <p>The y-coordinate of the ordered pair $(-2,3)$ is 3.</p>  |
| year | <ul style="list-style-type: none"> • A <i>unit of time</i> equal to 365 days. (366 in a leap year). | <p>1st of January to the 31st of December.</p> |

MATHS FACTS

SYMBOLS

| Number | Geometry |
|-----------------------------------|--|
| + | plus or add |
| - | minus or subtract |
| × | multiplied by, times, lots of |
| ÷ | divided by, into groups of |
| = | equals, is equal to |
| ≠ | is not equal to |
| ≈ | is approximately equal to |
| < | is less than, $4 < 6$ |
| > | is greater than, $8 > 5$ |
| ≤ | is less than or equal to |
| ≥ | is greater than or equal to |
| () | brackets, a grouping symbol |
| % | percentage, $12\% = \frac{12}{100}$ |
| . | decimal point as in 7.9 |
| -3 | negative 3 |
| 6^3 | 6 raised to the 3 rd power, $6 \times 6 \times 6$ |
| $\sqrt{9}$ | square root of 9 |
| $\frac{4}{7}$ | fraction, $4 \div 7$, four sevenths |
| $a:b$ or $\frac{a}{b}$ | ratio of a to b |
| $2.\dot{4}$ or $2.\dot{1}\dot{3}$ | recurring decimal |
| | π (pi) ≈ 3.14 or $\frac{22}{7}$ |
| | $^\circ$ degree (a right angle measures 90°) |
| | \equiv is congruent to,  |
| | \sim is similar to,  |
| | \parallel is parallel to |
| | \perp is perpendicular to |
| | $\triangle ABC$ triangle with vertices A, B and C |
| |  right angle |
| | \overleftrightarrow{AD} line AD |
| | \overline{BC} segment BC |
| |  parallel lines (line a is parallel to line b) |
| |  congruent segments |
| |  equal angles |
| |  equal side lengths |

Algebra

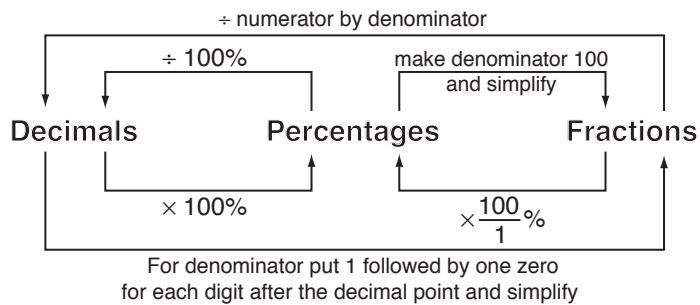
- $3x$ 3 times x , 3 lots of x , $3 \times x$, $3x$
- x^2 x raised to the 2nd power, $x \times x$
- $-x$ opposite of x
- $\frac{1}{x}$ reciprocal of x
- (x,y) coordinates in a Cartesian plane

NUMBER FACTS (1)

Place Value

| millions | hundreds of thousands | tens of thousands | thousands | hundreds | tens | units | ↓ decimal point | tenths | hundredths | thousandths |
|-----------|-----------------------|-------------------|-----------|----------|------|-------|-----------------|----------------|-----------------|------------------|
| 1 000 000 | 100 000 | 10 000 | 1 000 | 100 | 10 | 1 | | $\frac{1}{10}$ | $\frac{1}{100}$ | $\frac{1}{1000}$ |

Decimals / Fractions / Percentages



| Fraction | Decimal | Percentage |
|---------------|--------------|------------|
| $\frac{1}{1}$ | 1 | 100% |
| $\frac{1}{2}$ | 0.5 | 50% |
| $\frac{1}{3}$ | 0. $\dot{3}$ | 33.33% |
| $\frac{2}{3}$ | 0. $\dot{6}$ | 66.66% |
| $\frac{1}{4}$ | 0.25 | 25% |
| $\frac{3}{4}$ | 0.75 | 75% |
| $\frac{1}{5}$ | 0.2 | 20% |
| $\frac{2}{5}$ | 0.4 | 40% |
| $\frac{3}{5}$ | 0.6 | 60% |
| $\frac{4}{5}$ | 0.8 | 80% |
| $\frac{1}{8}$ | 0.125 | 12.5% |
| $\frac{1}{9}$ | 0. $\dot{1}$ | 11.11% |

0

Subtraction $a - 0 = a$

Multiplication $a \times 0 = 0$ and $0 \times a = 0$

Division $0 \div a = 0$

1

Multiplication $a \times 1 = a$ and $1 \times a = a$

Division $a \div 1 = a$

Prime numbers < 100

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89 and 97

Perfect squares of numbers 0 to 30

0, 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, 256, 289, 324, 361, 400, 441, 484, 529, 576, 625, 676, 729, 784, 841 and 900

NUMBER FACTS (2)

Real Numbers \mathbb{R}

IRRATIONAL

π , ϕ , e , $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$,
2.6293045632....
 $\cos 30^\circ$

 \mathbb{Q}

RATIONAL

$-2\frac{3}{7}$, 3.010101...,
 $\frac{4}{10}$, 0.56, $\sqrt{\frac{4}{9}}$

 \mathbb{Z}

Integers

..., -3, -2, -1, 0, 1, 2, 3, ...

 \mathbb{N}

Natural (Whole Numbers)
0, 1, 2, 3, 4, 5, 6, ...

Operation terminology

Addition: sum, all together, in total, more than

Subtraction: difference, less than, change

Multiplication: product, times, lots of

Division: a fraction (half, third, quarter) of,
quotient

Sign rules

$$++ = +$$

$$-- = +$$

$$+- = -$$

$$-+ = -$$

Order of operations

- 1) Simplify inside all brackets first.
- 2) Evaluate powers and square roots.
- 3) Do all multiplications or divisions in order from left to right.
- 4) Do all additions or subtractions in order from left to right.

Ratios and Proportions

$$a : b = \frac{a}{b}$$

$$a : b = c : d$$

$$\frac{a}{b} \times \frac{c}{d}$$

$$a \times d = b \times c$$

$$ad = bc$$

ALGEBRA FACTS

Identity properties

Additive identity $a + 0 = 0 + a = a$

Multiplicative identity $a \times 1 = 1 \times a = a$

Commutative properties

Addition $a + b = b + a$

Multiplication $a \times b = b \times a$

Associative properties

Addition $(a + b) + c = a + (b + c)$

Multiplication $(a \times b) \times c = a \times (b \times c)$

Distributive properties

$$a(b + c) = ab + ac$$

$$a(b - c) = ab - ac$$

Inverse operation rules

| Operation + | Inverse Operation − | Operation − | Inverse Operation + | Operation × | Inverse Operation ÷ | Operation ÷ | Inverse Operation × |
|---------------------|------------------------|---------------------|------------------------|------------------------------|------------------------|-------------------------------------|------------------------|
| $x + 3 = 6$ | | $x - 3 = 6$ | | $3x = 6$ | | $\frac{x}{3} = 6$ | |
| $x + 3 - 3 = 6 - 3$ | | $x - 3 + 3 = 6 + 3$ | | $\frac{3x}{3} = \frac{6}{3}$ | | $\frac{x}{3} \times 3 = 6 \times 3$ | |
| $x = 3$ | | $x = 9$ | | $x = 2$ | | $x = 18$ | |

Inverse properties

Addition $a + (-a) = a - a = 0$

Multiplication $a \times \frac{1}{a} = \frac{1}{a} \times a = 1, a \neq 0$

MEASUREMENT FACTS (1)

CONVERSIONS

Length

10 millimetres (mm) = 1 centimetre (cm)

$$\left. \begin{array}{l} 100 \text{ cm} = \\ 1000 \text{ mm} = \end{array} \right\} 1 \text{ metre (m)}$$

1000 m = 1 kilometre (km)

Temperature - degrees Celsius (°C)

0°C = freezing point of water

37°C = human body temperature

100°C = boiling point of water

Mass

1000 milligrams (mg) = 1 gram (g)

1000 g = 1 kilogram (kg)

1000 kg = 1 tonne (t)

Area

100 square mm (mm²) = 1 square cm (cm²)

10 000 cm² = 1 square metre (m²)

1 000 000 m² = 1 square km (km²)

Liquid capacity

$$\left. \begin{array}{l} 1000 \text{ millilitres (mL)} = \\ 1000 \text{ cm}^3 = \end{array} \right\} 1 \text{ litre (L)}$$

1000 L = 1 kilolitre (kL)

Volume

1000 cubic mm (mm³) = 1 cubic cm (cm³)

1 000 000 cm³ = 1 cubic metre (m³)

Time

60 seconds (s) = 1 minute (min)

60 minutes (min) = 1 hour (h)

24 hours = 1 day

7 days = 1 week

4 weeks (approx.) = 1 month

$$\left. \begin{array}{l} 365 \text{ or } 366 \text{ days} = \\ 52 \text{ weeks (approx.)} = \\ 12 \text{ months} = \end{array} \right\} 1 \text{ year}$$

10 years = 1 decade

100 years = 1 century

Conversion factors: capacity ⇔ volume

1 millilitre (mL) = 1 cubic centimetre (cm³)

1000 litre (L) = 1 cubic metre (m³)

METRIC PREFIXES

giga (G) = 1 billion = 1 000 000 000

mega (M) = 1 million = 1 000 000

kilo (k) = 1 thousand = 1000

hecto (h) = 1 hundred = 100

deca (da) = 1 ten = 10

micro (μ) = 1 millionth = $\frac{1}{1\,000\,000}$

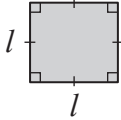
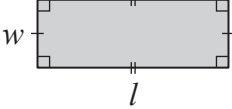
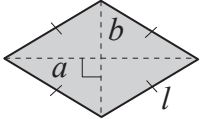
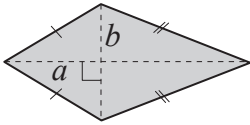
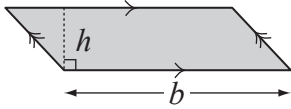
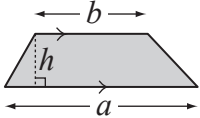
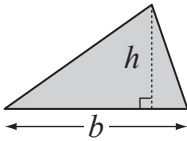

milli (m) = 1 thousandth = $\frac{1}{1000}$

centi (c) = 1 hundredth = $\frac{1}{100}$

deci (d) = 1 tenth = $\frac{1}{10}$

MEASUREMENT FACTS (2)

2D shapes - Formulae

| Name | Shape | Perimeter | Area |
|---------------|---|-------------------------------|---|
| Square |  | $P = 4 \times l$ $= 4l$ | $A = l \times l$ $= l^2$ |
| Rectangle |  | $P = 2l + 2w$ $= 2(l + w)$ | $A = l \times w$ $= lw$ |
| Rhombus |  | $P = 4 \times l$ $= 4l$ | $A = \frac{a \times b}{2}$ $= \frac{1}{2}ab$ |
| Kite |  | $P = \text{Sum of all sides}$ | $A = \frac{a \times b}{2}$ $= \frac{1}{2}ab$ |
| Parallelogram |  | $P = \text{Sum of all sides}$ | $A = b \times h$ $= bh$ |
| Trapezium |  | $P = \text{Sum of all sides}$ | $A = \frac{1}{2}(a + b)h$ |
| Triangle |  | $P = \text{Sum of all sides}$ | $A = \frac{b \times h}{2}$ $= \frac{1}{2}bh$ |
| Circle |  | $C = 2\pi r$ | $A = \pi r^2$ where $\pi \approx 3.14$ or $\frac{22}{7}$ |

Prefixes

poly - many
equi - equal
hedra - face
gon - angle
lateral - side

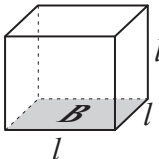
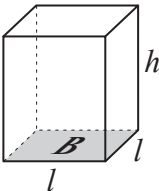
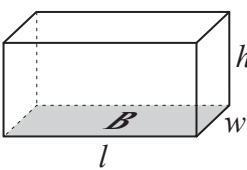
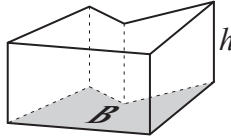
mono - one
bi or di - two
tri - three
quad or tetra - four
penta - five
hexa - six
hepta - seven
octa - eight
nona - nine
deca - ten

Abbreviations

l length
w width
h height
b base length
P perimeter
r radius
C circumference
A area

MEASUREMENT FACTS (3)

3D shapes - Formulae

| Name | Shape | Volume |
|-------------------|--|-------------------------|
| Cube |  | $V = l^3$ or $= Bh$ |
| Square Prism |  | $V = l^2h$ or $= Bh$ |
| Rectangular Prism |  | $V = lwh$ or $= Bh$ |
| Prism - (All) |  | $V = Bh$ |

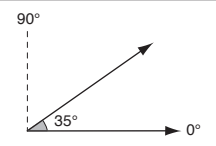
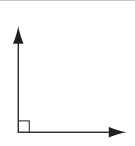
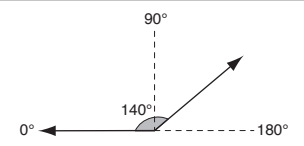
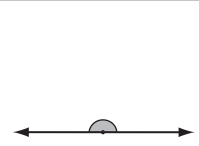
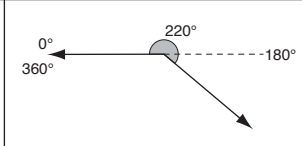
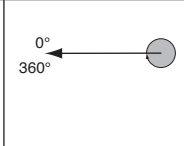
Abbreviations

l length
 w width
 h height
 b base length
 r radius

A area
 P perimeter
 V volume
 B base area
 C circumference

GEOMETRY FACTS

2D shapes

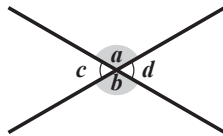
| Acute $< 90^\circ$ | Right 90° | Obtuse more than 90° less than 180° | Straight 180° | Reflex more than 180° less than 360° | Revolution 360° |
|--|---|---|---|--|---|
|  |  |  |  |  |  |

Properties of angles

Vertically opposite angles

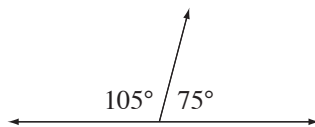
Are equal

$$\angle a = \angle b, \angle c = \angle d$$



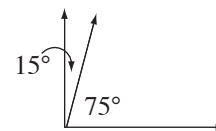
Supplementary angles

Add to 180°



Complementary angles

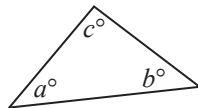
Add to 90°



Properties of angles in a triangle

The sum of interior angles of a triangle is 180° .

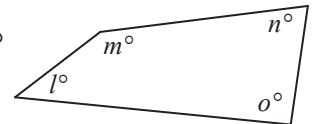
$$a^\circ + b^\circ + c^\circ = 180^\circ$$



Properties of angles in a quadrilateral

The sum of interior angles of a quadrilateral is 360° .

$$l^\circ + m^\circ + n^\circ + o^\circ = 360^\circ$$



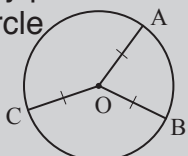
Triangle types

| Sides and angles | Triangle type |
|--------------------------|--------------------|
| no equal sides/angles | scalene |
| two equal sides/angles | isosceles |
| three equal sides/angles | equilateral |

| Angles | Triangle type |
|------------------|----------------------|
| all acute angles | acute-angled |
| one right angle | right-angled |
| one obtuse angle | obtuse-angled |

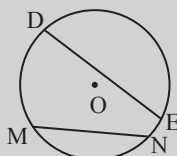
Properties of circles

Radius - joins the centre with any point on the circle

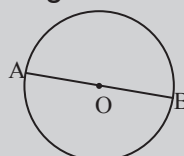


$$OA = OB = OC$$

Chord - joins any two points on the circle

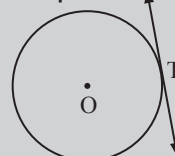


Diameter - a chord passing through the centre



$$AB = 2OA$$

Tangent - a line touching the circle in one point



Circumference - the distance around the circle



ANSWERS

1. [+ Whole Numbers to 10] page 1

- Skill 1.1** a) 15, 17, 20, 19, 26, 18, 13, 14, 22, 21
 b) 6, 15, 9, 11, 13, 10, 7, 12, 8, 14
 c) 29, 22, 18, 24, 15, 17, 26, 13, 21, 30
 d) 37, 13, 40, 12, 24, 18, 16, 49, 21, 15
 e) 21, 52, 27, 93, 26, 54, 22, 39, 15, 30
- Skill 1.2** a) 5, -7, 13, -4, 9, 14, -2, 17, 10, -8
 b) 10, -3, 1, 14, 13, -1, 12, 8, 15, -8
 c) 19, 6, 13, 0, 18, -6, 15, -11, 11, -18
 d) 15, -7, 33, 5, 52, 44, -9, 30, 18, -24
 e) 44, 1, 43, 28, -33, 35, -4, -11, 16, -2
 f) 19, -37, -11, 30, 93, 16, -4, 2, 17, -20

2. [- Whole Numbers to 10] page 3

- Skill 2.1** a) 3, 2, 8, 5, 10, 9, 6, 7, 1, 4
 b) 6, 9, 2, 7, 4, 10, 5, 8, 3, 1
 c) 10, 12, 5, 19, 17, 3, 11, 8, 26, 24
 d) 13, 7, 16, 9, 25, 18, 10, 11, 4, 42
- Skill 2.2** a) 5, 1, -13, 10, -16, 2, -1, -14, -3, -18
 b) -8, 5, -5, 8, 7, -7, 6, 2, -1, -14
 c) 6, -9, -11, -3, -16, 5, -1, 10, -10, 4
 d) 4, -16, 11, -13, -7, -18, -14, 5, 9, -12
 e) 29, 18, -14, 13, -48, 20, -3, -26, 1, -17
 f) 6, 48, -27, 2, -58, -29, -5, 24, -3, 63

3. [× Whole Numbers to 12] page 5

- Skill 3.1** a) 16, 32, 44, 40, 20, 24, 4, 28, 36, 8
 b) 2, 10, 20, 14, 8, 18, 24, 16, 6, 12
 c) 80, 100, 20, 70, 90, 30, 110, 50, 60, 40
 d) 16, 32, 64, 40, 56, 48, 96, 72, 88, 24
 e) 120, 48, 36, 72, 24, 60, 84, 96, 144, 108
- Skill 3.2** a) 9, -15, 24, -21, -33, 18, 6, -12, 36, 27
 b) 35, -20, -10, 15, 40, -25, 45, 5, 30, -50
 c) -66, 22, 121, -55, 110, 88, -44, 99, -77, 11
 d) -28, 12, -4, -8, 36, -24, 40, 20, -32, 16
 e) 14, -49, 63, -35, 21, 42, -84, 70, -28, 56
 f) -108, 27, 72, -36, -63, -81, 45, 99, 90, -54

4. [÷ Whole Numbers to 12] page 7

- Skill 4.1** a) 4, 7, 2, 10, 6, 5, 1, 8, 9, 11
 b) 9, 6, 3, 11, 4, 8, 7, 10, 1, 2
 c) 4, 9, 12, 3, 10, 1, 7, 5, 8, 6
 d) 8, 2, 4, 10, 9, 1, 3, 12, 6, 11
 e) 10, 4, 3, 2, 12, 5, 1, 8, 7, 6
- Skill 4.2** a) 4, 7, -2, 10, 5, -6, 12, -11, 1, -8
 b) 1, -6, 2, 9, -7, 8, -5, 12, 3, -4
 c) -4, 8, 11, -5, 2, 7, -3, 1, -6, 9
 d) 7, 9, -1, -5, 4, 2, 8, -3, 6, -10
 e) 11, -8, 6, -4, 3, 10, -2, 5, 9, -7
 f) 12, -10, -1, -5, 7, 4, -8, 11, -2, 3

5. [Large Number +, -] page 9

- Skill 5.1** a) 5782, b) 1799, c) 2487, d) 2666, e) 1978, f) 3584
 g) 9647, h) 5779, i) 4869, j) 8745, k) 6892, l) 6998
- Skill 5.2** a) 5426, b) 1171, c) 1123, d) 8401, e) 2452, f) 5372
 g) 3006, h) 5342, i) 3411, j) 3072, k) 2541, l) 2130
- Skill 5.3** a) 3524, b) 7918, c) 1645, d) 8574, e) 6312, f) 5910
 g) 9194, h) 5245, i) 8096, j) 50304, k) 37348, l) 61330

- Skill 5.4** a) 3824, b) 5516, c) 2182, d) 4290, e) 312, f) 5875, g) 6065
 h) 7622, i) 4149, j) 6854, k) 2126, l) 4114, m) 3551
 n) 1888, o) 3279, p) 7868, q) 6586, r) 2557, s) 36694
 t) 25828, u) 67477, v) 55168, w) 47690, x) 24512

- Skill 5.5** a) 5627, b) 1490, c) 1386, d) 1806, e) 8276, f) 3948
 g) 2626, h) 5143

6. [Large Number ×, ÷] page 15

- Skill 6.1** a) 3180, b) 20400, c) 90800, d) 23800, e) 701500
 f) 461900, g) 179000, h) 412000, i) 905000, j) 506000
 k) 803000, l) 248000

- Skill 6.2** a) 46, b) 28, c) 502, d) 89, e) 15, f) 370, g) 230, h) 4800
 i) 2005, j) 570, k) 706, l) 309

- Skill 6.3** a) 390, b) 306, c) 413, d) 1551, e) 1060, f) 3520, g) 2618
 h) 6258, i) 10075, j) 7254, k) 15642, l) 17528

- Skill 6.4** a) 156, b) 89, c) 95, d) 91, e) 37, f) 43, g) 738, h) 341
 i) 817, j) 591, k) 621, l) 299, m) 902, n) 745, o) 252

- Skill 6.5** a) 6860, b) 4500, c) 12380, d) 17300, e) 19080, f) 16110
 g) 130800, h) 88800, i) 112600, j) 103000, k) 288400
 l) 695600, m) 150000, n) 84000, o) 120000

- Skill 6.6** a) 280, b) 160, c) 204, d) 147, e) 161, f) 131, g) 45, h) 44
 i) 155, j) 135, k) 34, l) 141

- Skill 6.7** a) 4674, b) 5952, c) 1610, d) 12155, e) 18607, f) 22032
 g) 17472, h) 19768, i) 13248, j) 60300, k) 14896
 l) 41670, m) 30438, n) 98064, o) 68508, p) 135675
 q) 177306, r) 119991, s) 146657, t) 138644, u) 123772

- Skill 6.8** a) 29, b) 57, c) 79, d) 237, e) 263, f) 364, g) 370, h) 735
 i) 640, j) 518, k) 192, l) 214, m) 238, n) 430, o) 145
 p) 3072, q) 2345, r) 826

- Skill 6.9** a) 38880, b) 107400, c) 27520, d) 152160, e) 98560
 f) 243350, g) 291200, h) 1170700, i) 2582400

- Skill 6.10** a) 743.5, b) 1503.5, c) 512.8, d) 1486.25, e) 445.5
 f) 1528.5, g) 361.2, h) 341.5, i) 1452.6, j) 1006.5, k) 3692.5
 l) 732.75, m) 4652.5, n) 547.25, o) 1857.4

7. [Decimal +, -] page 27

- Skill 7.1** a) 7.91, b) 6.9, c) 54.9, d) 103.7, e) 6.83, f) 80.9, g) 7.15
 h) 94.3, i) 85.2, j) 43.6, k) 29.54, l) 54.98, m) 9.95, n) 13.84
 o) 73.7, p) 60.03, q) 84.06, r) 74.52, s) 61.34, t) 32.17
 u) 35.82, v) 56.61, w) 46.15, x) 64.36, y) 33.99, z) 31.164
 A) 32.718

- Skill 7.2** a) 3.61, b) 4.5, c) 61.4, d) 22.8, e) 4.64, f) 19.4, g) 4.51
 h) 38.7, i) 6.0, j) 17.8, k) 7.49, l) 34.9, m) 56.93, n) 18.91
 o) 16.77, p) 28.83, q) 30.49, r) 37.83, s) 17.39, t) 15.76
 u) 45.78, v) 85.95, w) 75.87, x) 17.87, y) 7.98, z) 46.69
 A) 47.36

- Skill 7.3** a) 1.73, b) 4.3, c) 1.25, d) 2.39, e) 3.62, f) 4.75, g) 10.46
 h) 15.13, i) 14.57, j) 6.643, k) 8.381, l) 5.198

8. [Decimal ×, ÷] page 33

- Skill 8.1** a) 2.7, b) 1.6, c) 3.5, d) 2.4, e) 2.1, f) 5.4, g) 15.3, h) 25.8
 i) 10.8, j) 7.6, k) 9.5, l) 58.4, m) 1.2, n) 4.26, o) 12.48
 p) 8.36, q) 9.78, r) 9.64, s) 84.12, t) 80.6, u) 54.06, v) 87.28
 w) 14.056, x) 3.126, y) 15.525, z) 21.248, A) 6.123

- Skill 8.2** a) 0.7, b) 0.3, c) 0.5, d) 1.3, e) 1.8, f) 1.4, g) 1.4, h) 0.37
 i) 2.9, j) 0.38, k) 0.16, l) 0.34, m) 2.6, n) 0.49, o) 2.6

- Skill 8.3** a) 46, b) 8, c) 53, d) 1.7, e) 32.9, f) 80.4, g) 650, h) 17.7
 i) 3.8, j) 13200, k) 7540, l) 9060, m) 83500, n) 1020
 o) 7690

8. [Decimal \times, \div] (cont.)

- Skill 8.4** a) 2.67, b) 3.08, c) 9.43, d) 0.658, e) 0.049, f) 0.173
g) 0.275, h) 0.186, i) 0.907, j) 0.013, k) 0.074, l) 0.052
m) 4.089, n) 6.237, o) 2.405, p) 0.9272, q) 0.1035
r) 0.4487
- Skill 8.5** a) 0.72, b) 0.12, c) 0.4, d) 0.42, e) 0.36, f) 0.72, g) 0.98
h) 2.07, i) 0.48, j) 0.03, k) 0.048, l) 0.963
- Skill 8.6** a) 6, b) 2, c) 5, d) 38, e) 23, f) 1.90, g) 0.2, h) 0.7, i) 10.7
j) 190, k) 30, l) 90, m) 160, n) 90, o) 160,
- Skill 8.7** a) 10, b) 20, c) 15, d) 80, e) 25, f) 8, g) 45, h) 50, i) 175
j) 200, k) 180, l) 150

9. [Fraction $+, -$] page 41

- Skill 9.1** a) $\frac{3}{4}$, b) $\frac{4}{5}$, c) $\frac{8}{11}$, d) $\frac{6}{7}$, e) $\frac{10}{13}$, f) $\frac{5}{9}$, g) $1\frac{3}{5}$, h) $1\frac{2}{7}$, i) $1\frac{5}{9}$
j) $1\frac{5}{11}$, k) $3\frac{2}{3}$, l) $1\frac{7}{13}$, m) $1\frac{1}{2}$, n) $1\frac{1}{2}$, o) $1\frac{2}{3}$, p) $\frac{3}{4}$, q) $\frac{1}{5}$
r) $\frac{1}{3}$, s) $\frac{1}{2}$, t) $\frac{2}{3}$, u) $\frac{4}{5}$, v) $\frac{1}{2}$, w) $\frac{5}{6}$, x) $\frac{4}{5}$
- Skill 9.2** a) $\frac{5}{11}$, b) $\frac{7}{9}$, c) $\frac{2}{13}$, d) $1\frac{4}{5}$, e) $2\frac{1}{3}$, f) $2\frac{4}{7}$, g) $\frac{1}{6}$, h) $\frac{1}{3}$, i) $\frac{2}{3}$
j) $\frac{2}{7}$, k) $\frac{3}{8}$, l) $\frac{4}{5}$, m) $\frac{2}{9}$, n) $\frac{3}{10}$, o) $\frac{1}{2}$
- Skill 9.3** a) $3\frac{4}{5}$, b) $4\frac{6}{7}$, c) $3\frac{5}{9}$, d) $3\frac{9}{11}$, e) $3\frac{7}{9}$, f) $2\frac{6}{7}$, g) $4\frac{1}{2}$, h) $2\frac{3}{5}$
i) $3\frac{1}{3}$, j) $3\frac{2}{3}$, k) $2\frac{1}{2}$, l) $5\frac{1}{3}$, m) $4\frac{1}{5}$, n) $6\frac{1}{3}$, o) $6\frac{4}{7}$, p) $3\frac{1}{9}$
q) $4\frac{3}{11}$, r) $4\frac{7}{9}$, s) $6\frac{1}{5}$, t) $5\frac{1}{4}$, u) $6\frac{1}{2}$, v) 6, w) $3\frac{1}{3}$, x) $5\frac{1}{5}$
y) 8, z) $9\frac{1}{6}$, A) $3\frac{3}{13}$
- Skill 9.4** a) $1\frac{2}{5}$, b) $1\frac{5}{7}$, c) $2\frac{2}{3}$, d) $1\frac{5}{7}$, e) $2\frac{5}{9}$, f) $\frac{6}{11}$, g) $1\frac{3}{5}$, h) $2\frac{1}{3}$
i) $2\frac{5}{6}$, j) $3\frac{5}{9}$, k) $1\frac{1}{4}$, l) $1\frac{7}{9}$, m) $2\frac{1}{2}$, n) $1\frac{2}{3}$, o) $1\frac{2}{3}$
- Skill 9.5** a) $1\frac{7}{9}$, b) $3\frac{3}{10}$, c) $2\frac{5}{6}$, d) $2\frac{3}{7}$, e) $1\frac{1}{5}$, f) $1\frac{5}{11}$, g) $2\frac{1}{8}$, h) $\frac{7}{8}$
i) $1\frac{7}{12}$, j) $3\frac{3}{5}$, k) $2\frac{4}{9}$, l) $1\frac{8}{11}$, m) $1\frac{1}{3}$, n) $\frac{3}{8}$, o) $2\frac{7}{10}$, p) $2\frac{4}{7}$
q) $\frac{1}{10}$, r) $3\frac{1}{12}$
- Skill 9.6** a) $\frac{5}{9}$, b) $\frac{11}{16}$, c) $\frac{5}{6}$, d) $\frac{7}{8}$, e) $\frac{3}{8}$, f) $\frac{17}{20}$, g) $\frac{5}{6}$, h) $\frac{1}{2}$, i) $\frac{4}{9}$
j) $1\frac{1}{15}$, k) $1\frac{1}{3}$, l) $1\frac{1}{12}$
- Skill 9.7** a) $\frac{17}{21}$, b) $\frac{17}{30}$, c) $\frac{31}{35}$, d) $\frac{37}{45}$, e) $\frac{11}{12}$, f) $\frac{13}{15}$, g) $1\frac{7}{20}$, h) $1\frac{3}{10}$
i) $1\frac{7}{15}$
- Skill 9.8** a) $\frac{1}{6}$, b) $\frac{13}{20}$, c) $\frac{3}{8}$, d) $\frac{1}{8}$, e) $\frac{4}{21}$, f) $\frac{3}{20}$, g) $\frac{1}{3}$, h) $\frac{1}{4}$, i) $\frac{6}{25}$
- Skill 9.9** a) $\frac{17}{18}$, b) $\frac{13}{28}$, c) $\frac{3}{10}$, d) $\frac{1}{21}$, e) $\frac{19}{60}$, f) $\frac{18}{55}$, g) $\frac{1}{36}$, h) $\frac{1}{14}$
i) $\frac{11}{30}$, j) $\frac{1}{40}$, k) $\frac{23}{42}$, l) $\frac{17}{45}$

10. [Fraction \times, \div] page 55


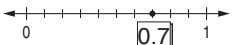
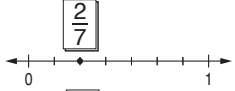

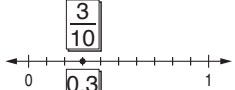

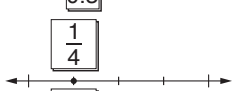
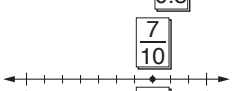
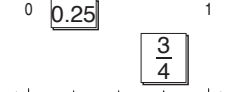
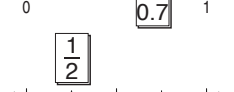
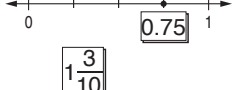
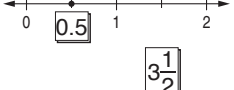
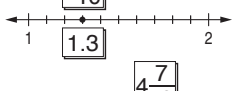
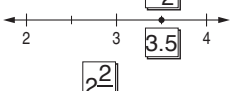
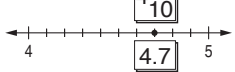

- Skill 10.1** a) $3\frac{3}{5}$, b) $4\frac{1}{6}$, c) $1\frac{7}{8}$, d) $2\frac{2}{5}$, e) $1\frac{1}{7}$, f) $\frac{4}{9}$, g) 6, h) $1\frac{1}{4}$
i) $\frac{5}{6}$, j) $2\frac{1}{2}$, k) 6, l) 15, m) $1\frac{2}{3}$, n) 4, o) 9
- Skill 10.2** a) 15 mL, b) 180 kg, c) \$18, d) 45 L, e) 200 m, f) \$5
g) 400 L, h) 20 cm, i) 45 m, j) 80 g, k) 32 mL, l) 30 kg
- Skill 10.3** a) 5, b) 8, c) 7, d) 10, e) 9, f) 11, g) 18, h) 20, i) 28, j) $5\frac{1}{3}$
k) $6\frac{2}{3}$, l) $2\frac{2}{5}$, m) $3\frac{3}{7}$, n) $5\frac{5}{6}$, o) $6\frac{6}{7}$, p) 27, q) 9, r) 12
s) 8, t) 10, u) 15, v) 28, w) 21, x) 22
- Skill 10.4** a) $\frac{1}{28}$, b) $\frac{9}{20}$, c) $\frac{3}{32}$, d) $\frac{7}{20}$, e) $\frac{8}{45}$, f) $\frac{12}{35}$, g) $\frac{4}{15}$, h) $\frac{5}{12}$, i) $\frac{3}{44}$
j) $\frac{1}{3}$, k) $\frac{5}{7}$, l) $\frac{2}{5}$, m) $\frac{2}{9}$, n) $\frac{2}{9}$, o) $\frac{1}{10}$, p) $\frac{6}{11}$, q) $\frac{3}{10}$, r) $\frac{2}{5}$
s) $\frac{1}{18}$, t) $\frac{3}{14}$, u) $\frac{5}{14}$, v) $\frac{1}{6}$, w) $\frac{2}{7}$, x) $\frac{1}{15}$, y) $\frac{1}{6}$, z) $\frac{2}{5}$, A) $\frac{1}{12}$

- Skill 10.5** a) $\frac{1}{9}$, b) $\frac{1}{5}$, c) $\frac{1}{7}$, d) $\frac{1}{12}$, e) $\frac{1}{30}$, f) $\frac{1}{21}$, g) $\frac{1}{20}$, h) $\frac{1}{28}$, i) $\frac{2}{11}$
j) $\frac{1}{24}$, k) $\frac{1}{35}$, l) $\frac{1}{72}$, m) $\frac{2}{27}$, n) $\frac{5}{24}$, o) $\frac{2}{33}$, p) $\frac{3}{16}$, q) $\frac{3}{10}$, r) $\frac{7}{60}$
- Skill 10.6** a) $1\frac{7}{8}$, b) $\frac{14}{27}$, c) $\frac{10}{21}$, d) $1\frac{7}{9}$, e) $\frac{44}{63}$, f) $1\frac{11}{24}$, g) $\frac{8}{9}$, h) $\frac{24}{35}$
i) $1\frac{7}{20}$, j) $3\frac{1}{2}$, k) $1\frac{1}{6}$, l) 4, m) $\frac{1}{2}$, n) $\frac{1}{8}$, o) $2\frac{1}{4}$, p) $2\frac{1}{2}$
q) $1\frac{1}{4}$, r) $2\frac{2}{5}$, s) $2\frac{2}{3}$, t) $2\frac{1}{2}$, u) $4\frac{2}{3}$

11. [Percentages] page 67

- Skill 11.1** a) 60%, b) 32%, c) 46%, d) 12%, e) 5%, f) 9%, g) 61%
h) 53%, i) 4%, j) 7%, k) 59%, l) 91%, m) 28%, n) 79%
- Skill 11.2** a) 41%, b) 40%, c) 25%, d) 11%, e) 22%, f) 4%, g) 28%
h) 62.5%, i) 26%, j) 7.6%, k) 9%, l) 34%
- Skill 11.3** a) 24, b) 85, c) 69, d) \$9, e) \$7, f) \$50, g) \$300, h) \$30
i) \$150, j) \$120, k) \$200, l) \$420, m) \$15, n) \$25, o) \$35
p) \$350, q) \$40, r) \$200, s) \$320, t) \$270, u) \$60, v) \$2.50
w) \$0.60, x) \$4.50, y) 20¢, z) 140¢, A) 135¢
- Skill 11.4** a) 10, b) 168, c) 16, d) 32, e) 150, f) 42, g) 84, h) 2, i) 6
j) 9, k) 28, l) 54, m) 45, n) 30, o) 90, p) 6, q) 1.8, r) 6.4
s) 3, t) 1.5, u) 1, v) 70, w) 10, x) 20, y) 50, z) 60, A) 20
B) 60, C) 100, D) 140
- Skill 11.5** a) \$4.50, b) \$30, c) \$125, d) \$32, e) \$2400, f) \$300
g) 62.50, h) \$216, i) \$280, j) \$22 500, k) \$360, l) \$255
m) B, n) A, o) B, p) B
- Skill 11.6** a) 120, b) 150, c) 280, d) 96, e) 99, f) 75, g) 100, h) 70
i) 176, j) 78, k) 84, l) 140
- Skill 11.7** a) 20%, b) 88%, c) 75%, d) 40%, e) 4%, f) 20%
- Skill 11.8** a) 10%, b) 20%, c) 20%, d) 50%, e) 30%, f) 33.3%
g) 12.5%, h) 25%

12. [Dec. / Frac. / Percentages] page 79

- Skill 12.1** a) $\frac{1}{4}$, b) $\frac{3}{8}$, c) $\frac{1}{2}$ or $\frac{3}{6}$, d) $\frac{3}{4}$, e) 50%, f) 20%, g) 30%, h) 40%
- Skill 12.2** a) $\frac{2}{5}$, b) $\frac{1}{2}$, c) $\frac{2}{3}$, d) $\frac{1}{3}$, e) $\frac{1}{4}$, f) $\frac{1}{3}$, g) $\frac{1}{2}$, h) $\frac{1}{10}$, i) $\frac{4}{5}$, j) $\frac{2}{3}$
k) $\frac{1}{3}$, l) $\frac{3}{4}$, m) $\frac{1}{2}$, n) $\frac{1}{10}$, o) $\frac{1}{3}$, p) $\frac{1}{5}$, q) $\frac{1}{2}$, r) $\frac{2}{3}$, s) $\frac{3}{8}$, t) $\frac{2}{5}$
u) $\frac{4}{5}$, v) $\frac{3}{5}$, w) $\frac{1}{9}$, x) $\frac{5}{7}$, y) $\frac{4}{5}$, z) $\frac{2}{7}$, A) $\frac{3}{5}$
- Skill 12.3** a)  b) 
c)  d) 
e)  f) 
g)  h) 
i)  j) 
k)  l) 
m)  n) 
A)  B) 

12. [Dec. / Frac. / Percentages] (cont.)

- Skill 12.4** a) 0.5, b) 0.4, c) 1.25, d) 1.8, e) 2.75, f) 3.6, g) 3.5, h) 4.2
i) 0.35, j) 0.015, k) 0.25, l) 0.045, m) 0.45, n) 0.035
- Skill 12.5** a) $\frac{35}{42} = \frac{5}{6}$, b) $\frac{3}{4} = \frac{27}{36}$, c) $\frac{2}{5} = \frac{14}{35}$, d) $\frac{4}{7} = \frac{28}{49}$, e) $\frac{9}{10} = \frac{54}{60}$
f) $\frac{48}{60} = \frac{12}{15}$, g) $\frac{2}{3} = \frac{10}{15} = \frac{40}{60}$, h) $\frac{3}{8} = \frac{12}{32} = \frac{36}{96}$, i) $\frac{3}{4} = \frac{6}{8} = \frac{48}{64}$
- Skill 12.6** a) 40%, b) 20%, c) 10%, d) 90%, e) 70%, f) 12%, g) 55%
h) 48%, i) 29%, j) 35%, k) 4%, l) 5%, m) 2%, n) 38%
o) 40%, p) 25%, q) 12.5%, r) 34.5%
- Skill 12.7** a) 0.05, b) 0.02, c) 0.88, d) 0.42, e) 0.6, f) 0.4, g) 0.005
h) 0.018, i) 0.72, j) 0.051, k) 0.97, l) 0.99, m) 0.2, n) 0.038
- Skill 12.8** a) $\frac{9}{10}$, b) $\frac{11}{100}$, c) $\frac{3}{10}$, d) $\frac{1}{10}$, e) $\frac{3}{50}$, f) $\frac{1}{50}$, g) $\frac{1}{2}$, h) $\frac{7}{25}$, i) $\frac{3}{20}$, j) $\frac{4}{5}$
- Skill 12.9** a) 0.3, b) 0.35, c) 0.36, d) 0.5, e) 1.4, f) 2.75, g) 0.25, h) 0.9
i) 0.05
- Skill 12.10** a) $\frac{47}{100}$, b) $\frac{9}{100}$, c) $\frac{3}{20}$, d) $\frac{3}{10}$, e) $\frac{1}{25}$, f) $\frac{3}{50}$, g) $\frac{21}{25}$, h) $\frac{67}{100}$, i) $\frac{2}{5}$
j) $\frac{11}{20}$, k) $\frac{14}{25}$, l) $\frac{9}{20}$
- Skill 12.11** a) 10%, b) 18%, c) 28%, d) 86%, e) 50%, f) 40%, g) 60%
h) 75%, i) 33.3%, j) 65%, k) 1%, l) 66.6%
- Skill 12.12** a)

| Decimal | Fraction | Percentage |
|---------|----------------|------------|
| 0.05 | $\frac{1}{20}$ | 5% |

 b)

| Decimal | Fraction | Percentage |
|---------|---------------------------------|------------|
| 0.45 | $\frac{45}{100} = \frac{9}{20}$ | 45% |

c)

| Decimal | Fraction | Percentage |
|---------|------------------------------|------------|
| 0.6 | $\frac{6}{10} = \frac{3}{5}$ | 60% |

 d)

| Decimal | Fraction | Percentage |
|---------|----------------|------------|
| 0.35 | $\frac{7}{20}$ | 35% |

e)

| Decimal | Fraction | Percentage |
|---------|-----------------|------------|
| 0.07 | $\frac{7}{100}$ | 7% |

 f)

| Decimal | Fraction | Percentage |
|---------|----------------|------------|
| 0.7 | $\frac{7}{10}$ | 70% |

g)

| Decimal | Fraction | Percentage |
|---------|----------------|------------|
| 0.1 | $\frac{1}{10}$ | 10% |

 h)

| Decimal | Fraction | Percentage |
|---------|----------------|------------|
| 0.3 | $\frac{3}{10}$ | 30% |

i)

| Decimal | Fraction | Percentage |
|---------|------------------------------|------------|
| 0.4 | $\frac{4}{10} = \frac{2}{5}$ | 40% |

 j)

| Decimal | Fraction | Percentage |
|---------|----------------------------------|------------|
| 0.55 | $\frac{55}{100} = \frac{11}{20}$ | 55% |

k)

| Decimal | Fraction | Percentage |
|---------|----------------|------------|
| 0.9 | $\frac{9}{10}$ | 90% |

 l)

| Decimal | Fraction | Percentage |
|---------|-----------------|------------|
| 0.34 | $\frac{17}{50}$ | 34% |
- Skill 12.13** a) 70%, b) 0.25, c) $\frac{9}{10}$, d) $\frac{4}{5}$, e) $\frac{1}{10}$, f) $\frac{2}{5}$, g) $\frac{5}{6}$, h) 0.4
i) 0.75, j) 0.5, k) 30%, l) $\frac{3}{5}$, m) $\frac{8}{10}$, n) $\frac{1}{3}$, o) $\frac{7}{8}$, p) 0.9, q) $\frac{3}{4}$
r) $\frac{1}{5}$, s) 0.23, t) $\frac{3}{10}$

13. [Integers] page 97

- Skill 13.1** a) C, b) A, c) A, d) B, e) B, f) C, g) A, h) A
i) -7, -4, -3, 3, 5 j) 8, 6, 0, -4, -9 k) 8, 4, 1, -8, -10
l) -6, -3, -2, 0, 5 m) -5°C, -3°C, 2°C, 4°C
n) 5°C, -1°C, -3°C, -5°C
- Skill 13.2** a) $< b < c > d < e > f > g < h > i > j < k < l >$
- Skill 13.3** a) 32°C, b) 5, c) 9, d) 8, e) 11, f) 13, g) 50°C, h) 48°C, i) 8 h
j) 9 h
- Skill 13.4** a) 17 m, b) 3780 m, c) 310 m, d) 51°C, e) 61°C, f) 52°C
g) 6051 m, h) 5664 m
- Skill 13.5** a) basement, b) ground, c) oncology, d) 6 m
e) homewares, f) 16 m
- Skill 13.6** a) -\$550, b) \$70, c) -\$140, d) -99°C, e) 449 BC
f) 1332 BC, g) -218°C, h) -272°C, i) \$740, j) 61 kg
- Skill 13.7** a) -5, b) -1, c) -2, d) 3, e) -4, f) 2, g) 2, h) 7, i) -6, j) -5
k) -8, l) -9
- Skill 13.8** a) -6, b) -8, c) -4, d) -8, e) -11, f) 3, g) 7, h) -4, i) 0
j) -13, k) 15, l) -4, m) -9, n) -2, o) -6, p) 5, q) -8, r) -10
s) 7, t) 6, u) 17, v) -16, w) -6, x) -9, y) -12, z) 7, A) -9
- Skill 13.9** a) -42, b) -12, c) -24, d) -15, e) -18, f) 64, g) 40, h) -36
i) -30, j) -56, k) -24, l) -49, m) -27, n) 28, o) 18, p) 16
q) -45, r) 16, s) 25, t) -20, u) -81
- Skill 13.10** a) -3, b) -9, c) 6, d) 6, e) -5, f) -4, g) -9, h) 3, i) -7, j) -5
k) 8, l) -3, m) -9, n) 4, o) -9, p) -7, q) 5, r) 8, s) -6, t) -9
u) -4

14. [Rates / Ratios] page 109

- Skill 14.1** a) 2 : 3, b) 1 : 2, c) 3 : 5, d) 2 : 3, e) 3 : 1, f) 3 : 4, g) 10 : 7
h) 4 : 1, i) 1 : 4, j) 5 : 9, k) 3 : 4, l) 3 : 2, m) 10 : 3, n) 3 : 8
- Skill 14.2** a) 3 : 5, b) 2 : 5, c) 10 : 3, d) 6 : 7, e) 15 : 2, f) 1 : 3
g) 20 : 1, h) 16 : 1, i) 3 : 14, j) 6 : 1
- Skill 14.3** a) 7.5 km, b) 9 km, c) 2.5 h, d) 14 km, e) 29 100 km
f) 2 h 30 min, g) 500 km/h, h) 520 km/h, i) 45 km/h
j) 15 min, k) 95 km, l) 9600 km, m) 27 000 km, n) 5 km
o) 0.75 s, p) 2 h 15 min
- Skill 14.4** a) 9 : 2 : 5, b) 1 : 2 : 4, c) 1 : 3 : 9, d) 2 : 6 : 9, e) 11 : 6 : 5
f) 2 : 4 : 3, g) 8 : 3 : 2, h) 5 : 10 : 3, i) 3 : 1 : 5, j) 2 : 3 : 6
k) 6 : 2 : 3, l) 2 : 3 : 4
- Skill 14.5** a) true, b) false, c) B, d) C, e) A, f) C
- Skill 14.6** a) 3 : 4 = 12 : 16 b) 24 : 15 = 8 : 5 c) 3 : 10 = 27 : 90
d) 9 : 2 = 45 : 10 e) $\frac{5}{9} = \frac{35}{63}$ f) $\frac{3}{7} = \frac{18}{42}$ g) $\frac{1}{7} = \frac{8}{56}$ h) $\frac{7}{20} = \frac{49}{140}$
i) $\frac{24}{40} = \frac{3}{5}$ j) $\frac{20}{15} = \frac{4}{3}$ k) $\frac{10}{45} = \frac{2}{9}$ l) $\frac{64}{80} = \frac{8}{10}$ m) $\frac{63}{18} = \frac{7}{2}$
n) $\frac{11}{5} = \frac{33}{15}$
- Skill 14.7** a) A, b) B, c) B, d) A, e) B, f) A, g) B, h) A, i) A, j) B, k) B
l) A, m) A, n) B, o) A, p) A
- Skill 14.8** a) 11 : 9, b) 6 : 5, c) 1 : 9, d) 10 : 1, e) 1 : 4, f) 3 : 4, g) 5 : 4
h) 7 : 8, i) 1 : 4, j) 31 : 100, k) 2 : 3, l) 19 : 16, m) 11 : 18
n) 11 : 39
- Skill 14.9** a) 41 600 g, b) 225 m, c) 2 m/week, d) 60 L/min, e) 17.5 L
f) 42, g) 9 L, h) \$207.50

15. [Indices / Square Roots] page 123

- Skill 15.1** a) 6^5 , b) 2^3 , c) 5^2 , d) 4^6 , e) $8 \times 8 \times 8$, f) $3 \times 3 \times 3 \times 3$
g) $2 \times 2 \times 2 \times 2 \times 2$, h) $9 \times 9 \times 9$, i) 1^7 , j) 7^3 , k) $6 \times 6 \times 6 \times 6$
l) 2^8
- Skill 15.2** a) 49, b) 9, c) 4, d) 100, e) 25, f) 1, g) 144, h) 121, i) 0, j) 16
k) 81, l) 400, m) 2500, n) 900, o) 4900, p) 6400, q) 1600
r) 3600
- Skill 15.3** a) 1 000 000 000, b) 100, c) 10 000 000, d) 10 000, e) 10
f) 100 000, g) 1 000 000, h) 1000, i) 100 000 000
j) 10 000 000 000
- Skill 15.4** a) 5, b) 3, c) 6, d) 2, e) 4, f) 10, g) 12, h) 11, i) 8, j) 30, k) 70
l) 50, m) 90, n) 60, o) 110
- Skill 15.5** a) 243, b) 16, c) 64, d) 1, e) 32, f) 256, g) 81, h) 0, i) 64, j) 1
k) 27, l) 125, m) 729, n) 512, o) 1024, p) 1, q) 256, r) 729
- Skill 15.6** a) 8 and 9, b) 4 and 5, c) 2 and 3, d) 7 and 8, e) 5 and 6
f) 4 and 5, g) 8 and 9, h) 8 and 9, i) 7 and 8, j) 9 and 10
k) 6 and 7, l) 9 and 10
- Skill 15.7** a) 81, b) 16, c) 36, d) -1, e) -27, f) 16, g) -8, h) 25, i) -243
j) 256, k) -1, l) 49, m) 64, n) 144, o) -1000

16. [Order of Operations] page 131

- Skill 16.1** a) 15, b) 7, c) 11, d) 4, e) 2, f) 18, g) 20, h) 2, i) 20, j) 6
k) 24, l) 3, m) 16, n) 11, o) 35, p) 12, q) 70, r) 18
- Skill 16.2** a) 17, b) 9, c) 5, d) 30, e) 8, f) 18, g) 0, h) 11, i) 6, j) 17
k) 41, l) 13, m) 16, n) 21, o) 7, p) 4, q) 16, r) 23, s) 23
t) 16, u) 13
- Skill 16.3** a) 3, b) 7, c) 8, d) 8, e) 5, f) 16, g) 7, h) 4, i) 9, j) 12, k) 18
l) 7, m) 15, n) 9, o) 8, p) 0, q) 14, r) 10
- Skill 16.4** a) 40, b) 9, c) 2, d) 6, e) 4, f) 4, g) 20, h) 30, i) 55, j) 2, k) 7
l) 108, m) 12, n) 50, o) 10, p) 15, q) 37, r) 27, s) 7
t) 15, u) 8
- Skill 16.5** a) 170, b) 1, c) 27, d) 19, e) 59, f) 288, g) 16, h) 25, i) 49
j) 15, k) 23, l) 76, m) 16, n) 23, o) 3, p) 112, q) 28, r) 144
- Skill 16.6** a) -10, b) -6, c) 13, d) 29, e) 59, f) 65, g) 200, h) -3, i) -47
j) -5, k) 2, l) 12
- Skill 16.7** a) 13, b) 5, c) 10, d) 20, e) 9, f) 10, g) 28, h) -14, i) 33, j) 28
k) 17, l) 18

- Skill 17.1** a) true, b) false, c) false, d) true, e) true, f) false, g) B, h) A
i) B, j) A, k) C, l) B
- Skill 17.2** a) 5, b) 3, c) 8, d) 4, e) 6, f) 1, g) 8, h) 7, i) 50, j) 200
k) 6000, l) 900, m) 5000, n) 1, o) 20000, p) 700, q) 0.04
r) 0.002, s) 0.9, t) 0.07, u) A, v) B, w) B, x) A, y) B, z) B
- Skill 17.3** a) 215, b) 4150, c) 6082, d) 8117, e) 902, f) 3400, g) 298
h) 7309, i) 530, j) 12600, k) 714, l) 14063, m) 60540
n) 31007, o) 403200, p) 800050, q) 1900026
r) 7600040
- Skill 17.4** a) three hundred and eighteen, b) sixty-five, c) ninety
d) four hundred and thirteen, e) seven hundred and six
f) five hundred and twenty, g) eight hundred
h) six hundred and nine, i) five hundred and seventy
j) one thousand, six hundred
k) four thousand, two hundred, l) two thousand and four
m) five thousand and seven
n) three thousand and twelve, o) eight thousand and forty
p) thirty-five thousand, q) eighty-six thousand
r) nineteen thousand, s) ten thousand, seven hundred
t) twenty-four thousand, three hundred
u) fifteen thousand and ninety
v) seventeen thousand and eight
w) nine hundred and three thousand
x) four hundred and six thousand
y) one hundred and two thousand
z) nine hundred and five thousand
- Skill 17.5** a) 12000, b) 350, c) 2600, d) 810, e) 220, f) 34000
g) 1700, h) 72000, i) 4910, j) 1400, k) 21000, l) 3700
m) 170, n) 5600
- Skill 17.6** a) 0.69, 0.609, 0.096, 0.09 b) 0.047, 0.074, 0.407, 0.74
c) 0.08, 0.085, 0.508, 0.58 d) 0.53, 0.513, 0.135, 0.105
e) 0.07, 0.087, 0.708, 0.807, 0.87
f) 0.043, 0.063, 0.34, 0.364, 0.63
g) 0.302, 0.3, 0.239, 0.209, 0.093
h) 0.016, 0.065, 0.105, 0.156, 0.51
- Skill 17.7** a) $\frac{2}{5}$, b) $\frac{5}{8}$, c) $\frac{7}{10}$, d) $\frac{4}{9}$, e) $\frac{1}{2}$, $\frac{3}{5}$, $\frac{5}{8}$ f) $\frac{9}{10}$, $\frac{5}{6}$, $\frac{4}{5}$
- Skill 17.8** a) 13, b) 18, c) 46, d) 2, e) 1.874, f) 18.68, g) 0.6, h) 9.8
i) 7.84, j) 0.086, k) 0.5, l) 0.197
- Skill 17.9** a) 68, 7 b) 52, 98 c) 79, 21 d) 250, 13 e) -1512, 48, 60
f) 21, -4, 7500 g) -63, 0, -824 h) $\frac{25}{5}$, -1, 110
i) $\frac{12}{4}$, 71, -54, -1039 j) 30, -11, $\frac{10}{2}$, 4000
- Skill 17.10** a) $\frac{1}{3}$, 7.95, -24 b) -150, 0.72, $\frac{18}{101}$ c) $-\frac{19}{3}$, 3.1415, 15, -4
d) $\frac{14}{569}$, 98, 3.58904, -79 e) C and D, f) B and C
g) A and C, h) A and D, i) A, j) C

- Skill 18.1** a) 8, 16, 24, 32, b) 2, 4, 6, 8, 10, 12, 14
c) 10, 20, 30, 40, 50, d) 3, 6, 9, 12, 15, 18, 21
e) 6, 12, 18, 24, 30, 36, f) 11, 22, 33, 44, 55, 66
g) 8, 16, 24, 32, 40, h) 9, 18, 27, 36, 45, i) 7, 14, 21, 28, 35
j) 12, 24, 36, 48, 60
- Skill 18.2** a) 6, 12, 18, b) 28, c) 18, 36, 54, d) 24, 48, e) 12, 24
f) 24, 48, g) 40, 80, h) 63
- Skill 18.3** a) 24, b) 28, c) 22, d) 45, e) 18, f) 20, g) 12, h) 24, i) 24
j) 45
- Skill 18.4** a) no, b) yes, c) no, d) yes, e) 1, 5, 25, f) 1, 2, 4, 7, 14, 28
g) 4, h) 36, i) 49, j) 18
- Skill 18.5** a) 1, 2, 4, b) 1, 3, c) 1, 2, 4, d) 1, 2, 5, 10, e) 1, 3, 9
f) 1, 5, g) 1, 2, 3, 6, 9, 18, h) 1, 2, 7, 14
- Skill 18.6** a) 8, b) 2, c) 5, d) 10, e) 24, f) 9, g) 14, h) 6, i) 4, j) 15
- Skill 18.7** a) 4, 6, b) 8, 9, 10, 12, 14, 15, c) 47, d) 101, e) 43, f) 83
g) 41, 43, 47, h) 16, 18, 20, 21, 22, i) 83, j) 97
- Skill 18.8** a)
$$= \begin{array}{c} 150 \\ \swarrow \quad \searrow \\ 10 \quad \times \quad 15 \\ \hline = \begin{array}{c} \boxed{2} \times \boxed{5} \times \boxed{3} \times \boxed{5} \end{array} \end{array}$$
- b)
$$= \begin{array}{c} 105 \\ \swarrow \quad \searrow \\ 3 \quad \times \quad 35 \\ \hline = \begin{array}{c} \boxed{3} \times \boxed{5} \times \boxed{7} \end{array} \end{array}$$
- c)
$$= \begin{array}{c} 68 \\ \swarrow \quad \searrow \\ 2 \quad \times \quad 34 \\ \hline = \begin{array}{c} \boxed{2} \times \boxed{2} \times \boxed{17} \end{array} \end{array}$$
- d)
$$= \begin{array}{c} 42 \\ \swarrow \quad \searrow \\ 6 \quad \times \quad 7 \\ \hline = \begin{array}{c} \boxed{2} \times \boxed{3} \times \boxed{7} \end{array} \end{array}$$
- e)
$$= \begin{array}{c} 54 \\ \swarrow \quad \searrow \\ 6 \quad \times \quad 9 \\ \hline = \begin{array}{c} \boxed{2} \times \boxed{3} \times \boxed{3} \times \boxed{3} \end{array} \end{array}$$
- f)
$$= \begin{array}{c} 100 \\ \swarrow \quad \searrow \\ 10 \quad \times \quad 10 \\ \hline = \begin{array}{c} \boxed{2} \times \boxed{5} \times \boxed{2} \times \boxed{5} \end{array} \end{array}$$
- g)
$$= \begin{array}{c} 90 \\ \swarrow \quad \searrow \\ 9 \quad \times \quad 10 \\ \hline = \begin{array}{c} \boxed{3} \times \boxed{3} \times \boxed{2} \times \boxed{5} \end{array} \end{array}$$
- h)
$$= \begin{array}{c} 150 \\ \swarrow \quad \searrow \\ 6 \quad \times \quad 25 \\ \hline = \begin{array}{c} \boxed{2} \times \boxed{3} \times \boxed{5} \times \boxed{5} \end{array} \end{array}$$
- i)
$$= \begin{array}{c} 124 \\ \swarrow \quad \searrow \\ 4 \quad \times \quad 31 \\ \hline = \begin{array}{c} \boxed{2} \times \boxed{2} \times \boxed{31} \end{array} \end{array}$$
- j)
$$= \begin{array}{c} 36 \\ \swarrow \quad \searrow \\ 3 \quad \times \quad 12 \\ \hline = \begin{array}{c} \boxed{3} \times \boxed{3} \times \boxed{4} \\ \hline = \begin{array}{c} \boxed{3} \times \boxed{3} \times \boxed{2} \times \boxed{2} \end{array} \end{array}$$
- k)
$$= \begin{array}{c} 96 \\ \swarrow \quad \searrow \\ 6 \quad \times \quad 16 \\ \hline = \begin{array}{c} \boxed{2} \times \boxed{3} \times 4 \times 4 \\ \hline = \begin{array}{c} \boxed{2} \times \boxed{3} \times \boxed{2} \times \boxed{2} \times \boxed{2} \end{array} \end{array}$$
- l)
$$= \begin{array}{c} 144 \\ \swarrow \quad \searrow \\ 12 \quad \times \quad 12 \\ \hline = \begin{array}{c} 3 \times 4 \times 3 \times 4 \\ \hline = \begin{array}{c} \boxed{3} \times \boxed{2} \times \boxed{2} \times \boxed{3} \times \boxed{2} \times \boxed{2} \end{array} \end{array}$$
- m)
$$= \begin{array}{c} 144 \\ \swarrow \quad \searrow \\ 9 \quad \times \quad 16 \\ \hline = \begin{array}{c} \boxed{3} \times \boxed{3} \times 4 \times 4 \\ \hline = \begin{array}{c} \boxed{3} \times \boxed{3} \times \boxed{2} \times \boxed{2} \times \boxed{2} \times \boxed{2} \end{array} \end{array}$$
- n)
$$= \begin{array}{c} 280 \\ \swarrow \quad \searrow \\ 4 \quad \times \quad 70 \\ \hline = \begin{array}{c} \boxed{2} \times \boxed{2} \times 7 \times 10 \\ \hline = \begin{array}{c} \boxed{2} \times \boxed{2} \times \boxed{7} \times \boxed{2} \times \boxed{5} \end{array} \end{array}$$
- Skill 18.9** a) $110 = 2 \times 5 \times 11$, b) $65 = 5 \times 13$, c) $69 = 3 \times 23$
d) $27 = 3 \times 3 \times 3$, e) $124 = 2 \times 2 \times 31$, f) $198 = 2 \times 3 \times 3 \times 11$
g) $81 = 3 \times 3 \times 3 \times 3$, h) $40 = 2 \times 2 \times 2 \times 5$
- Skill 18.10** a) $450 = 2 \times 3^2 \times 5^2$, b) $200 = 2^3 \times 5^2$, c) $360 = 2^3 \times 3^2 \times 5$
d) $64 = 2^6$, e) $900 = 2^2 \times 3^2 \times 5^2$, f) $576 = 2^6 \times 3^2$

19. [Number Patterns]

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- Skill 19.1** a) 20, 24, b) 16, 19, c) 28, 33, d) 13, 15, e) 14, 17, f) 19, 23
g) 35, 43, h) 30, 37, i) 26, 32, j) 41, 50
- Skill 19.2** a) 6, 3, b) 6, 4, c) 5, 2, d) 10, 5, e) 10, 6, f) 14, 8, g) 58, 48
h) 10, 3, i) 10, 2, j) 14, 5
- Skill 19.3** a) 2.6, 3.2, b) 0.6, 0.3, c) 2.5, 2.7, d) 3, 3.5, e) 3, 3.4
f) 2.3, 2.1, g) 1.7, 1.4, h) 5.4, 6.5, i) 3.2, 3.8, j) 1.3, 0.9
- Skill 19.4** a) $\frac{7}{8}, \frac{8}{8}$ b) $\frac{9}{10}, \frac{11}{10}$ c) $\frac{14}{11}, \frac{17}{11}$ d) $\frac{15}{11}, \frac{13}{11}$ e) $\frac{30}{13}, \frac{29}{13}$ f) $\frac{17}{12}, \frac{15}{12}$
g) $\frac{14}{11}, \frac{10}{11}$ h) $\frac{12}{9}, \frac{8}{9}$
- Skill 19.5** a)

| Growth (mm) | | | | | |
|-------------|-----|---|-----|---|-----|
| Fingernail | 2 | 4 | 6 | 8 | 10 |
| Toenail | 0.5 | 1 | 1.5 | 2 | 2.5 |

 b)

| Bouquets | | | | | |
|-------------|---|---|---|----|----|
| White roses | 2 | 4 | 6 | 8 | 10 |
| Red roses | 3 | 6 | 9 | 12 | 15 |

c)

| Food intake of a baby robin | | | | | | |
|-----------------------------|---|---|----|----|----|----|
| No. of days | 1 | 2 | 3 | 4 | 5 | 6 |
| Length of worms (m) | 4 | 8 | 12 | 16 | 20 | 24 |

 d)

| Children (9-13) | | | | | |
|---------------------|----|----|----|----|----|
| calories (hundreds) | 17 | 34 | 51 | 68 | 85 |
| day | 1 | 2 | 3 | 4 | 5 |

e)

| Rent | | | | | |
|--------------------|-----|-----|-----|-----|-----|
| Number of bedrooms | 1 | 2 | 3 | 4 | 5 |
| Cost per week (\$) | 200 | 275 | 350 | 425 | 500 |

 f)

| Shark teeth regeneration (thousands) | | | | | | |
|--------------------------------------|----|-----|-----|-----|-----|----|
| No. of days | 10 | 20 | 30 | 40 | 50 | 60 |
| Teeth regenerated | 3 | 3.6 | 4.2 | 4.8 | 5.4 | 6 |

g)

| Exercise program | | | | | |
|------------------|-----|-----|-----|-----|-----|
| Time (min) | 10 | 15 | 20 | 25 | 30 |
| Energy (cal) | 240 | 280 | 320 | 360 | 400 |

 h)

| Equilateral triangle | | | | | | |
|----------------------|-----|-----|-----|-----|-----|-----|
| Side length | 0.4 | 0.8 | 1.2 | 1.6 | 2 | 2.4 |
| Perimeter | 1.2 | 2.4 | 3.6 | 4.8 | 6.0 | 7.2 |
- Skill 19.6** a) 162, 486, b) 16, 32, c) 324, 972, d) 405, 1215, e) 4, 8
f) 192, 768, g) 1, 2, h) 18, 54, i) 12.5, 62.5, j) 30, 300
- Skill 19.7** a) 15, 3, b) 8, 4, c) 10, 2, d) 20, 10, e) 0.01, 0.001, f) 9, 3
g) 0.2, 0.1, h) 0.5, 0.1, i) $7\frac{7}{10}$, j) $2\frac{1}{2}$
- Skill 19.8** a) 48, 60, b) 62, 86, c) 19, 4, d) 5, 3, e) 5, 2, f) 15, 19
g) 28, 39, h) 16, 4, i) 81, 121, j) 27, 8
- Skill 19.9** a) -11, -19, b) -2, 1, c) 3, 8, d) -9, -11, e) -6, -10
f) 11, 17, g) -19, -28, h) 5, 12, i) -9, -13, j) 9, 17
- Skill 19.10** a) 27, b) 13, c) 40, d) 75, e) 184, f) 1000, g) 31, h) 35, i) 43
j) 50, k) $\frac{1}{20}$, l) $\frac{1}{256}$
- Skill 19.11** a) 6, b) 25, c) 5, d) 24, e) 41, f) 20, g) 52, h) 2, i) 101, j) 70

20. [Expressions]

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- Skill 20.1** a) $4n$, b) $2a$, c) $2u$, d) $3f$, e) $4w$, f) $5z$, g) x , h) $2b$, i) $2e$, j) $2k$
k) p , l) $2c$, m) $2ab$, n) $3hi$, o) $4fg$, p) $4op$, q) $5tu$, r) $2uv$
s) ab , t) $3wx$, u) $2de$
- Skill 20.2** a) $5m$, b) $6h$, c) $7g$, d) $4j$, e) $6z$, f) $5e$, g) $4q$, h) a , i) $2k$, j) $4r$
k) $7f$, l) $6a$, m) $7y$, n) $7m$, o) $9h$, p) $5j$, q) $3c$, r) $5k$, s) $6op$
t) $2ab$, u) $6kl$, v) $7mn$, w) ij , x) $2de$
- Skill 20.3** a) $n + 14$, b) $b + c$, c) $e + f$, d) $j + 4$, e) $z - 3$, f) $v - 5$, g) $3m$
h) $2d$, i) $2h$, j) $3m$, k) $9p$, l) $7z$, m) $2y$ cm, n) $4b$, o) $a + b$
p) $3n$, q) $300 - m$, r) $70 - w$, s) $x - 70$, t) $h - 5$, u) B, v) A
w) B, x) B
- Skill 20.4** a) $4f$, $2f$, b) c , $3c$, c) h , $3h$, d) b , $3b$, e) f , $3f$, f) n , $4n$, g) r , $5r$
h) $2m$, $3m$, i) $2x$, $4x$, j) $2jk$, jk , k) ab , $2ab$, l) $2x$, $4x$
m) $2hi$, hi , n) d , $3d$, o) v , $5v$, p) $2no$, no , q) a , $2a$, r) $3st$, st
- Skill 20.5** a) $2s + r$, b) $2d + e$, c) $2h + i$, d) $2a + 2b$, e) $2l + 2m$
f) $3r + s$, g) $2x + 3y$, h) $3e + 2f$, i) $m + 2n$, j) $t + 2u$
k) $jk + 2kl$, l) $2qr + rs$, m) $2cd + de$, n) $5h + i$, o) $3j + 5k$
p) $4g + 3$, q) $4l + 1$, r) $2v + 7w$, s) $5p + 6q$, t) $3y + 2z$
u) $3j + 2k$

21. [Substitution]

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- Skill 21.1** a) 7, b) 9, c) 8, d) 8, e) 9, f) 7, g) 6, h) 8, i) 14, j) 15, k) 18
l) 24, m) 10, n) 20, o) 20, p) 7, q) 21, r) 18
- Skill 21.2** a) 54, b) 12, c) 10, d) 21, e) 32, f) 42, g) 24, h) 18, i) 35, j) 8
k) 6, l) 12, m) 9, n) 8, o) 7, p) 8, q) 4, r) 12
- Skill 21.3** a) 2, b) 11, c) 11, d) 37, e) 22, f) 23, g) 40, h) 28, i) 5, j) 7
k) 11, l) 6, m) 3, n) 1, o) 4
- Skill 21.4** a) 7, b) -27, c) -12, d) 1, e) 13, f) 2, g) 10, h) -13, i) 2
j) -36, k) 21, l) 30, m) -3, n) -7, o) -4, p) -10, q) -26, r) 23
- Skill 21.5** a) 17, b) 10, c) 14, d) 12, e) 8, f) 6, g) 24, h) -3, i) -8
j) -7, k) -17, l) -10, m) 13, n) -12, o) -10, p) -6, q) -6
r) 16
- Skill 21.6** a) 21, b) 8, c) 30, d) 18, e) 44, f) 39, g) 30, h) 40, i) 0, j) 6
k) 5, l) -11, m) 9, n) 8, o) 9, p) 0, q) -64, r) 105
- Skill 21.7** a) 19, b) 11, c) 7, d) 90, e) 0, f) 11, g) 8, h) -40, i) -18, j) -9
k) 3, l) -4
- Skill 21.8** a) 55, b) 60, c) 48, d) 81, e) 28, f) 190, g) 18, h) 20, i) 20
j) 100, k) 125, l) 314
- Skill 21.9** a) 15, b) 64, c) 17, d) 100, e) 40, f) 7, g) 40, h) 210, i) 55
j) 39, k) -98, l) 6
- Skill 21.10** a) 21, b) 24, c) 30, d) 60, e) 12, f) 99, g) 90, h) -16, i) -28
j) 90, k) -24, l) 35, m) 2, n) -3, o) 18
- Skill 21.11** a) 20, b) 77, c) 70, d) 48, e) 36, f) 40, g) 28, h) 21, i) 40
j) 5, k) 4, l) 28

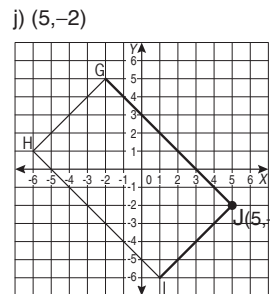
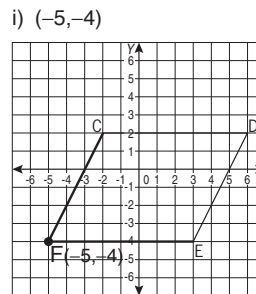
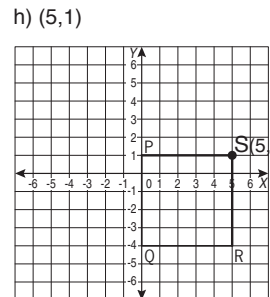
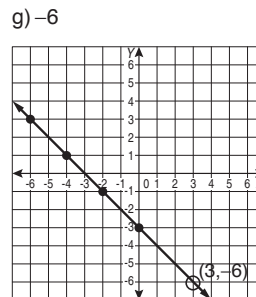
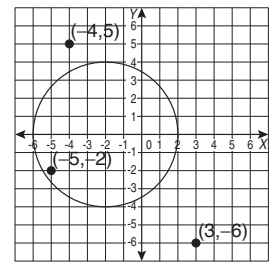
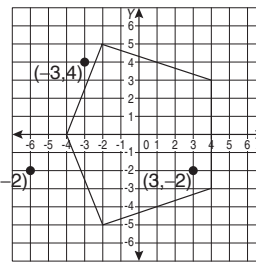
22. [Equations]

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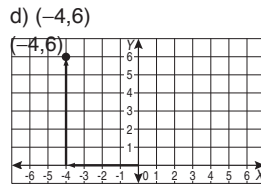
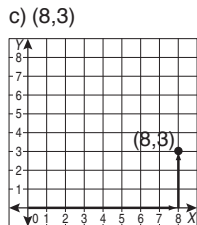
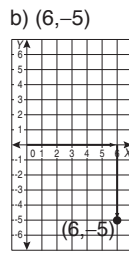
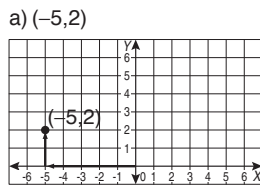
- Skill 22.1** a) 7, b) 8, c) 6, d) 8, e) 10, f) 13, g) 12, h) 7, i) 21, j) 9, k) 27
l) 5, m) 17, n) 16, o) 11, p) 14, q) 18, r) 20, s) 25, t) 33
u) 27, v) 35, w) 9, x) 7, y) 15, z) 24, A) 20
- Skill 22.2** a) 7, b) 4, c) 8, d) 6, e) 5, f) 8, g) 2, h) 6, i) 9, j) 5, k) 12, l) 6
m) 11, n) 3, o) 40, p) -2, q) 3, r) 7, s) -3, t) 9, u) -9, v) -2
w) -7, x) 11, y) 25, z) -2, A) -7
- Skill 22.3** a) 48, b) 34, c) 63, d) 45, e) 90, f) 50, g) 64, h) 192, i) 180
j) 15, k) 20, l) 30, m) 25, n) 60, o) 42, p) -63, q) -44, r) -60
s) -30, t) -56, u) -27
- Skill 22.4** a) 10, b) 7, c) 8, d) 5, e) 3, f) 6, g) 5, h) 12, i) 8, j) 13, k) 9
l) 16, m) 9, n) 8, o) 7, p) 9, q) 10, r) 6, s) 4, t) 5, u) 2
- Skill 22.5** a) 4, b) 1.2, c) 1.6, d) 0.8, e) 2.2, f) 3, g) 1.5, h) 2.3, i) 2.2
j) 1.5, k) 1.4, l) 0.9, m) 6, n) 2, o) 5
- Skill 22.6** a) 9, b) 7, c) 8, d) 20, e) 9, f) 7, g) 3, h) 4, i) 9, j) 9, k) 13
l) 7, m) 32, n) 23, o) 40, p) 8, q) 14, r) 11, s) 8, t) 15, u) 7
v) 12, w) 18, x) 15, y) 21, z) 32, A) 21
- Skill 22.7** a) 9, b) 10, c) 12, d) 11, e) 9, f) 8, g) 3, h) 4, i) 6, j) 12
k) 15, l) 9, m) -2, n) -5, o) -7, p) 12, q) -2, r) 7, s) -8
t) -3, u) -10, v) 36, w) 30, x) 24, y) 21, z) 96, A) 60, B) 72
C) 90, D) 70
- Skill 22.8** a) 6, b) 5, c) 7, d) 6, e) 10, f) 4, g) 12, h) -3, i) 0, j) -2
k) -5, l) 2, m) -8, n) -5, o) -3, p) -1, q) -4, r) -2, s) -1
t) -4, u) -6

Skill 23.5

a) M(-4,1) N(4,-3), b) A(0,-3) B(-4,2) C(1,4), c) M, d) G e) C f) B



Skill 23.1



Skill 23.2

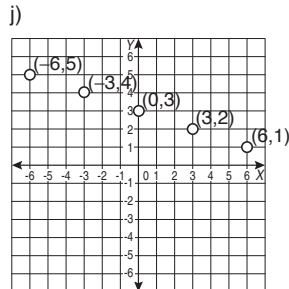
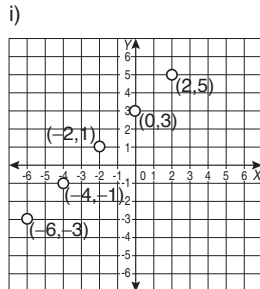
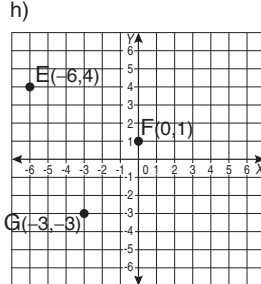
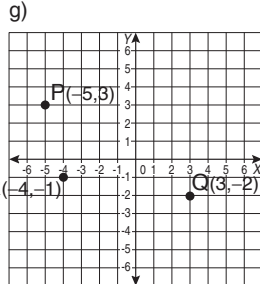
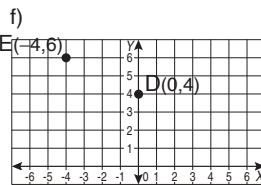
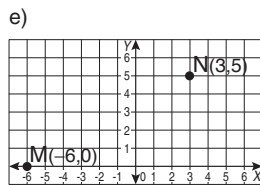
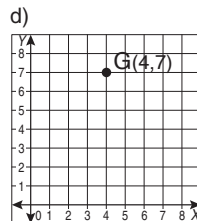
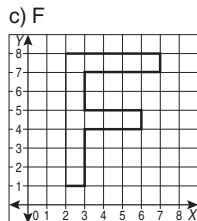
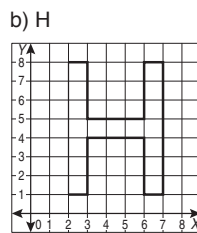
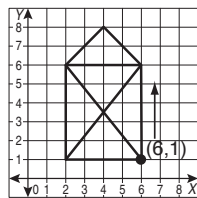
a) Egypt, b) South America, c) scientist, d) Española e) Mount Orto, f) I3, g) J6, h) G7, i) E1, j) C2

Skill 23.3

a) (4,1), b) Christchurch, c) (7,3), d) (4,3)

Skill 23.4

a) house



Skill 23.6

| Houses sold (x) | Earnings (2000x) |
|-----------------|---------------------------|
| 1 | $2000 \times 1 = 2000$ |
| 2 | $2000 \times 2 = 4000$ |
| 3 | $2000 \times 3 = 6000$ |
| 4 | $2000 \times 4 = 8000$ |
| 5 | $2000 \times 5 = 10\,000$ |
| 6 | $2000 \times 6 = 12\,000$ |

| No. of guests (x) | Dinner cost in dollars (15x) |
|-------------------|------------------------------|
| 4 | $15 \times 4 = 60$ |
| 8 | $15 \times 8 = 120$ |
| 12 | $15 \times 12 = 180$ |
| 16 | $15 \times 16 = 240$ |
| 20 | $15 \times 20 = 300$ |
| 24 | $15 \times 24 = 360$ |

| No. of days (x) | Records entered (90x) |
|-----------------|-----------------------|
| 1 | $90 \times 1 = 90$ |
| 2 | $90 \times 2 = 180$ |
| 3 | $90 \times 3 = 270$ |
| 4 | $90 \times 4 = 360$ |
| 5 | $90 \times 5 = 450$ |
| 6 | $90 \times 6 = 540$ |

| No. of days (x) | Number of T-shirts sold (16x) |
|-----------------|-------------------------------|
| 1 | $16 \times 1 = 16$ |
| 2 | $16 \times 2 = 32$ |
| 3 | $16 \times 3 = 48$ |
| 4 | $16 \times 4 = 64$ |
| 5 | $16 \times 5 = 80$ |
| 6 | $16 \times 6 = 96$ |

| No. of hours worked (x) | Pay in dollars (8x) |
|-------------------------|---------------------|
| 2 | $8 \times 2 = 16$ |
| 4 | $8 \times 4 = 32$ |
| 6 | $8 \times 6 = 48$ |
| 8 | $8 \times 8 = 64$ |
| 10 | $8 \times 10 = 80$ |
| 12 | $8 \times 12 = 96$ |

| No. of s (x) | Distance travelled in metres (18x) |
|--------------|------------------------------------|
| 10 | $18 \times 10 = 180$ |
| 20 | $18 \times 20 = 360$ |
| 30 | $18 \times 30 = 540$ |
| 40 | $18 \times 40 = 720$ |
| 50 | $18 \times 50 = 900$ |
| 60 | $18 \times 60 = 1080$ |

| x | $y = x + 5$ | y |
|---|------------------|----|
| 0 | $y = 0 + 5 = 5$ | 5 |
| 1 | $y = 1 + 5 = 6$ | 6 |
| 2 | $y = 2 + 5 = 7$ | 7 |
| 3 | $y = 3 + 5 = 8$ | 8 |
| 4 | $y = 4 + 5 = 9$ | 9 |
| 5 | $y = 5 + 5 = 10$ | 10 |

| x | $y = 8 - x$ | y |
|---|-----------------|---|
| 3 | $y = 8 - 3 = 5$ | 5 |
| 4 | $y = 8 - 4 = 4$ | 4 |
| 5 | $y = 8 - 5 = 3$ | 3 |
| 6 | $y = 8 - 6 = 2$ | 2 |
| 7 | $y = 8 - 7 = 1$ | 1 |
| 8 | $y = 8 - 8 = 0$ | 0 |

| x | $y = 7 + x$ | y |
|----|-------------------|----|
| 0 | $y = 7 + 0 = 7$ | 7 |
| 2 | $y = 7 + 2 = 9$ | 9 |
| 4 | $y = 7 + 4 = 11$ | 11 |
| 6 | $y = 7 + 6 = 13$ | 13 |
| 8 | $y = 7 + 8 = 15$ | 15 |
| 10 | $y = 7 + 10 = 17$ | 17 |

| x | $y = x - 4$ | y |
|---|------------------|----|
| 0 | $y = 0 - 4 = -4$ | -4 |
| 1 | $y = 1 - 4 = -3$ | -3 |
| 2 | $y = 2 - 4 = -2$ | -2 |
| 3 | $y = 3 - 4 = -1$ | -1 |
| 4 | $y = 4 - 4 = 0$ | 0 |
| 5 | $y = 5 - 4 = 1$ | 1 |

23. [Coordinates] (cont.)

Skill 23.10

Skill 23.6

k)

| x | y = 3x | y |
|---|-----------------------|----|
| 0 | $y = 3 \times 0 = 0$ | 0 |
| 1 | $y = 3 \times 1 = 3$ | 3 |
| 2 | $y = 3 \times 2 = 6$ | 6 |
| 3 | $y = 3 \times 3 = 9$ | 9 |
| 4 | $y = 3 \times 4 = 12$ | 12 |
| 5 | $y = 3 \times 5 = 15$ | 15 |

l)

| x | y = x - 6 | y |
|---|------------------|----|
| 1 | $y = 1 - 6 = -5$ | -5 |
| 2 | $y = 2 - 6 = -4$ | -4 |
| 3 | $y = 3 - 6 = -3$ | -3 |
| 4 | $y = 4 - 6 = -2$ | -2 |
| 5 | $y = 5 - 6 = -1$ | -1 |
| 6 | $y = 6 - 6 = 0$ | 0 |

m)

| x | y = 100 ÷ x | y |
|-----|------------------------|----|
| 5 | $y = 100 \div 5 = 20$ | 20 |
| 10 | $y = 100 \div 10 = 10$ | 10 |
| 20 | $y = 100 \div 20 = 5$ | 5 |
| 25 | $y = 100 \div 25 = 4$ | 4 |
| 50 | $y = 100 \div 50 = 2$ | 2 |
| 100 | $y = 100 \div 100 = 1$ | 1 |

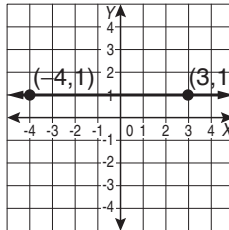
n)

| x | y = 2 - x | y |
|---|------------------|----|
| 0 | $y = 2 - 0 = 2$ | 2 |
| 1 | $y = 2 - 1 = 1$ | 1 |
| 2 | $y = 2 - 2 = 0$ | 0 |
| 3 | $y = 2 - 3 = -1$ | -1 |
| 4 | $y = 2 - 4 = -2$ | -2 |
| 5 | $y = 2 - 5 = -3$ | -3 |

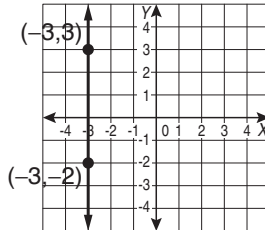
Skill 23.7

a) C, b) B, c) A, d) B

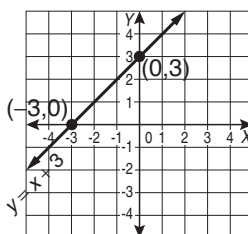
e)



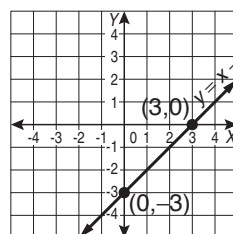
f)



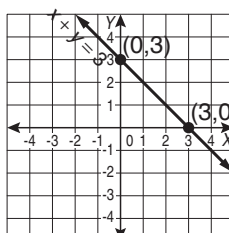
g)



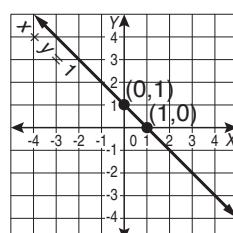
h)



i)



j)



Skill 23.8

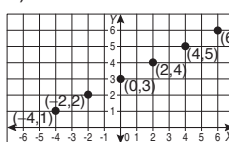
a) 1400 m, b) 4:45 pm, c) 2.5 h, d) 40°C, e) 200 min
f) 30 km, g) 14 min, h) 2, i) Lavinia, j) 200 m, k) B

- l) A) ~~Stopped for lunch~~
B) ~~Driving on a dirt road~~
C) ~~Driving on a freeway~~

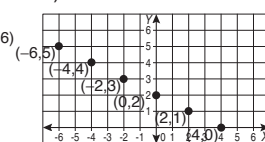
m) 3:20 pm, n) 5 km

Skill 23.9

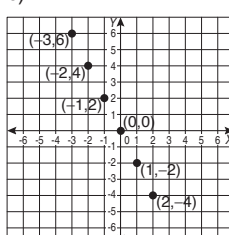
a)



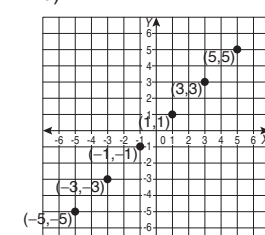
b)



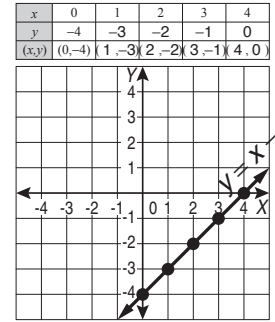
c)



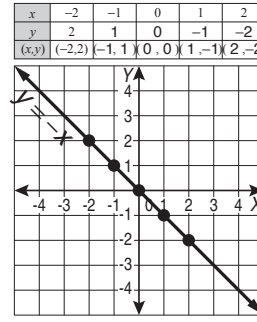
d)



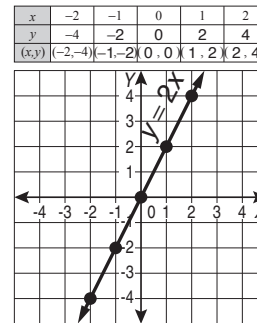
b)



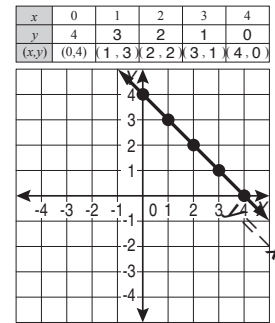
a)



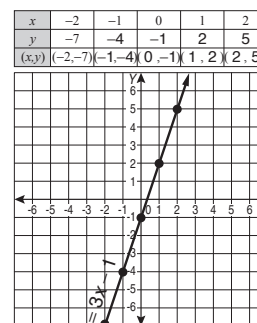
c)



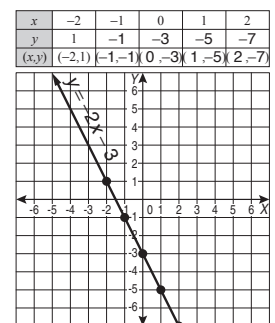
d)



e)



f)



24. [Units of Measurement / Time] page 227

Skill 24.1

a) 10 min, b) 300 min, c) 240 s, d) 3 min, e) 600 min, f) 4 h
g) 5 h, h) 300 s, i) 96 h, j) 28 days, k) 120 months, l) 120 h
m) 1.5 h, n) 4.5 h, o) 215 min, p) 330 s, q) 26 days
r) 170 min, s) 145 s, t) 370 min, u) 56 h, v) 75 min
w) 18 h, x) 150 min

Skill 24.2

a) 240 mm, b) 12 cm, c) 1300 mm, d) 8000 m, e) 7 km
f) 600 cm, g) 19000 mm, h) 5 cm, i) 12000 m, j) 11 km
k) 15000 mm, l) 1600 cm, m) 7 km, n) 40 m, o) 14000 cm
p) 190 mm, q) 2.7 m, r) 3000 cm, s) 0.5 m, t) 4100 m
u) 2800 mm, v) 0.6 km, w) 200 m, x) 3700 mm

Skill 24.3

a) 6000 kg, b) 9 kg, c) 2 tonnes, d) 3400 g, e) 5 kg
f) 70 kg, g) 8000 kg, h) 1900 g, i) 20 kg, j) 10 t

Skill 24.4

a) 3700 mL, b) 6000 mL, c) 22000 mL, d) 8 L
e) 40000 mL, f) 9400 mL, g) 500 mL, h) 1200 mL, i) 30 L
j) 15300 mL, k) 0.2 L, l) 0.5 L

Skill 24.5

a) 6655000 m, b) 5000 mL, c) 120000 kg, d) 100 cm
e) 238 s, f) less than, g) 12000 g, h) 2500 mL
i) 105000 g, j) 8640 L

Skill 24.6

a) 6 h 30 min, b) 1 h 45 min, c) 1 h 15 min, d) 7 h 40 min
e) 10 h 25 min, f) 7 h 10 min

Skill 24.7

a) 1:15 pm, b) 10:00 am, c) 9:00 pm, d) 10:00 pm
e) 7 h 50 min, f) 5

25. [Perimeter]

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- Skill 25.1** a) 8 cm, b) 160 mm, c) 12 cm, d) 18 cm, e) 150 mm
f) 170 mm.
- Skill 25.2** a) 140 mm, b) 16 cm, c) 14 cm, d) 89 mm, e) 150 mm
f) 10.5 cm, g) 17 cm, h) 108 mm, i) 12 cm, j) 98 mm
k) 14 cm, l) 126 mm, m) 123 mm, n) 135 mm
- Skill 25.3** a) 70 mm, b) 92 mm, c) 90 mm, d) 88 mm, e) 14.5 cm
f) 134 mm
- Skill 25.4** a) 48 m, b) 1420 cm, c) 118 mm, d) 120 mm, e) 108 m
f) 160 km
- Skill 25.5** a) 164 mm, b) 17 cm, c) 90 mm, d) 12.5 cm, e) 152 mm
f) 16.2 cm
- Skill 25.6** a) 30 mm, b) 1.5 cm, c) 47 mm, d) 45 mm
- Skill 25.7** a) 18.84 cm, b) 6.28 cm, c) 88 mm, d) 132 mm
e) 125.6 mm, f) 62.8 mm, g) 157 mm, h) 176 mm, i) 44 mm
j) 94.2 mm
- Skill 25.8** a) 15 cm, b) 18 cm, c) 180 mm, d) 27 cm, e) 122 mm
f) 124 mm

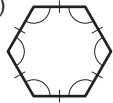
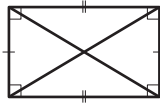
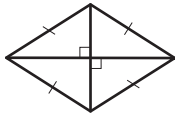
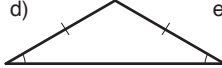

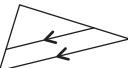
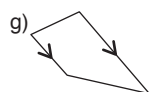

26. [Area / Volume]

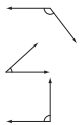

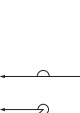
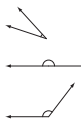

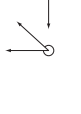
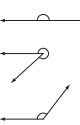


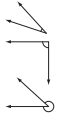


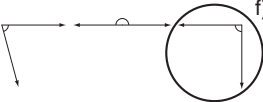
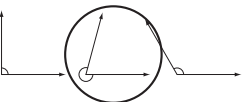
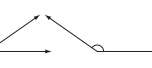

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







- Skill 26.1** a) 4.5 cm², b) 6 cm², c) 21 cm², d) 12 cm², e) 10 cm²
f) 6 cm², g) 12 cm², h) 11 cm², i) 8 cm², j) 13 cm²
k) 12 cm², l) 8 cm², m) 9 cm², n) 12 cm²
- Skill 26.2** a) yes, b) no, c) yes, d) yes, e) yes, f) no, g) yes, h) yes
i) yes, j) no, k) yes, l) no
- Skill 26.3** a) 9 sq. units, b) 10 sq. units, c) 21 sq. units, d) 14 sq. units
- Skill 26.4** a) 14 cm², b) 6 cm², c) 9 cm², d) 8 cm², e) 8 cm²
f) 600 mm², g) 100 mm², h) 6.25 cm², i) 9 cm²
j) 1200 mm², k) 640 mm², l) 5.25 cm², m) 1100 mm²
n) 720 mm²
- Skill 26.5** a) 5 cm², b) 10.5 cm², c) 7.5 cm², d) 625 mm², e) 3 cm²
f) 520 mm², g) 7.5 cm², h) 400 mm², i) 135 mm²
j) 825 mm²
- Skill 26.6** a) 72 cm³, b) 1200 cm³, c) 30 cm³, d) 200 cm³, e) 90 cm³
f) 60 cm³, g) 160 cm³, h) 72 cm³, i) 180 cm³, j) 150 cm³
k) 108 cm³, l) 105 cm³
- Skill 26.7** a) 16800 mm³, b) 12 cm³, c) 6.25 cm³, d) 1000 mm³
e) 3 m³, f) 10800 mm³, g) 3375 mm³, h) 22.5 cm³
i) 13.5 cm³, j) 18000 mm³
- Skill 26.8** a) 4.5 cm², b) 28.5 sq. units, c) 57.5 sq. units
d) 37.5 sq. units, e) 42 sq. units, f) 29 sq. units
g) 40 cm², h) 7 cm², i) 770 mm², j) 11 cm²
- Skill 26.9** a) 392 mm², b) 750 mm², c) 10 cm², d) 625 mm²
- Skill 26.10** a) 20.13 cm², b) 1386 mm², c) 6.28 cm², d) 8.56 cm²
- Skill 26.11** a) 2500 mm³, b) 17 cm³, c) 2.1 m³, d) 9900 mm³, e) 15 cm³
f) 9000 mm³

27. [Shapes]





















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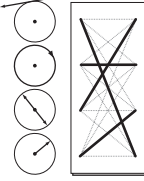
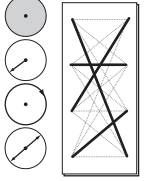
- Skill 27.1** a) 55°, b) 40°, c) 90°, d) 70°, e) 155°, f) 15°, g) 130°
h) 60°, i) 45°, j) 105°, k) 80°, l) 160°
- Skill 27.2** a) 120°, b) 75°, c) 80°, d) 125°, e) 95°, f) 145°, g) 45°
h) 30°, i) 110°, j) 155°, k) 130°, l) 15°
- Skill 27.3** a)  b)  c) 
- d)  e)  f) 
- g)  h) 

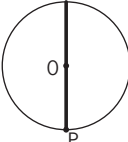
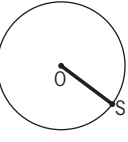
- Skill 27.4** a)  acute
 right
 obtuse
- b)  obtuse
 acute
 straight
- c)  obtuse
 reflex
 straight
- d)  acute
 reflex
 right
- e)  f) 
- g)  h) 

- Skill 27.5** a)  b) 
- c)  scalene
 isosceles
 equilateral
- d)  acute-angled
 obtuse-angled
 right-angled

- e) C, f) D
- Skill 27.6** a) B, b) C, c) D, d) C, e) B, f) C, g) D, h) C
- Skill 27.7** a) C, b) C

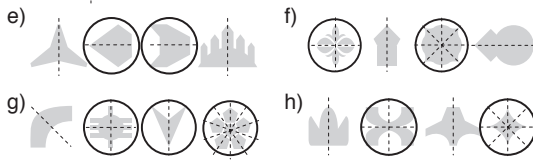
- c)  d)  e)  f) 
- g)  h)  i)  j) 
- k)  l)  m)  n) 
- o)  p) 
- Skill 27.8** a) trapezoidal prism  b) cube 
- c) triangular prism  d) hexagonal prism 
- e) octagonal prism  f) hexagonal pyramid 

- Skill 27.9** a) 43°, b) 155°, c) 18°, d) 21°, e) 63°, f) 30°, g) 17°, h) 20°
- Skill 27.10** a) 97°, b) 32°, c) 40°, d) 55°, e) 90°, f) 20°
g) $x^\circ = 115^\circ$, $y^\circ = 75^\circ$, h) $x^\circ = 25^\circ$, $y^\circ = 155^\circ$
- Skill 27.11** a) 40°, b) 56°, c) 25°, d) 105°, e) 55°, f) 48°, g) 108°, h) 70°
- Skill 27.12** a) 96°, b) 62°, c) 100°, d) 45°, e) 105°, f) 83°
- Skill 27.13** a)  diameter
circumference
radius
tangent
- b)  circumference
radius
diameter
area

- c) B, d) D, e),  f) 

Skill 28.1 a) Dean Street, b) west, c) 2, d) Dodge Hall

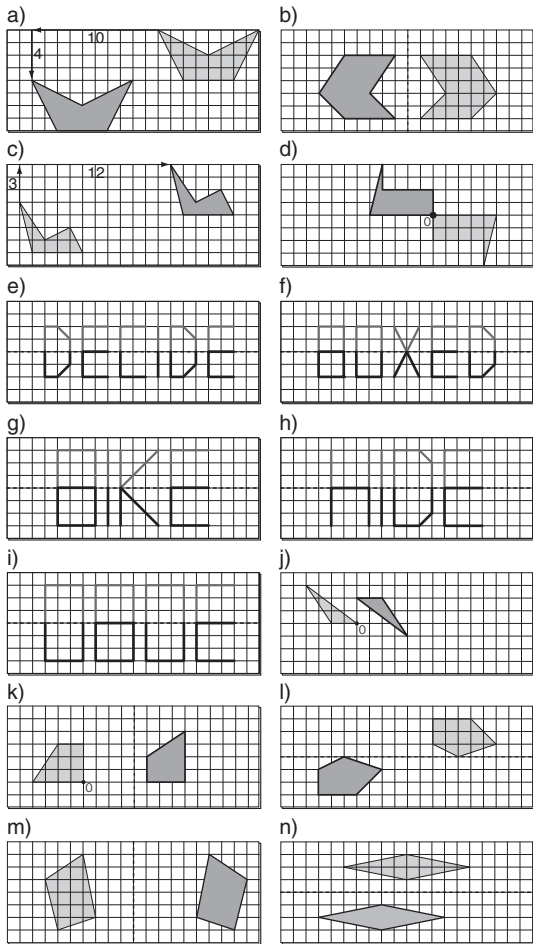
Skill 28.2 a) 4 b) 2 c) 5 d) 3



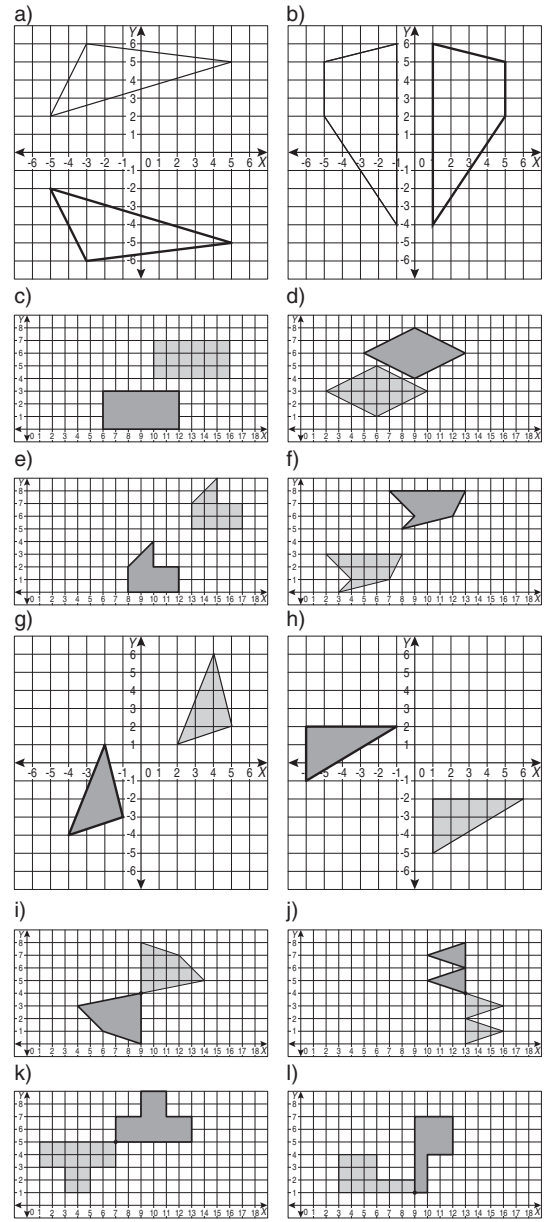
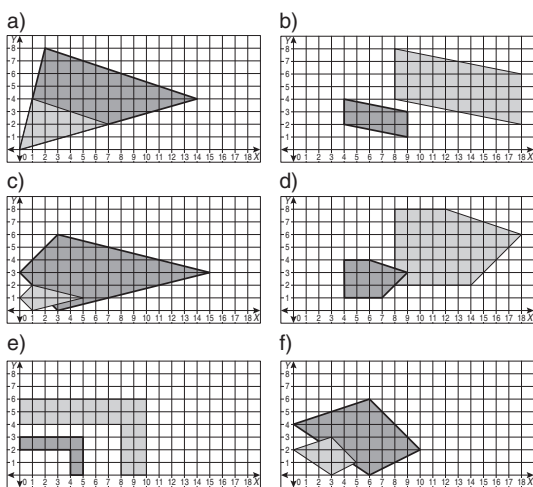
Skill 28.3 a) 1250 m, b) 4500 km, c) 700 m, d) 2 km

Skill 28.4 a) 180°, b) 90°, c) 45°, d) 180°, e) 30°, f) 270°, g) 135°
h) 225°, i) 90°, j) 135°

Skill 28.5

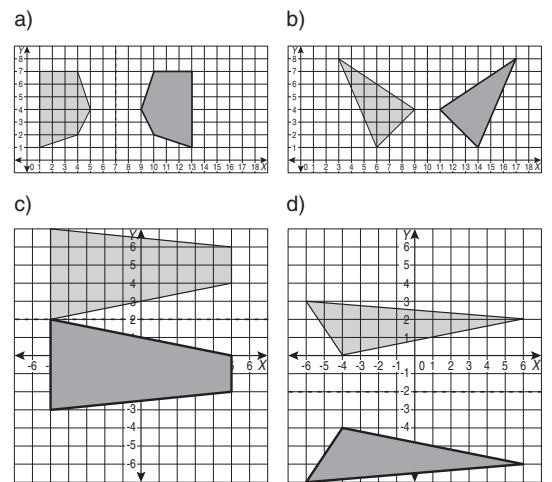


Skill 28.6



Skill 28.8 a) A, b) C, c) B, d) B

Skill 28.9



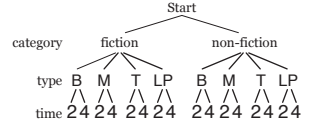
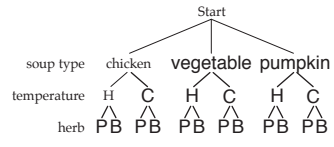
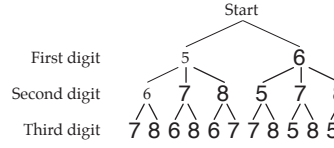
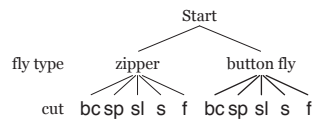
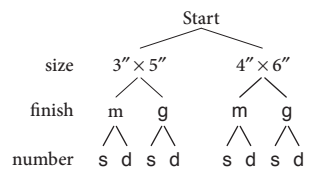
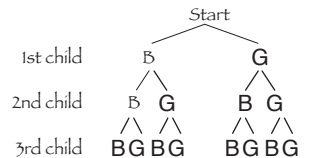
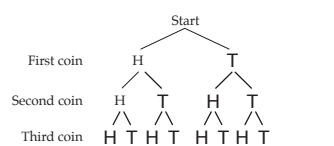
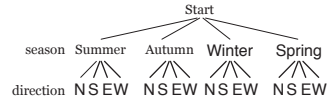
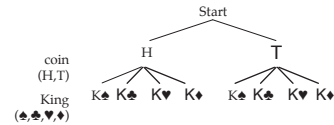
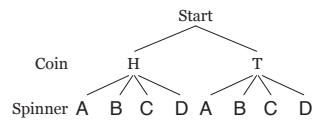
- Skill 29.1** a) 6, b) 9, c) 9, d) 8
Skill 29.2 a) Aston Martin b) Mississippi, c) England, d) hydro-electric
Skill 29.3 a) stork, b) anthracite, c) writing, d) 5, e) Mt Buller, f) flea
Skill 29.4 a) 2, b) 4, c) bottle-nosed dolphin, d) gorilla
 e) 1983, 1987 and 1989, f) Australia, g) 55%, h) U10
 i) 3, j) 1 kg cheese
Skill 29.5 a) Emerson, b) Court, c) 80%, d) 30 - 44 yr, e) UK
 f) National Book Critics Circle Award, g) Murray Darling
 h) 1984, i) harp seal, j) Germany
Skill 29.6 a) 5, b) 9, c) 11.5, d) 22°C, e) 16, f) 4, g) 120, h) 4.7
 i) mean = 5, median = 5, j) mean = 22, median = 24
Skill 29.7 a) mode = 4, range = 33, b) mode = 1, range = 9
 c) mode = 5, range = 18, d) mode = 40, range = 55
Skill 29.8 a) 0.5%, b) 5 am, c) 1860 - 1870, d) 5 h, e) 6.5%
 f) 1996 - 1997, g) Saturday, h) 2010, i) Australia, j) 2002
Skill 29.9 a) OECD, b) hydrogen, c) B, d) dogs & cats, e) C, f) no
Skill 29.10 a)

| Stem | Leaf |
|------|-------------|
| 4 | 4 8 8 9 |
| 5 | 5 5 5 6 7 9 |
| 6 | 0 2 6 |
| 7 | 2 3 |

 b)

| Stem | Leaf |
|------|---------------|
| 18 | 2 |
| 19 | 2 3 7 |
| 20 | 1 2 2 3 5 5 6 |

 Key: 3|5 = 35 23|5 = 235 cm
 c) median = 22.5, range = 14, d) median = 580, range = 56
 e) median = 15, range = 26, f) median = 118, range = 99
Skill 29.11 a) fit, b) bituminous, c) glass bottle, d) elephant, e) urine
 f) bat, g) 8, h) more, i) shorter, j) C, k) B, l) A



- Skill 30.1** a) 8, b) 16, c) 11, d) 17, e) 21, f) 116, g) 13, h) 8
Skill 30.2 a) A, b) B, c) B, d) C, e) A, f) D
Skill 30.3 a) 4

| Outcomes (sample space) | |
|-------------------------|------------|
| male | gorilla |
| male | chimpanzee |
| female | gorilla |
| female | chimpanzee |

b) 6

| Possible outcomes | Primary colour | | | |
|-------------------|----------------|-----|-----|-----|
| | R | G | B | |
| Coin | H | R,H | G,H | B,H |
| | T | R,T | G,T | B,T |

c) 12

| Possible outcomes | Die | | | | | | |
|-------------------|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | |
| Coin | H | H,1 | H,2 | H,3 | H,4 | H,5 | H,6 |
| | T | T,1 | T,2 | T,3 | T,4 | T,5 | T,6 |

d) 10

| Possible outcomes | Spinner | | | | | |
|-------------------|---------|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | |
| Coin | H | 1,H | 2,H | 3,H | 4,H | 5,H |
| | T | 1,T | 2,T | 3,T | 4,T | 5,T |

e) 6

| Outcomes (sample space) | |
|-------------------------|-------------|
| silver | convertible |
| silver | hardtop |
| red | convertible |
| red | hardtop |
| purple | convertible |
| purple | hardtop |

f) 8

| Outcomes (sample space) | | |
|-------------------------|--------|-----------|
| vanilla | waffle | hot fudge |
| vanilla | waffle | caramel |
| vanilla | sugar | hot fudge |
| vanilla | sugar | caramel |
| chocolate | waffle | hot fudge |
| chocolate | waffle | caramel |
| chocolate | sugar | hot fudge |
| chocolate | sugar | caramel |

- Skill 30.5** a) $\frac{6}{13}$, b) $\frac{1}{2}$, c) $\frac{1}{2}$, d) $\frac{1}{8}$, e) $\frac{1}{2}$, f) $\frac{2}{11}$, g) $\frac{1}{13}$, h) $\frac{1}{15}$, i) $\frac{1}{20}$
 j) $\frac{1}{4}$, k) $\frac{1}{2}$, l) $\frac{1}{4}$, m) $\frac{1}{2}$, n) $\frac{7}{10}$, o) $\frac{1}{6}$, p) $\frac{2}{5}$, q) $\frac{1}{6}$, r) $\frac{2}{5}$
 s) A, t) A, u) C, v) C, w) C, x) B, y) B, z) A
Skill 30.6 a) B, b) B, c) D, d) B, e) B, f) B
Skill 30.7 a) $\frac{1}{5}$, b) $\frac{1}{4}$, c) $\frac{7}{15}$, d) $\frac{4}{5}$
Skill 30.8 a) 98%, b) $\frac{2}{3}$, c) $\frac{3}{5}$, d) $\frac{7}{10}$, e) $\frac{16}{25}$, f) 23%
Skill 30.9 a) $\frac{3}{4}$, b) $\frac{1}{3}$, c) $\frac{3}{4}$, d) 1
Skill 30.10 a) 60, b) 120, c) 12, d) 24, e) 20, f) 720, g) 30, h) 36, i) 20
 j) 120