

# 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

$$2 \text{ h} : 40 \text{ min}$$

$$= 120 \text{ min} : 40 \text{ min}$$

$$\begin{array}{c} \div 40 \\ \downarrow \quad \downarrow \\ = 120 \text{ min} : 40 \text{ min} \\ \quad \quad \quad \downarrow \\ \quad \quad \quad 1 \end{array} \div 40$$

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

$$= \underline{\hspace{2cm}} : \underline{\hspace{2cm}} = \boxed{\quad} : \boxed{\quad}$$

d) Simplify the ratio 150 g : 175 g

$$= \underline{\hspace{2cm}} : \underline{\hspace{2cm}} = \boxed{\quad} : \boxed{\quad}$$

e) Simplify the ratio \$3.00 : 40 cents

\$1 = 100¢

2 zeros, 2 places right

$$\$3.00 = 3.\overset{00}{00} \times 100\text{¢} = 300\text{¢}$$

$$= \overset{15}{300\text{¢}} : \overset{2}{40\text{¢}} \quad \text{Simplify: } \div 20 = \boxed{15:2}$$

f) Simplify the ratio 40 s : 2 min

$$= \underline{\hspace{2cm}} : \underline{\hspace{2cm}} = \boxed{\quad} : \boxed{\quad}$$

g) Simplify the ratio 12 m : 60 cm

$$= \underline{\hspace{2cm}} : \underline{\hspace{2cm}} = \boxed{\quad} : \boxed{\quad}$$

h) Simplify the ratio \$4.00 : 25 cents

$$= \underline{\hspace{2cm}} : \underline{\hspace{2cm}} = \boxed{\quad} : \boxed{\quad}$$

i) Simplify the ratio 6 days : 4 weeks

$$= \underline{\hspace{2cm}} : \underline{\hspace{2cm}} = \boxed{\quad} : \boxed{\quad}$$

j) Simplify the ratio 5 min : 50 s

$$= \underline{\hspace{2cm}} : \underline{\hspace{2cm}} = \boxed{\quad} : \boxed{\quad}$$

$$\begin{aligned} \text{speed } (v) &= \frac{\text{distance travelled } (d)}{\text{time taken } (t)} & \text{OR } v &= \frac{d}{t} \\ \text{distance travelled } (d) &= \text{speed } (v) \times \text{time taken } (t) & \text{OR } d &= vt \\ \text{time taken } (t) &= \frac{\text{distance travelled } (d)}{\text{speed } (v)} & \text{OR } t &= \frac{d}{v} \end{aligned}$$

- 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?

$$t = 45 \text{ min} = 0.75 \text{ h} \quad (\text{three quarters of an hour})$$

Use  $d = rt$

$$d = 10 \text{ km/h} \times 0.75 \text{ h} = \boxed{7.5 \text{ km}}$$

**b)** How far will a salmon swim in 12 minutes if it swims at 45 km/h?

$$t =$$

$$d = \quad = \boxed{\text{km}}$$

**c)** A cyclist rides at an average speed of 18 km/h. At this rate how long would it take to travel 45 km?

$$t = \frac{d}{v}$$

$$= \frac{45 \text{ km}}{18 \text{ km/h}} \quad \text{Simplify: } \div 9 = \boxed{\text{h}}$$

**d)** A hot air balloon travels at a speed of 21 km/h. At this rate how far will it travel in 40 minutes?

$$t =$$

$$d = \quad = \boxed{\text{km}}$$

**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?

$$d =$$

$$= \quad = \boxed{\text{km}}$$

**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?

$$t =$$

$$= \quad = \boxed{\text{h min}}$$

- 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

$= \begin{matrix} 9 & 2 & 5 \\ \hline 72 & 16 & 40 \end{matrix} \xrightarrow{\text{Simplify: } \div 8} = \boxed{9 : 2 : 5}$

**b)** Simplify the ratio 4 : 8 : 16

$= \dots = \boxed{\quad : \quad : \quad}$

**c)** Simplify the ratio 3 : 9 : 27

$= \dots = \boxed{\quad : \quad : \quad}$

**d)** Simplify the ratio 10 : 30 : 45

$= \dots = \boxed{\quad : \quad : \quad}$

**e)** Simplify the ratio 33 : 18 : 15

$= \dots = \boxed{\quad : \quad : \quad}$

**f)** Simplify the ratio 18 : 36 : 27

$= \dots = \boxed{\quad : \quad : \quad}$

**g)** Simplify the ratio 48 : 18 : 12

$= \dots = \boxed{\quad : \quad : \quad}$

**h)** Simplify the ratio 50 : 100 : 30

$= \dots = \boxed{\quad : \quad : \quad}$

**i)** Simplify the ratio 36 : 12 : 60

$= \dots = \boxed{\quad : \quad : \quad}$

**j)** Simplify the ratio 30 : 45 : 90

$= \dots = \boxed{\quad : \quad : \quad}$

**k)** Simplify the ratio 42 : 14 : 21

$= \dots = \boxed{\quad : \quad : \quad}$

**l)** Simplify the ratio 40 : 60 : 80

$= \dots = \boxed{\quad : \quad : \quad}$

### 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.**  $\frac{5}{7} \times \frac{10}{35} \Rightarrow 5 \times 35 = 7 \times 10$  A  
 $\Rightarrow 175 = 70 \Rightarrow \text{false}$

Cross multiply

$\frac{5}{7} \times \frac{15}{14} \Rightarrow 5 \times 14 = 7 \times 15$  B  
 $\Rightarrow 70 = 105 \Rightarrow \text{false}$

$\frac{5}{7} \times \frac{20}{28} \Rightarrow 5 \times 28 = 7 \times 20$  C  
 $\Rightarrow 140 = 140 \Rightarrow \text{true}$

The answer is **C**

**a)** 5 : 12 is equivalent to 25 : 60  
True or false?

$$\frac{5}{12} \times \frac{25}{60} \Rightarrow 5 \times 60 = 12 \times 25$$

$$300 = 300 \Rightarrow \boxed{\phantom{00}}$$

**b)** 4 : 9 is equivalent to 16 : 81  
True or false?

$$\Rightarrow \boxed{\phantom{00}}$$

**c)** Which ratio is equivalent to 3 : 5?  
A) 9 : 25    B) 9 : 15    C) 18 : 25

A  $\frac{3}{5} \times \frac{9}{25} \Rightarrow 3 \times 25 = 5 \times 9 \Rightarrow 75 = 45 (F)$

B  $\frac{3}{5} = \frac{9}{15} \Rightarrow$

C  $\Rightarrow \Rightarrow \boxed{\phantom{00}}$

**d)** Which ratio is equivalent to 5 : 6?  
A) 10 : 30    B) 25 : 36    C) 35 : 42

A  $\Rightarrow$

B  $\Rightarrow$

C  $\Rightarrow \Rightarrow \boxed{\phantom{00}}$

**e)** Which ratio is equivalent to 2 : 7?  
A) 8 : 28    B) 10 : 70    C) 4 : 49

A  $\Rightarrow$

B  $\Rightarrow$

C  $\Rightarrow \Rightarrow \boxed{\phantom{00}}$

**f)** Which ratio is equivalent to 7 : 9?  
A) 21 : 36    B) 49 : 81    C) 35 : 45

A  $\Rightarrow$

B  $\Rightarrow$

C  $\Rightarrow \Rightarrow \boxed{\phantom{00}}$

## 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:

$$\boxed{\phantom{00}} : 28 = 12 : 7$$

**A.**  $\frac{x}{28} = \frac{12}{7}$

$$\frac{x}{28} = \frac{12}{7} \quad \text{Cross multiply}$$

$$x \times 7 = 28 \times 12$$

$$7x = 28 \times 12$$

$$\frac{1}{7} \cancel{x} = \frac{4}{1} \cancel{28} \times 12 \quad \text{Simplify: } \div 7$$

$$x = 4 \times 12$$

$$x = 48$$

**a)** Complete the equivalent ratios:

$$3 : \boxed{4} = 12 : 16$$

$$\frac{3}{x} = \frac{12}{16} \Rightarrow 3 \times 16 = x \times 12$$

$$\frac{1}{12} \cancel{x} = \frac{1}{4} \cancel{3} \times 16 \quad \text{Simplify: } \div 3, \div 4$$

$$\frac{1}{12} x = \frac{1}{4} \times 16 \Rightarrow x = 4$$

**b)** Complete the equivalent ratios:

$$24 : 15 = \boxed{\phantom{00}} : 5$$

$$\frac{24}{15} = \frac{x}{5} \Rightarrow 24 \times 5 = 15 \times x$$

$$\frac{15x}{15} = \frac{24 \times 5}{15} \Rightarrow x =$$

**c)** Complete the equivalent ratios:

$$3 : 10 = \boxed{\phantom{00}} : 90$$

$\Rightarrow$

$$\Rightarrow x =$$

**d)** Complete the equivalent ratios:

$$\boxed{\phantom{00}} : 2 = 45 : 10$$

$\Rightarrow$

$$\Rightarrow x =$$

**e)** Complete the equivalent ratios:

$$\frac{5}{9} = \frac{35}{\boxed{\phantom{00}}}$$

$\Rightarrow$

$$\Rightarrow x =$$

**f)** Complete the equivalent ratios:

$$\frac{3}{7} = \frac{18}{\boxed{\phantom{00}}}$$

$\Rightarrow$

$$\Rightarrow x =$$

g) Complete the equivalent ratios:

$$\frac{1}{7} = \frac{\boxed{\phantom{000}}}{56}$$

⇒

⇒  $x =$ 

h) Complete the equivalent ratios:

$$\frac{7}{20} = \frac{\boxed{\phantom{000}}}{140}$$

⇒

⇒  $x =$ 

i) Complete the equivalent ratios:

$$\frac{24}{40} = \frac{3}{\boxed{\phantom{000}}}$$

⇒

⇒  $x =$ 

j) Complete the equivalent ratios:

$$\frac{20}{15} = \frac{4}{\boxed{\phantom{000}}}$$

⇒

⇒  $x =$ 

k) Complete the equivalent ratios:

$$\frac{10}{45} = \frac{\boxed{\phantom{000}}}{9}$$

⇒

⇒  $x =$ 

l) Complete the equivalent ratios:

$$\frac{64}{80} = \frac{\boxed{\phantom{000}}}{10}$$

⇒

⇒  $x =$ 

m) Complete the equivalent ratios:

$$\frac{63}{18} = \frac{\boxed{\phantom{000}}}{2}$$

⇒

⇒  $x =$ 

n) Complete the equivalent ratios:

$$\frac{11}{5} = \frac{\boxed{\phantom{000}}}{15}$$

⇒

⇒  $x =$



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).

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

- 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.**  $\text{zinc} = 100\% - 84\% = 16\%$

$$\begin{aligned} & \text{zinc} : \text{copper} \\ & = 16\% : 84\% \quad \text{Ignore the \% sign} \\ & = \frac{16}{4} : \frac{84}{4} \quad \text{Simplify: } \div 4 \\ & = 4 : 21 \end{aligned}$$

- 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*

$$\begin{aligned} & 44 : 36 \quad \text{Simplify: } \div 4 \\ & \xrightarrow{\div 4} \frac{44}{4} : \frac{36}{4} \\ & = 11 : 9 \end{aligned}$$

- 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*

$$60 : 50$$

$$= \frac{60}{10} : \frac{50}{10} = \boxed{\phantom{00} : \phantom{00}}$$

- c)** The alloy platinum is 90% platinum and 10% iridium. Find the ratio of iridium to platinum in the alloy.

*iridium : platinum*

$$= \frac{10}{90} : \frac{90}{90} = \boxed{\phantom{00} : \phantom{00}}$$

- 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.

$$= \frac{8}{80} : \frac{80}{80} = \boxed{\phantom{00} : \phantom{00}}$$

- e)** The 8-carat gold is 33% gold, 20% silver and the rest is copper. Find the ratio of silver to other components.

$$= \frac{20}{33+20} : \frac{33}{33+20} = \boxed{\phantom{00} : \phantom{00}}$$

- 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.

$$= \frac{75}{100} : \frac{100}{100} = \boxed{\phantom{00} : \phantom{00}}$$

**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.

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

**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.

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

**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?

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

**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).

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

**k)** A soccer field is 120 metres long and 80 metres wide. Find the ratio of width to length.

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

**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.

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

**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.

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

**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.

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

**Skill 14.9** Finding other rates.

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

$$\text{rate} = \frac{\text{amount}}{\text{time}}$$

**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 (CO<sub>2</sub>). How many grams of CO<sub>2</sub> 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?

$$1 \text{ year} = 52 \text{ weeks}$$

$$\text{rate/wk} = \dots = \boxed{\phantom{000}}$$

**d)** It takes 45 minutes to fill a 2700 litre swimming pool. What is the average rate in litres per minute?

$$\text{rate} =$$

$$= \dots = \boxed{\phantom{000}}$$

**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?

$$\text{amount} =$$

$$= \dots = \boxed{\phantom{000} \text{ L}}$$

**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?

$$1 \text{ week} =$$

$$\text{bottles} = \dots = \boxed{\phantom{000}}$$

**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?

$$\text{amount} =$$

$$= \dots = \boxed{\phantom{000} \text{ L}}$$

**h)** The annual fuel cost for a Lamborghini Coupe is around \$2490. How much is the cost per month?

$$1 \text{ year} =$$

$$= \dots = \boxed{\phantom{000} \$}$$

