# 16. [Expressions]

## Skill 16.1 Writing expressions to represent word problems.

MM5.2 **1 1** 2 2 3 3 4 4
MM6.1 **1** 1 2 2 3 3 4 4

- 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"* ⇒ *addition* ⇒ +
  *"Difference, less than, change"* ⇒ *subtraction* ⇒ –
  *"Product, times, lots of"* ⇒ *multiplication* ⇒ ×
  *"A fraction (half, third, quarter) of"* ⇒ *division* ⇒ ÷

**Q.** Lisa earns a weekly wage of $w$ dollars. How much money did she earn in a fortnight, if she received a \$300 bonus?

**A.** *w dollars a week*
*2 weeks in a fortnight* } ⇒ *2 times w*
*\$300 bonus* ⇒ +
*The × sign can be left out*
⇒ ***2 × w + 300 or 2w + 300***

**a)** Write as an expression:
The sum of $d$ and 20.

*sum* ⇒ + ⇒ $d + 20$

**b)** Write as an expression:
The number seven times $y$.

⇒

**c)** Write as an expression:
The number 15 less than $p$.

⇒

**d)** Write as an expression:
Nine lots of $s$.

⇒

**e)** Write as an expression:
The product of –8 and $t$.

⇒

**f)** Write as an expression:
The sum of $2u$ and $3v$.

⇒

**g)** Lily had $d$ dollars and spent a third of her money. How much money did she spend?

*a third of* ⇒ ÷ ⇒ $\frac{d}{3}$
or $d \div 3$

**h)** Out of the $t$ tickets for sale, a quarter remained unsold. How many tickets remained unsold?

⇒

**i)** You pay \$50 dollars at the petrol station. How much change do you get if the petrol was $p$ dollars?

⇒

**j)** There are $a$ local and $b$ imported products at the supermarket. How many products are there altogether?

⇒

**k)** Write as an expression:
Twice the product of $p$ and $q$.

⇒

**l)** Write as an expression:
The number 6 less than the product of $a$ and $b$.

⇒

## Skill 16.2 Simplifying expressions.

- Leave out the multiplication sign between variables (letters) or between variables and numbers.
  Example: $1 \times a = 1a = a$
- Write the number first, followed by the variables.
  Example: $m \times 3 = 3m$
- Write the variables in alphabetical order.
  Example: $c \times a \times b = abc$
- Replace the division sign with a fraction line.
  Example: $m \div n = \frac{m}{n}$
- Use the sign rules. (see skill 9.1, page 93)

**Q.** Simplify $p \times 3 \times m$

**A.** $p \times 3 \times m =$ *The × signs can be left out*
$= 3mp$
*number first* *alphabetical order*

**a)** Simplify $j \times 5$ *number first* *The × sign can be left out* $5j$

**b)** Simplify $y \times 7$

**c)** Simplify $n \times m$

**d)** Simplify $h \times g$

**e)** Simplify $6 \times z \times y$

**f)** Simplify $4 \times u \times r$

**g)** Simplify $3 \times x \div 2$ *÷ becomes fraction line* *The × sign can be left out* $\frac{3x}{2}$

**h)** Simplify $6 \times z \div 5$

**i)** Simplify $4 \times b \times b$ *$b \times b = b^2$*

**j)** Simplify $3 \times a \times -a$ *+ × − = −*

**k)** Simplify $w \times z \times w$

**l)** Simplify $c \times d \times -c$

**m)** Simplify $s \times r^2 \times 2$

**n)** Simplify $j \times k^2 \times -1$

**o)** Simplify $r \times 5 \times s \div t$

**p)** Simplify $2 \times a \times b \div c$

**q)** Simplify $u \times 10 \times v \div -w$

**r)** Simplify $g \times 6 \times h \div -i$

## Skill 16.3 Finding like terms.

- Look at the combination of variables in all terms.

EITHER

- Find the **like terms**, terms that have the same combination of variables.

Example: $4c$ and $-c$
$-2x^2$ and $5x^2$
$-ab$, $5ba$ and $3ba$

like terms

OR

- Find the **unlike terms**, terms that do not have the same combination of variables.

Example: $2k$ and $2k^2$
$5uv$ and $vw$
$3xy$, $x$ and $y$

unlike terms

*Hint: The order of the variables in a term does not matter.*
$gh = hg$, $mn^2 = n^2m$

**Q.** Choose the like terms:
$a^2b$, $-ab$, $4ba$

**A.** $4ba = 4ab$
*$-ab$ and $4ab$ have the same combination of variables ($ab$)*
$\Rightarrow$ ***$-ab$*** *and* ***$4ba$*** *are like terms.*

**a)** Choose the like terms:
$8a$, 3, $5a$

like terms

$8a$, $5a$

**b)** Choose the like terms:
$-2$, $-2m$, $3m$

**c)** Choose the like terms:
$m^2$, $3m^2$, $3m$

unlike terms

**d)** Choose the like terms:
$t^2$, $2t$, $-t^2$

**e)** Choose the like terms:
$3cd$, $dc$, $3c$

$3cd$, $dc$

**f)** Choose the like terms:
$-bc$, $5c$, $5cb$

**g)** Choose the like terms:
$3t^2$, $-2t$, 4, $3t$

**h)** Choose the like terms:
$-6w$, 8, $w^2$, $w$

**i)** Choose the like terms:
$3s$, $2.3s$, $s^2$, 2.3

**j)** Choose the like terms:
$-0.2y$, $-0.2y^2$, $2y$, 2.2

**k)** Choose the like terms:
$v^2$, $-2v$, $u^2$, $-2v^2$

**l)** Choose the like terms:
$4k$, $4k^2$, $l^2$, $-k^2$

**m)** Choose the like terms:
$z^2$, $8z$, $-8z^2$, $z^3$

**n)** Choose the like terms:
$g$, $g^2$, $-4g^2$, $g^3$

**o)** Choose the like terms:
$-5w$, $-5w^4$, $-5$, $w^4$

**p)** Choose the like terms:
$a^2b$, $2ab$, $2ba^2$, $-ab^2$

**q)** Choose the like terms:
$-xy$, $x^2y$, $2yx^2$, $2xy^2$

**r)** Choose the like terms:
$3t^2u^2$, $3tu$, $-tu^2$, $3u^2t$

## Skill 16.4 Simplifying expressions by adding and subtracting like terms.



- Group like terms. (see skill 16.3, page 169)
- Read the sign in front of each term.
- Add and/or subtract only the like terms.
- Add and/or subtract the coefficients first, then copy the variable.
  Example: $3g + 5g = (3 + 5)g = 8g$
  *coefficients*
- Write coefficient 1 in front of any variable.
  Example: $a = 1a$, $-b = -1b$, $c^2 = 1c^2$
  *Hint: Unlike terms cannot be added or subtracted.*

**Q.** Simplify $3x^2 - 6x + x^2 + 7x$

**A.** $3x^2 - 6x + x^2 + 7x =$ *group like terms*; *$x^2 = 1x^2$*
$= 3x^2 + 1x^2 - 6x + 7x$ *3 + 1 = 4*; *−6 + 7 = 1*
$= 4x^2 + 1x$
$= \mathbf{4x^2 + x}$

**a)** Simplify $2m + m$

$= 2m + 1m =$ 3m

**b)** Simplify $5cd + dc$

$= 5cd + 1cd =$

**c)** Simplify $4j - 3j + 2j$

$=$ ..... $=$

**d)** Simplify $7xy - 5xy + xy$

$=$ ..... $=$

**e)** Simplify $5a + 3b - 2a$ *group like terms*

$= 5a - 2a + 3b =$

**f)** Simplify $t^2 + 3t + 2t^2$

$=$ ..... $=$

**g)** Simplify $6ad + 2d - 5da + 3d$ *group like terms*

$= 6ad - 5ad + 2d + 3d =$

**h)** Simplify $3m + 5n - 4m - n$

$=$ ..... $=$

**i)** Simplify $4p^2 - p^2 - 3p + 2p^2$

$=$ ..... $=$

**j)** Simplify $3y^2 - 2yz - y^2 + 3zy$

$=$ ..... $=$

**k)** Simplify $2r^2 + s^2 + r^2 - 4s^2$

$=$ ..... $=$

**l)** Simplify $-3x - x^2 + x + 4x^2$

$=$ ..... $=$

**m)** Simplify $3d - d^2e - 2ed^2 - 4d$

$=$ ..... $=$

**n)** Simplify $3ab^2 - 2ab^2 - 4a^2b + a^2b$

$=$ ..... $=$

## Skill 16.5 Simplifying expressions by multiplying terms.



- Read the sign in front of each term.
- Multiply the coefficients.
- Multiply the variables (join the letters).
- Use the sign rules. (see skill 9.1, page 93)
  Example: $2u \times -3v = (2 \times -3) \times (u \times v) = -6 \times uv = -6uv$
  (coefficients; + × − = −)
- Write coefficient 1 in front of any variable.
  Example: $a = 1a$, $-b = -1b$, $c^2 = 1c^2$
  *Hint: Any terms can be multiplied.*

**Q.** Simplify $-3cd \times 4c \times -d$

**A.** $-3cd \times 4c \times -d =$ (× the coefficients)
$= (-3 \times 4 \times -1) \times (cd \times c \times d) =$ (× the letters)
$= (-12 \times -1) \times (c^2d \times d) =$ (− × − = +)
$= 12 \times c^2d^2$
$= \mathbf{12c^2d^2}$

**a)** Simplify $4 \times 3v$

$= (4 \times 3) \times v$ (× the coefficients) $=$ 12v

**b)** Simplify $3xy \times 5$

$=$ ..... $=$ .....

**c)** Simplify $2m \times 7n$

$=$ ..... $=$ .....

**d)** Simplify $-8j \times 5k$

$=$ ..... $=$ .....

**e)** Simplify $-4d \times -5e$

$= (-4 \times -5) \times (d \times e)$ (− × − = +) $=$ 20de

**f)** Simplify $3b \times 6b$ ($b \times b = b^2$)

$=$ ..... $=$ .....

**g)** Simplify $2v \times -12w$

$=$ ..... $=$ .....

**h)** Simplify $-4ab \times 7b$

$=$ ..... $=$ .....

**i)** Simplify $-10xz \times 3z$

$=$ ..... $=$ .....

**j)** Simplify $-4gh \times 5g$

$=$ ..... $=$ .....

**k)** Simplify $2s \times -5t \times 3s$

$= (2 \times -5 \times 3) \times (s \times t \times s)$ $=$ .....

$=$ ..... $=$ .....

**l)** Simplify $-4p \times 2q \times 3p$

$=$ ..... $=$ .....

$=$ ..... $=$ .....

**m)** Simplify $3jk \times -5k \times -j$

$=$ ..... $=$ .....

$=$ ..... $=$ .....

**n)** Simplify $-bc \times -5c \times 5c$

$=$ ..... $=$ .....

$=$ ..... $=$ .....

## Skill 16.6 Simplifying expressions by dividing terms.

- Read the sign in front of each term.
- Write the division as a fraction.
- Simplify by dividing the coefficients.
- Simplify by dividing the variables.
- Use the sign rules. (see skill 9.1, page 93)
- Write coefficient 1 in front of any variable.
  Example: $a = 1a$, $-b = -1b$, $c^2 = 1c^2$

**Q.** Simplify $-30x^2y \div 3y$

**A.** $-30x^2y \div 3y =$

$= -\dfrac{\overset{10}{\cancel{30}}x^2y}{\underset{1}{\cancel{3}y}}$ *Simplify: ÷ 3*

$= -\dfrac{10x^2\overset{1}{\cancel{y}}}{\underset{1}{\cancel{y}}}$ *Simplify: ÷ y*

$= \mathbf{-10x^2}$

**a)** Simplify $12y \div 3$

$= \dfrac{\overset{4}{\cancel{12}}y}{\underset{1}{\cancel{3}}}$ = $4y$

**b)** Simplify $24pq \div 4$

$= \dfrac{\overset{6}{\cancel{24}}pq}{\underset{1}{\cancel{4}}}$ =

**c)** Simplify $14a \div 2a$ *a ÷ a = 1*

=

=

**d)** Simplify $-35mn \div -5n$ *− ÷ − = +*

=

=

**e)** Simplify $-15z^2 \div 3z$ *− ÷ + = −*

= *$z^2 \div z = z$*

=

**f)** Simplify $-12xy \div 2y$

=

=

**g)** Simplify $18x \div 15x$

=

=

**h)** Simplify $20cd \div cd$

=

=

**i)** Simplify $-24t^2 \div 8t$

=

=

**j)** Simplify $11ab \div -11b$

=

=

**k)** Simplify $-25v^2w \div 5w$

$= -\dfrac{\overset{5}{\cancel{25}}v^{2\,\overset{1}{}}\cancel{w}}{\underset{1}{\cancel{5}}\underset{1}{\cancel{w}}}$ *Simplify: ÷ 5 then ÷ w* = $-5v^2$

**l)** Simplify $-45ab^2 \div 9b$

=

=

**m)** Simplify $20xy \div 4x \times xz$

$= \dfrac{\overset{5}{\cancel{20}}\overset{1}{\cancel{x}}y}{\underset{1}{\cancel{4}}\underset{1}{\cancel{x}}} \times xz = 5y \times xz$ =

**n)** Simplify $27gh \div 9g \times gi$

=

=