



Using letters

- Distinguishing between equations, formulae and functions
- Identifying and using an identity
- Using negative indices
- Using the index laws in algebra and with standard form

Keywords

You should know

explanation 1a

explanation 1b

explanation 1c

explanation 1d

1 Solve these equations.

a $3x - 7 = 17$

b $\frac{x}{4} + 5 = 23$

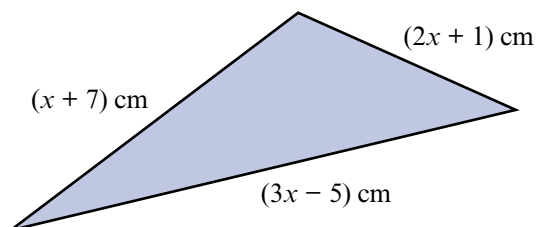
c $3(2x - 5) = 24$

d $6x + 5 = 8x - 5$

e $4(2x - 7) = 8 - x$

f $\frac{2x - 3}{5} = 7$

2



The triangle has a perimeter of 27 cm.

Form an equation and solve it to find the value of x and the length of each side of the triangle.

3 Jane is x years old and her brother Tom is two years older than her, while her sister Hannah is three times her age. The sum of their ages is 57.

- a** Write expressions in terms of x for Tom's age and Hannah's age.
- b** Write an equation for the sum of their ages.
- c** Solve your equation to find Jane's age.

explanation 2a

explanation 2b

explanation 2c

explanation 2d

- 4** State whether each of the following is a formula, equation or function.

Some parts may have more than one answer.

a $5x - 3 = 17$

b $\frac{c}{6} - 5 = \frac{3}{5}$

c $y = 5x - 7$

d $A = \pi r^2$ where A is the area and r is the radius of the circle.

e $p = 2l + 2w$ where p is the perimeter, l is the length and w is the width.

f $y = 3x^3 + 5$

g $5(x + 2) = 3x - 7$

h $3x + 2y = 18$

- 5** Copy and complete the table of values for these functions without using a calculator.

a $y = 6x - 1$

b $y = 7 - 2x$

c $2y + 3x = 12$

x	-1	-3		5		
y			0		11	-5

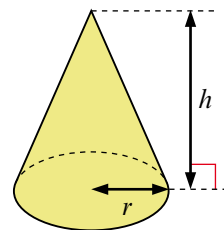
- 6** The volume of a cone is given by the formula $V = \frac{1}{3}\pi r^2 h$.

Find the volume of these cones.

a $r = 4\text{ cm}$, $h = 6\text{ cm}$

b $r = 7\text{ cm}$, $h = 12\text{ cm}$

c $r = 1.2\text{ cm}$, $h = 3.5\text{ cm}$



- 7** The perimeter P of a right-angled triangle is given by the formula

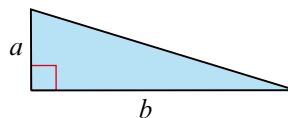
$$P = a + b + \sqrt{a^2 + b^2}.$$

Find the perimeter of each of these triangles.

a $a = 3\text{ cm}$, $b = 4\text{ cm}$

b $a = 12.5\text{ cm}$, $b = 30\text{ cm}$

c $a = 6.1\text{ cm}$, $b = 3.2\text{ cm}$



8 Copy and complete these identities. Check by substituting some values of x .

a $4(x + 7) \equiv 4x + \square$

b $7(2x + 5) \equiv \square x + \square$

c $2(\square - 7) \equiv 6x - \square$

d $9x - 12 \equiv 3(\square - 4)$

e $5(2x - 3) \equiv \square - \square$

f $15x + 25 \equiv 5(\square + \square)$

9 Which of these expressions are identically equal to $r \div \frac{s}{t}$?

A $\frac{r \div s}{t}$

B $r \times \frac{t}{s}$

C $\frac{r}{1} \div \frac{s}{t}$

D $\frac{t}{rs}$

E $\frac{rt}{s}$

10 Which of these expressions are identically equal to $7 + 3(x + 2)$?

A $7 + 3x + 2$

B $10x + 20$

C $7 + 3x + 6$

D $9 + 3x$

E $3x + 13$

explanation 3a

explanation 3b

explanation 3c

11 Write these using indices.

a $d \times d \times d \times d \times e \times e$

b $g \times h \times h \times g \times h \times g \times h \times g \times h \times g$

c $4 \times p \times p \times p \times q \times q \times r$

d $4 \times y \times y \times 5 \times z \times z \times z \times z$

e $6 \times a \times a \times 4 \times b \times b \times c \times c \times c$

f $4 \times m \times 4 \times n \times n \times n \times 2 \times p \times p \times p \times p$

12 Find the value of each of these without using a calculator.

a 2^3

b 4^3

c 3^4

d 2^5

e 10^8

f $(-2)^2$

g $(-3)^3$

h $2^3 \times 5^2$

i $10^2 \div 5^2$

j $(-5)^2 + 3^4$

k $27 - 5^3$

13 Simplify these, leaving your answer as a power.

a $6^5 \times 6^2$

b $5^{12} \div 5^4$

c $(3^4)^6$

d $\frac{7^5 \times 7^2}{7^3}$

e $a^2 \times a^7$

f $(b^5)^3 \div b^6$

g $\frac{x \times x^3}{x^{-2}}$

h $(g^{10})^{-2} \times g^{20}$

explanation 4

14 Copy and complete these statements.

a $4^{-1} = \frac{1}{4^1} = \frac{1}{\square}$

b $5^{-2} = \frac{1}{\square} = \frac{1}{\square}$

c $10^{-1} = \frac{1}{\square} = \frac{1}{\square}$

d $10^{-2} = \frac{\square}{\square} = \frac{\square}{\square}$

15 Match each index statement in the top row to its value from the bottom row.

4^{-2} 10^{-3} $(-4)^2$ 5^{-3} $(-10)^3$ $-(4)^2$ 5^3 $(-5)^3$

125 -16 -125 $\frac{1}{16}$ -1000 16 $\frac{1}{125}$ $\frac{1}{1000}$

16 Find the value of each expression without using a calculator.

a 2^{-3} **b** 4^{-2} **c** 3^{-2} **d** 2^{-4} **e** 10^{-5}

f $(-2)^{-2}$ **g** $(-3)^{-3}$ **h** 2^{-6} **i** $(-6)^{-3}$ **j** 10^{-4}

17 How many values can you find for x and y to make this statement true?

$x^y = 64$

18 Simplify these, leaving your answer as a power.

Write each answer in two different ways.

a $5^2 \div 5^3$

b $6^2 \div 6^5$

c $a^2 \div a^7$

d $\frac{3^5 \times 3^2}{3^{10}}$

e $\frac{y^{-1} \times y^3}{y^5}$

f $(p^{10})^2 \div p^{30}$

explanation 5a
explanation 5b
explanation 5c

19 Use the index laws to simplify these expressions.

a $3a \times 5a^2$

b $2c^3 \times 2c^2$

c $4n^2 \times n^{-2}$

d $m^2 \times 3m$

e $4b^3 \times 3b^2$

f $4p^2 \div 2p^3$

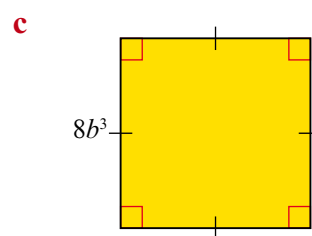
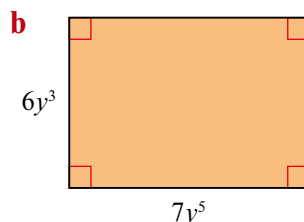
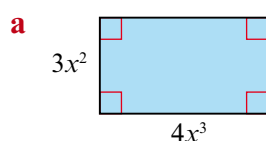
g $8x^2 \div 2x^{-1}$

h $4xy^2 \times 3x^3y^2$

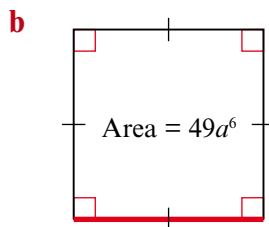
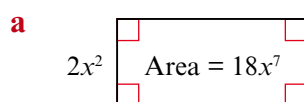
20 Use the index laws to simplify these expressions.

a $4n^4p \div 2n^2p$	b $4t^8r^3 \times 3t^4$	c $3g^2 \times 2g^3 \times 2g$	d $10b^8 \div 5b^8$
e $\frac{9a^2}{3a}$	f $\frac{10n^6p^8}{2n^5p^3}$	g $c^4 \times 3c^2 \times 2c^5 \times c^3$	h $\frac{(3b^2 \times 4b^4)}{6b^3}$
i $(2x^7)^3$	j $(10y^3)^4$	k $(6a^2)^2$	l $(2m^3)^{-3}$

21 Write an expression for the area of each shape.
Use the index laws to simplify them.



22 Write and simplify an expression for the red length of each shape.



23 Work these out. Give your answers in standard form.

a $(3 \times 10^2) \times (2 \times 10^5)$	b $(3.2 \times 10^{-3}) \times (3 \times 10^2)$
c $(4 \times 10^6) \times (6 \times 10^4)$	d $(3.2 \times 10^6) \times (3 \times 10^5)$
e $(7 \times 10^{-2}) \times (3 \times 10^4)$	f $(6 \times 10^{-4}) \times (2.5 \times 10^{-3})$
g $(6 \times 10^6) \div (2 \times 10^2)$	h $(8.4 \times 10^{-3}) \div (4 \times 10^5)$
i $(9.6 \times 10^3) \div (2 \times 10^{-5})$	j $(3 \times 10^7) \div (6 \times 10^5)$
k $(2 \times 10^6) \div (8 \times 10^5)$	l $(4.8 \times 10^{-5}) \div (2 \times 10^{-2})$
m $(6 \times 10^6)^2$	n $(5 \times 10^3)^3$
o $(2 \times 10^{-2})^4$	p $(2 \times 10^4)^{-2}$