Planner

Expressions and equations

- Simplifying algebraic expressions
- Solving equations using inverse operations
- Expanding brackets

Keywords

You should know

explanation 1a | explanation 1b | online

1 Write an expression for each set of instructions.
Start with x.

a Multiply by 4.

b Subtract 6.

c Add 14.

d Divide by 3.

e Subtract from 5.

2 Write an expression for each set of instructions.
Start with x.

a Subtract 11 then divide the answer by 5.

b Add 7 then multiply the answer by 2.

c Multiply by 3 then add 5 and divide the answer by 4.

d Subtract from 10 and multiply the answer by 3.

e Divide by 3 then add 5.

3 Write an expression for each set of instructions.
Start with y.

a Divide by 10.

b Multiply by 3 and divide by 5.

c Divide by 4 then subtract 3.

d Multiply by 5 then subtract the answer from 17.

e Subtract 9 and divide 20 by the answer.

f Multiply by 3 then divide by 4 and subtract the answer from 10.

4 Write the instructions contained in these expressions. Start with x.

a $2(x - 5)$ **b** $21 - 5x$ **c** $\frac{x}{3} + 4$

d $\frac{x + 8}{4}$ **e** $35 - 4(x + 1)$ **f** $\frac{18}{x - 3}$

5 Find the value of each of these expressions when $x = 5$.

a $3(x + 2)$ **b** $11 + 2x$ **c** $\frac{4x - 2}{3}$

d $\frac{35}{x}$ **e** $10 + 3(x + 1)$ **f** $x(x - 2)$

g $x(x + 1)$ **h** $\frac{x + 10}{x}$ **i** $2x - \frac{3x}{5}$

6 Give the value of these expressions as mixed numbers when $x = 9$.

a $\frac{x}{4}$ **b** $\frac{2x}{5}$ **c** $\frac{x + 1}{3}$ **d** $\frac{10}{x}$ **e** $3 + \frac{x}{4}$ **f** $x - \frac{x}{5}$

explanation 2 online

7 Simplify each of these expressions.

a $2x - 3 + 3$ **b** $\frac{x}{4} + 7 - 7$ **c** $\frac{5x}{5}$

d $\frac{3x}{3}$ **e** $\frac{x}{4} \times 4$ **f** $\frac{x + 3}{7} \times 7$

8 Copy and complete the following expressions so that they simplify to x.

a $x + 8 - \square$ **b** $x - 9 + \square$ **c** $x - \square + 6$

d $\frac{4x}{\square}$ **e** $\frac{4x}{\square} + 5 - \square$ **f** $\frac{x - 9}{7} \times \square + \square$

9 Copy and complete these function machines.

a $2x + 3 \rightarrow$ [$- 3$] $\rightarrow$ [$2x$] $\rightarrow$ [$\square$] $\rightarrow x$

b $3x - 5 \rightarrow$ [$\square$] $\rightarrow$ [$\square$] $\rightarrow$ [$\square$] $\rightarrow x$

c $\frac{x + 7}{4} \rightarrow$ [$\square$] $\rightarrow$ [$\square$] $\rightarrow$ [$\square$] $\rightarrow x$

d $\frac{x}{5} - 6 \rightarrow$ [$\square$] $\rightarrow$ [$\square$] $\rightarrow$ [$\square$] $\rightarrow x$

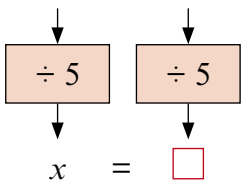
e $3(x + 2) \rightarrow$ [$\square$] $\rightarrow$ [$\square$] $\rightarrow$ [$\square$] $\rightarrow x$

f $\frac{4x}{5} \rightarrow$ [$\square$] $\rightarrow$ [$\square$] $\rightarrow$ [$\square$] $\rightarrow x$

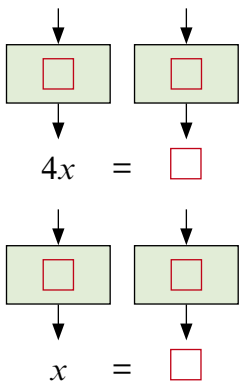
explanation 3 online

10 Copy and complete.

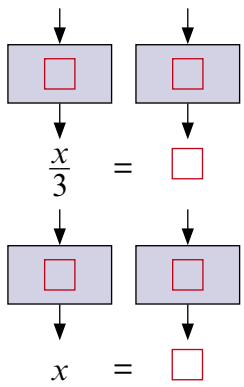
a $5x = 45$



b $4x + 11 = 39$



c $\frac{x}{3} - 7 = 118$



11 Solve these equations.

a $\frac{x}{10} = 17$ **b** $4x = 64$ **c** $x + 99 = 147$

d $x - 134 = 270$ **e** $\frac{x}{11} = 20$ **f** $12x = 60$

12 Solve these equations.

a $x - 47 = 86$ **b** $10x = 140$ **c** $5x = 75$

d $\frac{x}{8} = 31$ **e** $x + 58 = 94$ **f** $\frac{x}{25} = 4$

13 Copy and complete the steps to solve the following equations.

a $3x - 17 = 16$

$3x = \square$

$x = \square$

b $2(x + 12) = 68$

$x + 12 = \square$

$x = \square$

c $\frac{x}{5} + 112 = 126$

$\frac{x}{5} = \square$

$x = \square$

d $\frac{5x}{3} = 15$

$5x = \square$

$x = \square$

e $11 = \frac{x - 19}{6}$

$\square = x - 19$

$x = \square$

f $75 = 5(x - 32)$

$\square = x - 32$

$x = \square$

g $2 = \frac{x + 10}{4}$

$\square = x + 10$

$x = \square$

h $9 = 3(4 - x)$

$\square = 4 - x$

$x = \square$

i $x = \frac{x + 4}{2}$

$\square = x + 4$

$x = \square$

14 Solve these equations.

a $\frac{x-24}{8} = 7$ **b** $9x + 73 = 109$ **c** $11(x + 14) = 220$

d $17 = \frac{x}{4} - 53$ **e** $25 = \frac{x+81}{4}$ **f** $40 = \frac{8x}{3}$

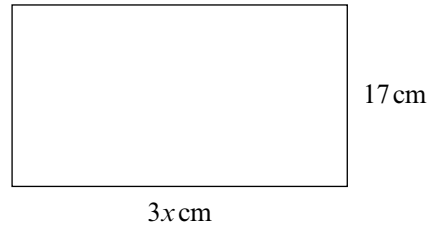
***15** Solve these equations and give your answers as fractions in their simplest form.

a $10x = 5$ **b** $12x = 8$ **c** $25x = 15$

d $12x + 10 = 19$ **e** $25x - 9 = 11$ **f** $24 = 18x + 12$

explanation 4

16 The perimeter of the rectangle shown is 76 cm.

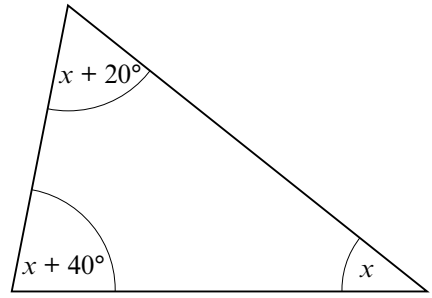


a Write this information as an equation and simplify it.

b Solve the equation.

c Find the length of the longest side of the rectangle.

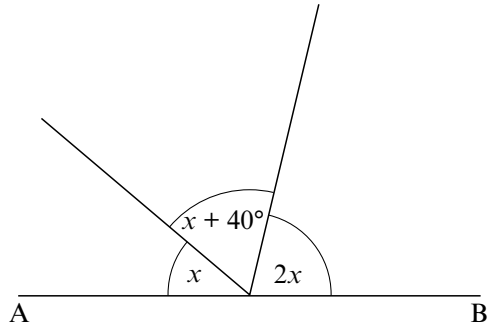
17 **a** Write an equation involving the sum of the angles of this triangle and simplify it.



b Solve the equation.

c Find the angles of the triangle.

18 In the diagram, AB is a straight line.



a Write an equation involving the sum of the angles shown and simplify it.

b Solve the equation.

c Write down the size of each of the labelled angles.

explanation 5

19 Do you think that the statement $x + y = y + x$ is always true, sometimes true or never true for numbers x and y? Give two examples to support your answer.

20 Repeat question **19** for each of the following statements.

a $x - y = y - x$ **b** $x - y = -(y - x)$

c $xy = yx$ **d** $\frac{x}{y} = \frac{y}{x}$

e $x + y + 1 = -(1 - y - x)$ **f** $(1 - x) - (1 + y) = -(x + y)$

explanation 6 online

21 Simplify each of these expressions.

a $xy + 2yx$ **b** $5zx + xz$ **c** $2xy + 3yx - xy$

d $5pq - 3qp$ **e** $rp + 6pr - 2$ **f** $pq + qp + pr$

g $a \times b \times c$ **h** $2 \times w \times 3$ **i** $2pq + q \times 6 \times p$

22 **a** Work out these multiplications.

i $(5 \times 4) \times 3$ **ii** $5 \times (4 \times 3)$ **iii** $(3 \times 8) \times 2$ **iv** $3 \times (8 \times 2)$

v $(7 \times 3) \times 5$ **vi** $7 \times (3 \times 5)$ **vii** $(4 \times 11) \times 2$ **viii** $4 \times (11 \times 2)$

b Copy and complete. $(xy)z = \square$

23 Write down which of the following expressions always have the same value as xyz.

zxy $x(yz)$ yxz $y(zx)$

24 Find the value of xyz when

a $x = 3, y = 5, z = 20$ **b** $x = 4, y = 25, z = 9$

c $x = 2, y = 2.5, z = 7$ **d** $x = 10, y = 2, z = 1.9$

e $x = \frac{1}{2}, y = 12, z = 11$ **f** $x = \frac{1}{2}, y = 7.9, z = 20$

Choose the simplest order to work out each calculation.

25 Simplify the following expressions.

a $3pqr + 2rpq$ **b** $p(qr) + 6rpq$

c $10r(qp) - pqr$ **d** $4pqr + 11r(qp) - prq$

26 Simplify these expressions. The first one is done for you.

a $2 \times 4p = (2 \times 4)p = 8p$ **b** $3 \times 5q$ **c** $4 \times 7t$

d $8r \times 3$ **e** $9n \times 4$ **f** $10k \times 3$

27 Simplify these expressions. The first one is done for you.

a $4 \times 3g + 5 \times 2g = 12g + 10g$
$= 22g$

b $3 \times 4w + 2 \times 7w$

c $5 \times 4v - 3 \times 3v$

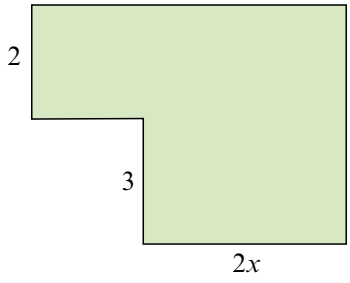
d $7 \times 3x - 5x \times 4$

e $6 \times 4y + y - 3 \times 2y$

f $a + 3a \times 5 - 2 \times 4a$

***28** Find and simplify an expression for the area of each of these figures.

a



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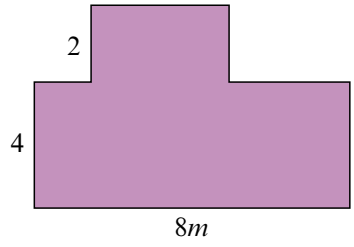

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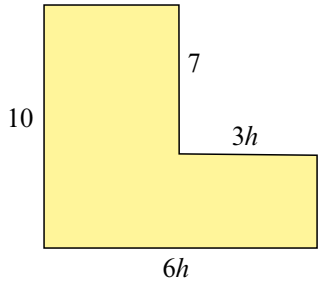

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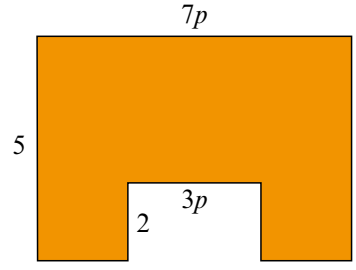

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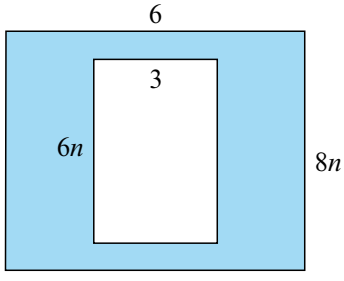

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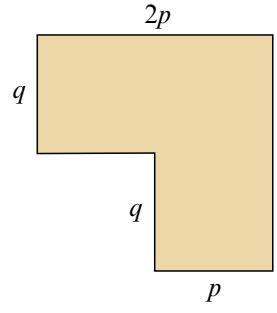
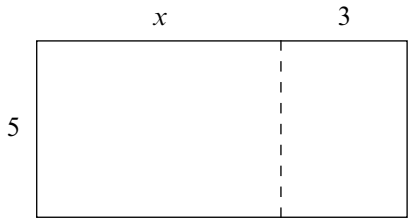


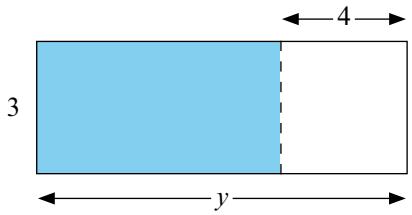
***29** Copy and complete the statement to show the total area in two different ways.

$5(x + \square) = 5x + \square$



***30** Copy and complete the statement to show the coloured area in two different ways.

$3(y - \square) = \square - 12$



explanation 7

31 Copy and complete the following steps to work out 24×19.

$24 \times 19 = 24\,(20 - \square)$

$= 24 \times \square - 24 \times \square$

$= \square - \square$

$= \square$

32 Use the method shown in question **31** to work out these calculations.

a 32×29 **b** 14×49 **c** 18×9.9

33 Expand the brackets in these expressions.

a $4(x + 5)$ **b** $6(n - 4)$ **c** $3(5 + t)$

d $10(12 - h)$ **e** $8(7 + p)$ **f** $9(11 - b)$

g $x(3 + y)$ **h** $r(5 - t)$ **i** $k(n + 2)$

34 Expand the brackets in these expressions.

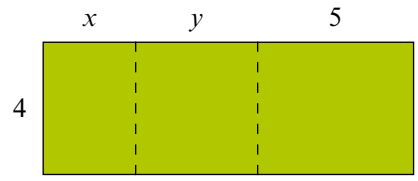
a $3(2x + 1)$ **b** $4(3n - 2)$ **c** $5(4 - 2k)$

d $6(10 + 3j)$ **e** $2(9 - 5e)$ **f** $7(3d + 4)$

g $a(2b + 5)$ **h** $g(9 - 3t)$ **i** $2z(5 + 3y)$

***35** Use the diagram to help you complete the statement below.

$4(x + \square + \square) = \square$



36 Expand the brackets in these expressions.

a $5(p + q + 3)$

b $3(2a + b - 6)$

c $4(12 - m + 2n)$

d $10(2h + 5 - k)$

e $6(5 - 3c - 4d + 2e)$

f $3n(2p + 3q - 3)$

37 Expand the brackets and simplify these expressions.

a $3(x + 5) + 2x$

b $4(2n - 3) - n$

c $2(4 - 5t) + 6$

d $7(2a + 3) - 6a - 11$

e $8(w + 2q) + w - 9q$

f $4h + 3(h + 5)$

38 Expand the brackets and simplify these expressions.

a $5(3t + 1) + 4t + 3$

b $4(m + 2n + 3) + m + 4n + 6$

c $14 + 3(7k + 2h + 5) - 9k - 10$

d $11 + 5x + 3(x + 2y) - 3y$

***39** Solve these equations by expanding the brackets first.

a $3(x + 2.5) = 19.5$

b $4(x + 3) + 7 = 51$

c $36 = 4(x + 3.5) + 6$

d $15 = x + 4(2x - 3)$

e $3x + 2(x + 7) = 59$

f $5(x + 1) - 2x - 26 = 0$

***40** Three friends count how many marbles they have.
Paula has p marbles. Quentin has six fewer marbles than Paula.
Rachel has twice as many marbles as the other two have in total.

a How many marbles does Quentin have, in terms of p?

b Write an expression for the number of marbles that Rachel has.

c Write an expression for the total number of marbles. Simplify it.

d Paula, Quentin and Rachel have 48 marbles altogether.
Write an equation involving p.

e Solve your equation. How many marbles does Rachel have?