› Learner's Book answers

Unit 1 Getting started

1 −7, −5, 0, 3, 6, 9

2 9, 18, 27, 36, 45

3 1, 3, 5, 15

4 5^2

Exercise 1.1

1 a 1 **b** −4 **c** −8 **d** 4

2 a −6 **b** 8 **c** −10 **d** 2

3 a −2 **b** 10 **c** 2 **d** −10

4 a 4 **b** −2 **c** −10 **d** −6

5 −9

6 a For example: 1 and 0; 2 and −1; 3 and −2; 4 and −3; 5 and −4

b One integer will be positive and the other integer will be zero or negative. If you ignore the − sign, the difference between them is 1 and the − sign is on the smaller integer.

7 a Learners could check this with some particular values for the two integers. They could use one positive integer and one negative integer or they could make them both negative integers.

b Only if the answer is zero, otherwise they have different signs.

8

+	−4	6	−2
3	−1	9	1
−5	−9	1	−7

9 Missing numbers from top to bottom.

a −6, −4 **b** −3, −5, 2

c −12, −2, −10 **d** 1, 5, −4

e −1, 7, −8

Reflection: You have to work backwards from the answer or do a subtraction.

10 a 5 **b** −12 **c** 10 **d** −19

11 a −40 **b** −130 **c** 1200 **d** −700

12 a i −4 **ii** −4

iii −4 **iv** −4

b Three numbers can be added in any order. It is true for any three integers.

13 a

+	−5	7
4	−1	11
−3	−8	4

b $-1 + 11 + -8 + 4 = 6$

c $4 + -3 + -5 + 7 = 3$

d $\mathbf{b} = 2 \times \mathbf{c} \ (6 = 2 \times 3)$

Reflection: Learner's own answer.

14 a There are three possible answers. They are 2, −13 and 17.

b Learner's own check.

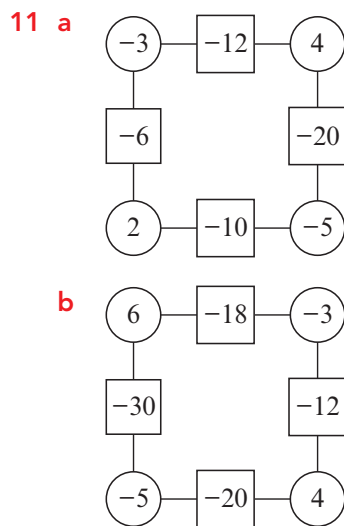## Exercise 1.2

1 a −6 **b** −35

c −40 **d** −36

2 a −5 **b** −5 **c** −6 **d** −3

3 a −2 **b** −6 **c** 7 **d** 5

4 a 4 **b** −2

c −16 **d** −20

5 There are four possible pairs: 2 and −5; −2 and 5; 1 and −10; −1 and 10.

Reflection: First, find all the pairs of numbers with a product of 10. Then think about if the sign is positive or negative.

6

×	−3	−5
5	−15	−25
7	−21	−35

7 **a** −21 **b** −50 **c** −8 **d** −4

8 **a** −200 **b** −1800 **c** −360 **d** −100

9 **a** −12 **b** −24

   c −30 **d** −20

10 **a** The missing numbers are: −5, −4, −2.

   b Add −20 ÷ 1 = −20 and −20 ÷ 20 = −1.

   c The lines can be in any arrangement. Learner's own diagram.

   d Learner's own check.

11 **a**

   b

12 There are four possible answers. Going clockwise from the top left-hand circle, the possible answers are: 1, −10, 3, −8; −1, 10, −3, 8; 2, −5, 6, −4; −2, 5, −6, 4.

Exercise 1.3

1 **a** 5, 10, 15, 20, 25

   b 10, 20, 30, 40, 50

   c 7, 14, 21, 28, 35

   d 12, 24, 36, 48, 60

2 **a** 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39

   b 5, 10, 15, 20, 25, 30, 35

   c 15, 30

3 **a** 12, 24, 36, 48 **b** 12

4 24

5 30

6 56

7 **a** 4 × 7 = 28 is a multiple of 4 and 7.

   b 6 × 5 = 30 is a multiple of 6 and 5.

   c It is always true. A × B is a multiple of A (B times) and of B (A times).

   d It is sometimes true but not always true. It is true when A = 4 and B = 7, then A × B is 28 and this is the LCM.

   A counterexample is when A = 6 and B = 4, then A × B = 24 but the LCM is 12.

8 12

9 36

10 There are two possible answers: 1 and 21; 3 and 7.

11 There are four possible answers: 1 and 30; 2 and 15; 3 and 10; 5 and 6.

Reflection: Learner's own answer.

Exercise 1.4

1 **a** 1, 2, 3, 4, 6, 8, 12, 24

   b 1, 2, 5, 10, 25, 50

   c 1, 3, 5, 9, 15, 45

   d 1, 19

2 **a** 1, 3, 11, 33 **b** 1, 2, 17, 34

   c 1, 5, 7, 35 **d** 1, 2, 3, 4, 6, 9, 12, 18, 36

   e 1, 37

3 **a** 1, 2, 3, 6 **b** 6

4 **a** 4 **b** 6 **c** 12

5 **a** 6 **b** 1 **c** 2 **d** 7

6 **a** 10 **b** 20 **c** 30

7 **a** 7 **b** $\frac{5}{8}$

Reflection: For example: If you divide the numerator and the denominator by the highest common factor, you have the fraction in its simplest form.

8 a 1

b You simplify $\frac{25}{36}$ by dividing 25 and 36 by a common factor. Since 1 is the only common factor, the fraction cannot be simplified.

9 9

10 a There are four possible pairs: 12 and 28, 12 and 32, 16 and 28, 16 and 36.

b Learner's own answer.

11 a 4 **b** 24 **c** $8 \times 12 = 96$

d $HCF \times LCM = 96$

e The answers are equal. This is always true.

f Learner's own answer.

12 a 3 is a factor of both numbers, so each number is a multiple of 3.

b 45 is a multiple of both numbers, so each number is a factor of 45.

c 9 and 15

d Learner's own answer.

Exercise 1.5

1 a $2 + 8 + 5 + 7 + 2 = 24$; this is a multiple of 3 but is not a multiple of 9.

b 28 575 has a total of 27, so is divisible by 9.

2 a $5 + 7 + 4 + 2 + 3 = 21$, which is a multiple of 3. 21 is odd, so 6 is not a factor.

b 0 or 6

3 a The final digit is even, so it is divisible by 2; the last two digits are 64 and this is divisible by 4, so the number is divisible by 4.

b The last three digits are 764 and $764 \div 8 = 95$ r. 4, so it is not a multiple of 8.

4 a $2 + 5 + 3 + 2 + 0 = 12$, which is a multiple of 3; 20 is a multiple of 4.

b Possible answers are 2, 5, 6, 8 and 10.

5 a–c Learner's own answers.

6 a odd $9 + 4 = 13$; even $= 2$; $13 - 2 = 11$

b odd $= 4 + 0 + 6 = 10$; even $= 8 + 1 + 1 = 10$; $10 - 10 = 0$, so it is a multiple of 11.

7 a $258 - 2 \times 3 = 252$ and $252 \div 7 = 36$

b $385 - 2 \times 2 = 381$ and $381 \div 7 = 54$ r 3

8 a The number is odd, so 2, 4, 6 and 8 are not factors. The last digit is 9, so 5 is not a factor. The sum of the digits is 27, so both 3 and 9 are factors. $22\,599 \div 7 = 3228$ r. 3, so 7 is not a factor. So, 3 and 9 are the only factors between 1 and 10.

b 99 522 has the same digits as 22 599 (the number in part **a**), so 3 and 9 are still factors. It is even, so 2 is a factor. 6 is also a factor, but 4 and 8 are not factors. 5 is not a factor. 7 is not a factor. The factors are 2, 3, 6 and 9.

9

Number	Factors between 1 and 10
12	2, 3, 4, 6
123	3
1234	2
12345	3, 5
123456	2, 3, 4, 6, 8

10 For example: 4675 because $4 + 7 = 6 + 5 = 11$. There are seven other possibilities.

11 a 2521 is odd and so not divisible by 2, 4, 6, 8 or 10. The sum of the digits is 10, so it is not divisible by 3 or 9. The last digit is 1, so it is not divisible by 5; $2521 \div 7 = 360$ r. 1. $1 + 5 = 6$ and $2 + 2 = 4$, so it is not divisible by 11.

b Any number with these digits that ends in 5.

c Any number with these digits that ends in 12 or 52.

d 2512 or 2152

e 2526

f 2530

12 a Because the last digit is 4, it is even and is divisible by 4.

b The last digit is always 4 and never 0 or 5.

c i 444 is possible.

ii 444 444 or 444 444 444 and so on because the sum of the digits is 24 and so on. Always a multiple of 3.

d **i** 44 is possible.

    ii 4444 or 444 444 or . . . If there is an even number of digits, the difference calculated in the test is 0.

13 a It is false. 12 is divisible by 2 and 4, but it is not divisible by 8.

  b It is true. A number divisible by 10 has a last digit of 0. Hence, it is even and also divisible by 5.

  c It is true. Learner's own answer.

Exercise 1.6

1 a 9   **b** 25   **c** 64

  d 100   **e** 225

2 a $\sqrt{9} = 3$ **b** $\sqrt{25} = 5$

  c $\sqrt{64} = 8$ **d** $\sqrt{100} = 10$

  e $\sqrt{225} = 15$

3 a 6   **b** 9   **c** 11   **d** 12

4 a 1   **b** 8   **c** 27   **d** 64

  e 125

5 a $\sqrt[3]{1} = 1$ **b** $\sqrt[3]{8} = 2$

  c $\sqrt[3]{27} = 3$ **d** $\sqrt[3]{64} = 4$

  e $\sqrt[3]{125} = 5$

6 a 4   **b** 8   **c** 12

7 a $9^2 = 81$ and $10^2 = 100$

  b 13 and 14   **c** 4 and 5

8 a 289   **b** $\sqrt{289} = 17$

9 a $\sqrt{324} = 18$ **b** $\sqrt{400} = 20$

  c $\sqrt{529} = 23$ **d** $\sqrt{676} = 26$

10 a $\sqrt[3]{343} = 7$ **b** $\sqrt[3]{729} = 9$

  c $\sqrt[3]{1000} = 10$ **d** $\sqrt[3]{1728} = 12$

11 a The factors are 1, 36, 2, 18, 3, 12, 4, 9, 6.

  b **i** 1, 9, 3   **ii** 1, 16, 2, 8, 4

    iii 1, 25, 5

  c Usually factors come in pairs. For example, $2 \times 18 = 36$ gives two factors, 2 and 18. Only for a square number can you get a single factor from a product. $6 \times 6 = 36$, so the total number is odd.

d Impossible

e No; a counterexample is 8, which is 2^3 and has four factors, 1, 2, 4 and 8.

f Learner's own answer.

Reflection: Learner's own answer.

12 a The differences are 3, 5, 7, 9, 11, . . .

  b They are odd numbers. They increase by two each time. Add the two numbers that are squared to find the difference.

  c The differences are 7, 19, 37, 61, 91, . . .

13 a **i** 1   **ii** 3   **iii** 6

  b The answer is the sum of the numbers cubed.

  c Try adding 4^3 and so on.

  d Learner's own answer.

14 a $\sqrt{1+3+5} = 3$

  b $\sqrt{1+3+5+7} = 4$

  c $\sqrt{1+3+5+7+9} = 5$ and so on.

 **d** The numbers in each part are $1+3+5+7 = 16$, which equals a 4 by 4 square. Compare with part **b**.

Check your progress

1 a −4   **b** −10   **c** −12   **d** −5

2 a 5 and −3   **b** 10 and −7

3 a −3   **b** 6

4 1, 2, 4, 8

5 a 54, 60, 66   **b** 30

6 a 13   **b** $\dfrac{2}{5}$

7 a $\sqrt{N}$ is an integer, so $\sqrt{N} \times \sqrt{N} = N$ is a square number.

  b $N = 64$

8 a 32 is divisible by 4.

  b 1 or 4 or 7

  c 9

9 $9^3 = 27^2$ and $16^3 = 64^2$

Unit 2 Getting started

1 **a** 19 **b** 14 **c** −2 **d** −3

e 32 **f** 5 **g** −16 **h** −12

2 **a** 13 **b** 84 **c** 13 **d** 1

e 21 **f** 4 **g** −20 **h** 0

3 **a** 2 **b** 6 **c** 10 **d** 11

e −5 **f** 3

4 **a** \$9.14 **b** \$12.20

5

		63		
	36		27	
20		16		11
8	12		4	7
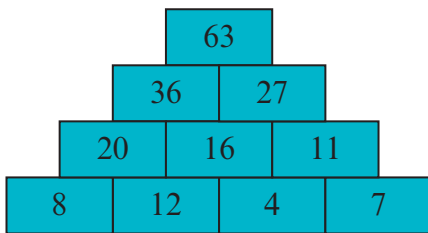
Exercise 2.1

1 **a** $n+2$ **b** $n-3$

2 Learner's own answers.

3 **a** $t+2$

b $2t$

c $\frac{t}{2}$ or $t \div 2$

4 **a** $x+6$ **b** $m+b$ **c** $3g$

5 **a** $6x+1$ **b** $4x-9$

c $\frac{x}{6}-1$ **d** $\frac{x}{2}+7$

e $25-2x$

6 **a** **i** $3y$

ii $\frac{y}{2}$ or $y \div 2$

iii $4y+1$

iv $2y-5$

v $52-5y$

vi $\frac{y}{4}+3$ or $y \div 4 + 3$

b Learner's own answers.

Activity 2.1

Learner's own answers.

7 **a** order of operations

b Equivalent to $2n+3$ is: A, D, G, K.

Equivalent to $2n-3$ is: B, I.

Equivalent to $3n+2$ is: C, H, J, L.

Equivalent to $3-2n$ is: E, F.

8 **a** Pedro multiplied instead of adding. Correct answer is \$$t+$$s$.

b He has confused two T-shirts and four shirts with four T-shirts and two shirts. Correct answer is \$$4t+$$2s$.

9 **a** $2t+4b$, where $t=$ cost of a taco, $b=$ cost of a burrito.

b $8x+5y$, where $x=$ cost of a lemon cake, $y=$ cost of a carrot cake.

c $12g$, where $g=$ cost of a gold coin.

d $15s$, where $s=$ cost of a silver coin.

10 **a** $x+y$ or $y+x$ **b** $y-x$

c $m+2n$ or $2n+m$ **d** $3b-a$

e pq **f** $4gh$

11 $6x-(2y+3)$ or $6x-2y-3$

Exercise 2.2

1 **a** 22 **b** 8 **c** 7 **d** 20

e 35 **f** 40

2 **a** 8 **b** 11 **c** 11 **d** 75

e 15 **f** 11 **g** 31

h 8 **i** 3 **j** 15

3 **a** For every day, there are 24 hours.

b $h=24d$ **c** 120 hours

4 **a** **i** number of minutes $=60\times$ number of hours

ii $m=60h$

b 300 minutes

5 a i Amount each pays = total cost ÷ five

ii $a = \frac{c}{5}$ or $a = c \div 5$

b $17

6 a T = total pay, h = hours worked

b Total pay = 9 × number of hours worked

c $270

7 a C = cost per week, p = cost of petrol, i = cost of insurance

b Cost per week = cost of petrol + cost of insurance

c $32

8 a i $153 **ii** $142

b $205, $P = M + E$

9 a 21 **b** 36

c 5 **d** 8

10 a If x is the cost of an adult ticket, then y is the cost for a child ticket. But if x was actually the cost of a child ticket, then y would be the cost for an adult ticket.

x can represent the cost of <u>either</u> the adult ticket <u>or</u> the child ticket, and y represents the other ticket.

b $C = a + c$, or still use x and y, but write down what each letter represents.

11 a No; p has to be the large piece because the small piece is taken (i.e. subtracted) from it.

b $W = l - s$, or still use p and q, but write down what each letter represents.

12 $k = 5$

Reflection: Learner's own answers.

Exercise 2.3

1 a $4a$ **b** $3b$ **c** $2a + b$

d $2a + 2c$ or $2(a + c)$

e $3a + 2b$

f $b + 2c$

2 a and v; b and iv; c and i; d and vi; e and ii; f and iii

3 a $5x$ **b** $6y$ **c** $8d$ **d** $13t$

e $14g$ **f** $16p$ **g** $3w$ **h** $7n$

i $4b^2$ **j** $5f$ **k** $3j$ **l** k^3

4 a

```
        14x
     8x    6x
   3x   5x    x
```

b

```
        12p
     8p    4p
   7p   p    3p
```
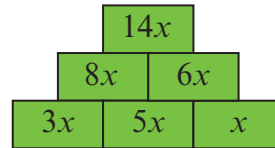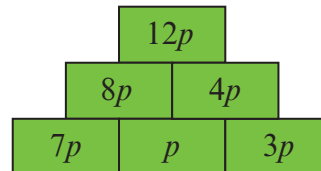
5 a $10x + 15y$ **b** $2d + 2h$ **c** $5g + 3$

d $5p + 13t$ **e** $3a + 2b - 3c$

6 a $5a + 5b$ **b** $8c + 3d$

c $7t + 10$ **d** $4m + 4n$

e $6k + 3f$ **f** $5q + 8$

g $5r + 3s + 5t$ **h** $6 + 3h + 5k$

7 xy means $x \times y$ and yx means $y \times x$, so $xy = yx$.

a $7xy$ or $7yx$

b $5pq + 4de$ or $5qp + 4ed$

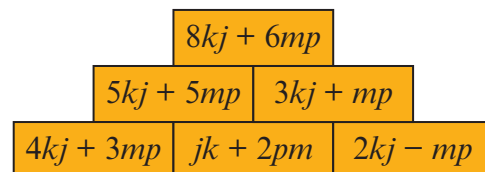**8 b** $8st + 16pu$ **c** $6bv + 2ad$

d $9rt + 2gh$ **e** $11xy + 3xz$

f $4a + 8ac$ **g** mn

9 a The '$8x + 4$' is correct, but you cannot add $8x$ to 4, so $8x + 4$ is the answer.

b Dai added $2bc$ to the $3bc$, when he should have subtracted. Also, you can simplify $5bd + 3db$ to $8bd$. Correct answer is $bc + 8bd$.
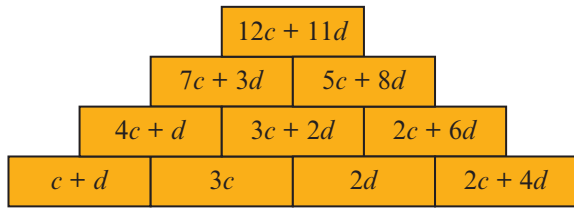
10

```
             8kj + 6mp
        5kj + 5mp   3kj + mp
   4kj + 3mp   jk + 2pm   2kj − mp
```

Activity 2.2

Learner's own answers.

11

	$12c + 11d$	
	$7c + 3d$ $\quad$ $5c + 8d$	
	$4c + d$ $\quad$ $3c + 2d$ $\quad$ $2c + 6d$	
	$c + d$ $\quad$ $3c$ $\quad$ $2d$ $\quad$ $2c + 4d$	

Marcus is incorrect. Every block can be filled in by working backwards.

12 a Learner's own answers.

b **i** $\dfrac{9a}{8}$ $\qquad$ **ii** $\dfrac{y}{3}$ $\qquad$ **iii** $\dfrac{x}{4}$

13 a $\dfrac{5a}{4}$ $\qquad$ **b** $\dfrac{16b}{15}$ $\qquad$ **c** $\dfrac{7c}{3}$

Exercise 2.4

1 a $2x + 18$ $\qquad$ **b** $3y - 3$

$\quad$ **c** $28 + 4p$ $\qquad$ **d** $5q - 15$

2 a Advantages: good if you like multiplication boxes, easy method to follow.

$\quad$ Disadvantage: takes a long time to draw the grid.

b Advantages: quick way to show workings, easy method to follow.

$\quad$ Disadvantages: must draw the arcs to show workings and to check all parts have been multiplied.

c Advantages: easy method to follow.

$\quad$ Disadvantages: takes a long time to show all workings.

d Learner's own answer.

3 a $3y + 18$ $\qquad$ **b** $4w + 8$

$\quad$ **c** $5z + 25$ $\qquad$ **d** $3b - 3$

$\quad$ **e** $6d - 54$ $\qquad$ **f** $2e - 16$

$\quad$ **g** $12 + 6f$ $\qquad$ **h** $2 + 2g$

$\quad$ **i** $27 + 9i$ $\qquad$ **j** $12 - 6x$

$\quad$ **k** $2 - 2y$ $\qquad$ **l** $35 - 5p$

4 a $4x + 2$ $\qquad$ **b** $15y - 10$

$\quad$ **c** $14g + 63p$ $\qquad$ **d** $16q - 44 + 4r$

5 a $6x + 3$ $\qquad$ **b** $12y + 20$

$\quad$ **c** $10w + 15$ $\qquad$ **d** $24z + 42v + 54$

e $6b - 8$ $\qquad$ **f** $8c - 12$

g $30d - 6$ $\qquad$ **h** $24e - 48 + 16f$

i $3a + 6f$ $\qquad$ **j** $15b + 20g$

k $42c - 49h$ $\qquad$ **l** $45 + 27h - 36i$

6 a Bethan did $4 + 4$ when it should be 4×4. Correct answer is $4x + 16$.

b Bethan forgot to multiply the -3 by 2. Correct answer is $12x - 6$.

c Changed the $-$ to a $+$. Correct answer is $6 - 15x$.

d You can't subtract $6x$ from 12. Correct answer is $12 - 6x$.

Reflection: Learner's own answer.

7 No; three of the expanded expressions give $30 + 24x$, but $4(6x + 26)$ expands to give $104 + 24x$.

8 a $3(4b + 5)$ and $3(5 + 4b)$ are the same as $12b + 15 = 15 + 12b$.

b $2(5c - 1)$ and $2(1 - 5c)$ are not the same as $10c - 2 \neq 2 - 10c$.

9 a $24y + 32 \,\text{cm}^2$ $\qquad$ **b** $6y + 24 \,\text{cm}$

10 $(8k - 14m)°$

11 a $4x + 27$ $\qquad$ **b** $12x + 21$ $\qquad$ **c** $3 + 6x$

Exercise 2.5

1 a $x = 4$, $4 + 6 = 10$

$\quad$ **b** $x = 16$, $16 - 6 = 10$

$\quad$ **c** $x = 5$, $2 \times 5 = 10$

2 a $x = 7$ $\qquad$ **b** $x = 3$ $\qquad$ **c** $x = 13$

$\quad$ **d** $x = 12$ $\qquad$ **e** $x = 13$ $\qquad$ **f** $x = 10$

$\quad$ **g** $x = 26$ $\qquad$ **h** $x = 48$ $\qquad$ **i** $x = 4$

$\quad$ **j** $x = 6$ $\qquad$ **k** $x = 10$ $\qquad$ **l** $x = 6$

3 a $y = 12$ $\qquad$ **b** $y = 7$ $\qquad$ **c** $y = 18$

$\quad$ **d** $y = 28$ $\qquad$ **e** $y = 3$ $\qquad$ **f** $y = 7$

4 a $n + 3 = 18$, $n = 15$

$\quad$ **b** $n - 4 = 10$, $n = 14$

$\quad$ **c** $4n = 24$, $n = 6$

5 **a** **i** I think of a number and subtract 8. The answer is 3.

      ii I think of a number and add 5. The answer is 12.

      iii I think of a number and multiply my number by 8. The answer is 96.

  b **i** $n = 11$ **ii** $n = 7$ **iii** $n = 12$

6 **a** $2 - 7 = -5$, but $-2 - 7 = -9$; $x = -9$

  b Should have added 6, not subtracted; $x = 4$

  c $35 \div 5 = 7$, but $-35 \div 5 = -7$; $x = -7$

7 **a** $a = 5$ **b** $a = 4$ **c** $a = 5$

  d $c = 6$ **e** $c = 4$ **f** $c = 8$

8 **a** **i** $2a + 8 = 20$ **ii** $3b + 3 = 24$

  b **i** $a = 6$ **ii** $b = 7$

  c Learner's own answer.

9 **a** **i** $2p + 1 = 14$ **ii** $p = 6.5$

  b **i** $4p - 5 = 37$ **ii** $p = 10.5$

  c **i** $6p - 10 = 26$ **ii** $p = 6$

10 **a** **i** $n - 3 = 26$ **ii** $n + 5 = 18$

     iii $2n = 48$ **iv** $2a + 3 = 35$

  b **i** 29 **ii** 13

     iii 24 km **iv** 16 years old

Activity 2.3

Learner's own answers.

11 **a** $2m - 6$ and 44 to give $m = 25$.

  b $6m + 2$ and 20 to give $m = 3$.

All solutions are in this table.

	32	44	20
$4m + 4$	$m = 7$	$m = 10$	$m = 4$
$2m - 6$	$m = 19$	$m = 25$	$m = 13$
$6m + 2$	$m = 5$	$m = 7$	$m = 3$

Exercise 2.6

1 **a** x is less than 10.

  b x is greater than 10.

  c x is less than -4.

  d x is greater than -4.

2 **a** $y > 8$ **b** $n > -1$

  c $p < 0$ **d** $q < -2$

3 **a**

  b

  c

  d
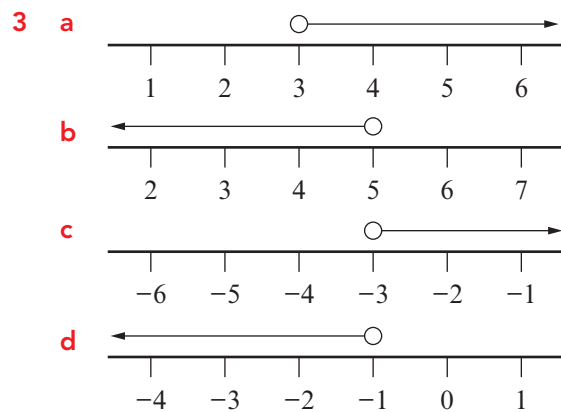
4 **a** $x > 2$ **b** $x < 9$

  c $x > -1$ **d** $x < -4$

5 **a** In part **i**, the smallest integer must be greater than 7, which is 8.

    In part **ii**, x could be any integer greater than 7, which is 8, 9, 10, 11, . . .

  b Learner's own answer.

6 **a** **i** 5 **ii** 5, 6, 7, . . .

  b **i** -6 **ii** $-6, -5, -4, \ldots$

  c **i** 3 **ii** 3, 4, 5, . . .

7 **a** **i** -7 **ii** $-7, -8, -9, \ldots$

  b **i** 11 **ii** 11, 10, 9, . . .

  c **i** 4 **ii** 4, 3, 2, . . .

8 **a** There is not a greatest integer because as long as y is greater than the values shown, it can be any integer.

  b There is not a smallest integer because as long as n is less than the values shown, it can be any integer.

9 **g** a and C and ii; b and E and i; c and A and iv; d and D and vi; e and F and iii; f and B and v

  h Advantage: easy to see the answer; disadvantage: takes a long time.

  i Learner's own answer.

Check your progress

1 a $4n$ **b** $n-6$

  c $n+12$ **d** $3n+5$

2 a 19   **b** 6   **c** 4

3 a i The cost each is the total electricity bill divided by four.

    ii $C = \dfrac{b}{4}$

  b $24

4 a $3n$ **b** $8c$

  c $8x^2$ **d** $xy+8yz$

5 a $3x+6$ **b** $18-6w$

  c $12x+8$ **d** $21-12v+18w$

6 a $n=5$ **b** $m=16$

  c $p=8$ **d** $h=9$

7 a $n+3=22$, $n=19$

  b $2n+4=28$, $n=12$

8 $x>6$

Unit 3 Getting started

1 a 20   **b** 400   **c** 7000

  d 130   **e** 3500   **f** 81 000

2 a C   **b** A   **c** B

  d C   **e** A   **f** C

3 a T

  b F (correct answer: 0.12)

  c T

  d F (correct answer: 3.46)

  e T

  f F (correct answer: 4.25)

4 150, 15, 15 000, 150, 0.15, 1.5, 150

5 a 7   **b** 4   **c** 18

  d 145   **e** 12   **f** 89

  g 254   **h** 124

6 a B   **b** A   **c** B

  d B   **e** A

Exercise 3.1

1 a i 1000   **ii** one thousand

  b i 100 000

    ii one hundred thousand

  c i 10 000 000   **ii** ten million

  d i 10   **ii** ten

2 a 10^2 **b** 10^8 **c** 10^4 **d** 10^{10}

3 a 30 000   **b** 5 000 000

  c 4 500 000   **d** 291 000

4 Yes

5 a 2300   **b** 7 680 000   **c** 9 000 000

6 a 420   **b** 65 000

  c 12 700   **d** 2 870 000

7 a–c Learner's own answers.

  d Marcus' method doesn't work because the number being multiplied has decimal places.

8 a 47 000

  b 91 500

  c 3 300 000

9 a 1500   **b** 10^2 **c** 6.12   **d** 6

10 a 8   **b** 805

11 Yes, as long as there are enough zeros to cross off.

12 a 8   **b** 510   **c** 84 600

13 Learner's own answers.

14 a 23   **b** 2.3   **c** 0.23

  d 0.023   **e** 6.5   **f** 0.65

  g 0.065   **h** 0.0065   **i** 0.9

  j 0.09   **k** 0.009   **l** 0.0009

15 a B   **b** A   **c** C

16 a 80   **b** 150

  c 7000   **d** 3400

  e 9 000 000   **f** 600 000

  g 124   **h** 32 250 000

17 a 8 km

b number of km = number of mm ÷ 10^6

c **i** 90 **ii** 15.6 **iii** 0.77

18 a Group 1: $78\,000 ÷ 10^3$, $780 ÷ 10$, $0.0078 × 10^4$; group 2: $7.8 × 10^3$, $78\,000\,000 ÷ 10^4$, $780 × 10$; group 3: $0.00078 × 10^6$, $7\,800\,000\,000 ÷ 10^7$, $78 × 10$. The left-over card is $780 ÷ 10^2$.

b For example: $0.078 × 10^2$, $0.78 × 10$, $78 ÷ 10$, $7800 ÷ 10^3$

Reflection: Learner's own answers.

Exercise 3.2

1 b 8.42 **c** 39.56 **d** 0.49

e 138.22 **f** 0.07

2 a Sofia

b Arun rounded to one decimal place, as he has only written one digit after the decimal place.

3 Any distance from 9.545 km to 9.554999999. . . km.

4 a 12.894 **b** 127.997

c 0.201 **d** 9.350

5 a Learner's own answers.

b Easy to follow method that shows workings. More difficult to make a mistake because the rounding is done in easy steps.

c Learner's own answers.

d Draw a line after the digit in the sixth decimal place, circle the digit in the seventh decimal place, then decide whether to increase the digit before the line by 1 (if the circled number is 5, 6, 7, 8 or 9) or leave it unchanged (if the circled number is 0, 1, 2, 3 or 4).

6 a B **b** C **c** A

7 a 126.9923 **b** 0.8

c 782.030 **d** 3.1415927

e 4.00 **f** 100.0

8 a A and c and iv; B and a and iii; C and e and i; D and b and vi; E and f and ii; F and d and v

b Advantage: you will get all the answers; disadvantage: this method takes a long time.

c You could start by matching the rounded numbers to the degree of accuracy. This is easy, just by counting the number of decimal places. You could then find which original number rounds to 6 d.p., then 5 d.p., then 4 d.p., etc.

9 a 1.29 **b** 4.5333 **c** 1.310

Activity 3.1

Learner's own answers.

10 a Sofia = \$15, Marcus = \$15.50, Arun = \$15.49

b Marcus, as his is the only amount that covers the bill.

Sofia's way is $3 × 15 = \$45$ (not enough); Marcus' way is $3 × 15.50 = \$46.50$ (enough); Arun's way is $3 × 15.49 = \$46.47$ (not enough).

c Learner's own answers. For example: You could round up to \$16 each, which would leave a small tip.

Check your progress

1 a 10 000 **b** ten thousand

2 a 10^3 **b** 10^6

3 a 40 000 **b** 12 000 000

c 890 000 **d** 4660

4 a 7 **b** 340

c 1.4 **d** 0.312

5 a 78.93 **b** 0.6674

c 154.829 **d** 6.505050

Unit 4 Getting started

1 b < **c** > **d** >

e > **f** <

2 15.0, 15.3, 15.6, 15.9

3 a F **b** T **c** T

d F **e** F **f** T

4 **a** 12.91 **b** 14.18

c 1.85 **d** 3.97

5 $5 \times 5.42 = 27.1$, $8 \times 3.3 = 26.4$, $4 \times 6.9 = 27.6$, $12 \times 2.4 = 28.8$, $6 \times 4.25 = 25.5$

6 **a** 2.1 **b** 0.7

c 3.11 **d** 2.75

Exercise 4.1

1 **a** 9.99 **b** 3.67 **c** 12.56

d 127.06 **e** 0.67 **f** 3.21

g 18.45 **h** 0.043 **i** 0.09

2 **a** 10.49, 10.64, 10.65, 10.73, 10.74, 10.75

b Shelly-Ann Fraser

3 No; looking at the tenths, 2 is less than 4.

4 **a** < **b** < **c** < **d** >

e > **f** < **g** > **h** >

5 **a** = **b** ≠ **c** ≠

d = **e** = **f** ≠

6 **a** 2.009, 2.15, 2.7

b 3.2, 3.342, 3.45

c 17.05, 17.1, 17.125, 17.42

d 0.52, 0.59, 0.71, 0.77

e 5.199, 5.2, 5.212, 5.219

f 9.03, 9.08, 9.7, 9.901, 9.99

g Advantage: easy method; disadvantage: could take a long time

Reflection: Learner's own answer.

7 **a** 300 mL, 38.1 cL, 0.385 L

b 7.3 cm, 0.705 m, 725 mm

c 519 000 mg, 530 g, 5.12 kg, 0.0058 t

d 0.45 m, 4450 mm, 0.0046 km, 461.5 cm

8 **a** Any three numbers between 3.071 and 3.082.

b 12

c All of the three decimal numbers are between 3.07 and 3.083 (but not including 3.070 and 3.083); i.e. 3.071, 3.072, 3.073, 3.074, 3.075, 3.076, 3.077, 3.078, 3.079, 3.080, 3.081, 3.082.

Exercise 4.2

1 **a** 7.7 **b** 17.2

c 3.4 **d** 8.0

2 Learner's own answer.

3 $1 - 0.36 = 0.64$, $1 - 0.78 = 0.22$, $1 - 0.44 = 0.56$, $1 - 0.284 = 0.716$, $1 - 0.432 = 0.568$

4 **a** 4.8 **b** 5.4 **c** 2.7 **d** 9.4

5 No, she must subtract the extra 0.2 to give 12.3.

6 **a** 12.2 **b** 18.5 **c** 26.1

d 3.5 **e** 10.5 **f** 14.4

7 **a** 34.21 **b** 4.66 **c** 29.13

8 **a** July **b** 86.53 kg

9 **a** 17.28 **b** 33.342

10 **a** Marcus' method: Advantage is that it works with numbers of all sizes; disadvantage is that it is still time-consuming even for simple numbers.

Arun's method: Advantage is that it is a quick method to use for numbers that have a small number of decimal places; disadvantage: can be confusing to use for numbers that have lots of decimal places.

b Learner's own answer.

c Learner's own answer.

11 **a** 3.58 **b** 7.17

c 25.45 **d** 23.218

12 **a** $7.35 **b** $2.65

13 **a** 8.6 m **b** 1.4 m

14 **a** −4.14 **b** −7.28

c −5.88 **d** −2.979

15 **a** −15 **b** −23.52

c 4.14 **d** 7.28

Exercise 4.3

1   **a**   0.8   **b**   2.5   **c**   1.8

2   **a**   0.12   **b**   1.2   **c**   0.012   **d**   12

3
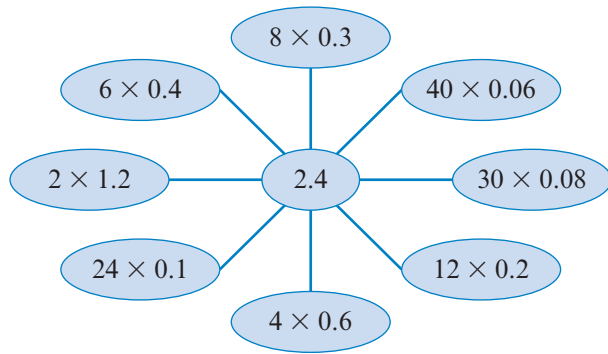
4   **a**   2761.3   **b**   276.13

5   **a** $52.1 \times 53 = 2761.3$, the answers are the same.

    b   521 is 100×5.21 and 0.53 is $53 \div 100$, so the $\times 100$ and $\div 100$ cancel each other out.

6   **a**   5508

    b   **i**   550.8   **ii**   55.08   **iii**   5.508

       iv   550.8   **v**   55.08   **vi**   5.508

Activity 4.1

Learner's own answers.

7   **a**   Advantages: simple step-by-step method, easy to see any mistakes; disadvantages: a slow method.

    b   Learner's own answer.

Reflection: Learner's own answer.

8   **a**   166.4; check: $3 \times 50 = 150$

    b   3110.4; check: $8 \times 400 = 3200$

    c   31.98; check: $0.8 \times 40 = 32$

9   **a**   An approximate answer of $50 \times 20 = 1000$. 85.23 is too far from 1000 for it to be correct.

    b   852.3

10   8.28 g

11   He will get \$354.75, which is just over \$350, so yes he is correct.

12 $\$91 + \$97.75 + \$88 + \$108 = \$384.75$

Exercise 4.4

1   **a**   2.138   **b**   1.877   **c**   0.816

    d   1.308   **e**   1.092   **f**   0.094

2   **a**   4.327   **b**   1.487

    c   6.585   **d**   7.364

3   \$1.16

4   \$3.65

5   \$24.25

6   **a**   2.321   **b**   3.125   **c**   31.313

7   **a**   Lara forgot to write the '0' above the 4.

    b   7.025

8   **a**   Kyle forgot to add a '0' to the end of 251.55 to put the remainder next to.

    b   9.675

9   **a**   Rounding or approximating; for example: $60 \div 10$, $56 \div 9$, $54 \div 9$

    b   For example: Work out 9×6.258 and it should equal 56.322.

10   **a**   14, 28, 42, 56, 70, 84, 98, 112, 126

     b   9.028

     c $126 \div 14 = 9$; $9.028 \times 14 = 126.392$

11   **a**   **i**   235   **ii**   23.5

        iii   2.35   **iv**   0.235

     b   Learner's own answer.

     c   **i**   4.7   **ii**   0.47   **iii**   0.047

     d   Learner's own answer.

12   **a**   1.5   **b**   1.35   **c**   0.662

13   **a**
```
   3. 9 8 2
2 )7 . ¹9 6 4
```

     b
```
   1. 5 0 7
6 )9 . 0 4 2
```

     c
```
   1. 6 9 9
5 )8 . ³4 9 5
```

Reflection: Learner's own answer.

Exercise 4.5

1 **a** $= 7 \times 18$
$= 7 \times 10 + 7 \times 8$
$= 70 + 56$
$= 126$

b $= 4 \times 76$
$= 4 \times 70 + 4 \times 6$
$= 280 + 24$
$= 304$

2 **a** 246 **b** 288 **c** 64 **d** 424

3 For example, when you multiply two numbers together:

- If you multiply one of the numbers by 10 and divide the other number by 10, it keeps the value of the calculation the same.

- If you multiply one of the numbers by 100 and divide the other number by 100, it keeps the value of the calculation the same.

4 **a** 2070, 1035, 345

b $2070 + 1035 + 345 = 3450$

5 **a** $46 - 4.6 = 41.4$

b $73 - 7.3 = 65.7$

6 **a** 61.2 **b** 42.3 **c** 113.4

7 Learner's own answers.

8 **a** 25.2 **b** 39 **c** 50.4

9 34.4 cm

10 **a** $= \frac{1.455}{3}$
$= 0.485$

b $= \frac{67.35 \div 10}{50 \div 10}$
$= \frac{6.735}{5}$
$= 1.347$

c $= \frac{0.4585}{7}$
$= 0.0655$

d $= \frac{893.6 \div 100}{200 \div 100}$
$= \frac{8.936}{2}$
$= 4.468$

11 When you divide both the numerator and the denominator by 10, it is equivalent to dividing the fraction by 1 and so it keeps the answer the same, but makes the calculation easier to do.

$\frac{45.6 \div 10}{30 \div 10} = \frac{4.56}{3}$

12 **a** **i** $28.21 **ii** $28

b $28.21 is better, as it gets closer to the actual bill (but $20 \times \$28.21 = \$564.20$, so will be 5 cents below the actual bill).

Check your progress

1 6.09, 6.45, 6.481, 6.5, 6.549

2 **a** 18.3 **b** 2.5

3 **a** 5.229 **b** 35.65

4 **a** 0.326 **b** 4.22

5 **a** 0.08 **b** 0.021

6 **a** 1339.8 **b** 133.98

7 254.93

8 7.356

9 **a** 13, 26, 39, 52, 65, 78, 91, 104, 117

b 18.365

c $18.365 \times 13 = 238.745$

10 **a** 63 **b** 77.4 **c** 1.16

Unit 5 Getting started

1 **a** 130° **b** 40°
c 90° **d** 250°

2 **a** obtuse **b** acute
c right **d** reflex

3 $180° - (54° + 20°) = 180° - 74° = 106°$

4 **a** 58°

b The three angles add up to 180°.

Exercise 5.1

1 **a** 64° **b** 125° **c** 96° **d** 56°

2 **a** 110° **b** 168° **c** 204° **d** 228°

3 **a** 120° **b** 72°

4 **a** 74° **b** 62° **c** 117°

5 110°

6 **a** 92° **b** 223° **c** 53°

7 The angles must all be 90°. It must be a square or a rectangle.

8 **a** $125° + 160° + 90° = 375°$. This is impossible. The sum of the three angles should be less than $360°$.

b Learner's own answer.

9 $66\frac{2}{3}°$

10 Opposite angles are equal, so $y = 68°$, $x = z = 112°$.

11 By symmetry, $D = 50°$, so $C = 360° - (50° + 50° + 60°) = 200°$.

12 **a** The only possibility is $30°$, $60°$, $120°$, $150°$.

b Six possible sets of angles: $30°$, $30°$, $90°$, $210°$; $30°$, $90°$, $90°$, $150°$; $30°$, $90°$, $120°$, $120°$; $60°$, $60°$, $90°$, $150°$; $60°$, $90°$, $90°$, $120°$; $90°$, $90°$, $90°$, $90°$

13 $a = 110°$, $b = 110°$, $c = 120°$, $d = 100°$, $e = 140°$

Reflection: Learner's own answer.

14 **a** **i** $60°$, $120°$, $60°$, $120°$

ii $60 + 120 + 60 + 120 = 360$

b Possible shapes:
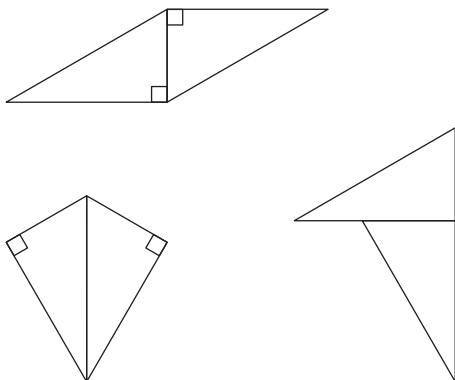
c $30° + 150° + 30° + 150° = 360°$; $90° + 120° + 90° + 60° = 360°$; $30° + 60° + 30° + 240° = 360°$

Reflection: Learner's own answer.

Exercise 5.2

1 **a** $x = 53°$, $y = 127°$

b $w = 114°$, $z = 66°$

2 $87°$, $93°$, $93°$

3 $a = 180° - (61° + 46°) = 73°$, angles on a straight line; $b = 61°$, opposite angle; $c = 46°$, opposite angle; $d = 73°$, opposite a

4
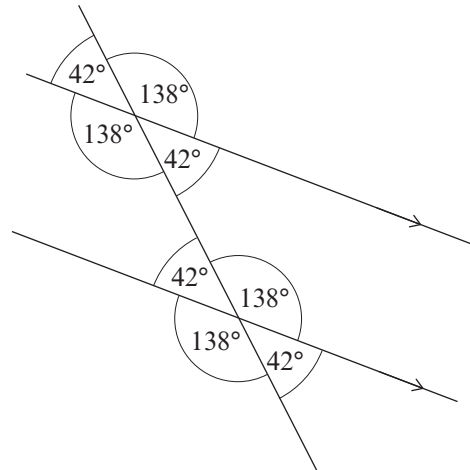
5 $a = 113°$, $b = 67°$, $c = 67°$

6 $a = 77°$, $b = 77°$, $c = 103°$

7 $s = 75°$, $t = 105°$

8 **a** For example: If the lines are parallel, the angles add up to $180°$. But $56° + 126° = 182°$, so the lines are not parallel. Other explanations are possible.

b Learner's own answer.

9 **a, b**
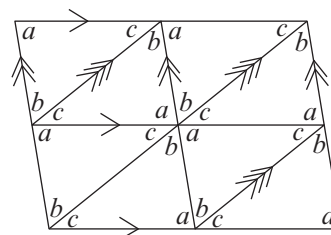
There are three sets of three parallel lines.

10 **a** $75°$

b $30°$

c $1°$

d Yes; the two marked angles in the triangle must add up to less than $180°$. If one angle is $60°$, X must be less than $120°$. This angle could be a fraction more than $119°$, such as $119.5°$, but it cannot be $120°$ or more.

11 $C = 113°$, $D = 135°$

12 **a** The angles add up to $90° + 90° + 60° + 60° + 60° = 360°$.

b
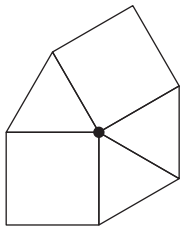
c
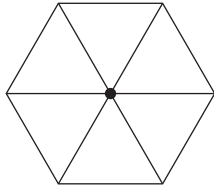
d
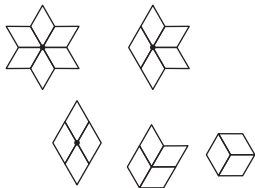
Reflection: Learner's own answer.

Exercise 5.3

1 a–c
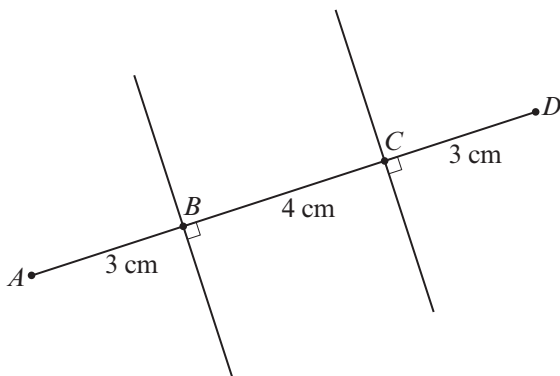
d Learner's own answer.

2 a, b
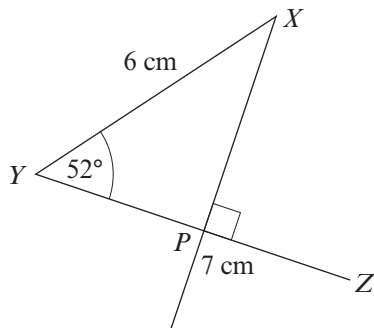
c i 4.7 cm **ii** 3.7 cm

d Learner's own answer.

3 a, b
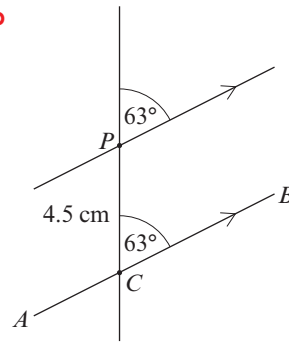
4 a
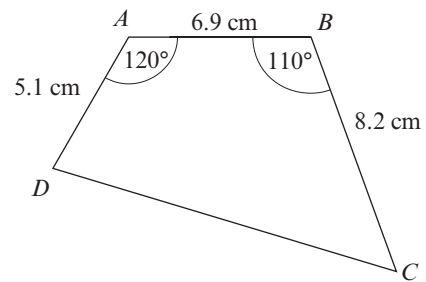
b 13.3 cm

c Learner's own answer.

5 a
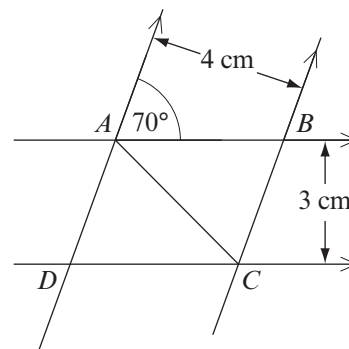
b 5.4 cm

c Learner's own answer.

6 a 95°

b, c Many answers possible.

Reflection: Learner's own answer.

7 Because $120° + 120° + 120° = 360°$, the diagram will look similar to this:
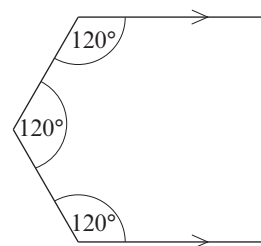
The two lines are parallel.

8 a
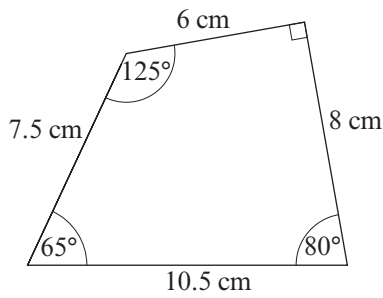
b five

c It can be done with three angles and two sides or two angles and three sides. These measurements need to be chosen carefully.

9
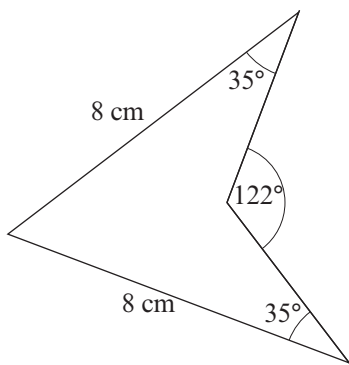
Check your progress

1 100° and 160° or 130° and 130°

2 a 46°

b

c 8.2 or 8.3 cm

3 $a = 108°$, $b = 72°$, $c = 55°$, $d = 125°$

4 a
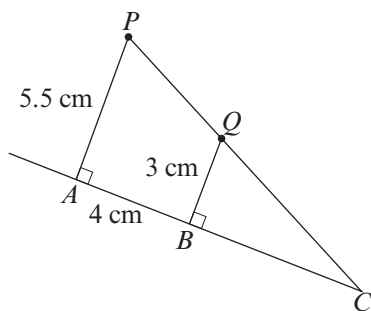
b 32°

Unit 6 Getting started

1 a A set of questions used in a survey.

b To investigate a statistical question or to test a prediction.

2 a For example: What type of vehicles use the road? How busy is the road? How many people are in each vehicle? How fast are the vehicles travelling? How old are the vehicles?

b For example: There are more cars than trucks. There are more than ten cars each minute. Most cars have only one person. All the vehicles are travelling under the speed limit. Most of the cars are less than 4 years old.

3 a You need to choose some 12-year-old girls and some 12-year-old boys and measure their masses and heights. You could have two tables, one for boys and one for girls.

b You could put the masses of the boys and the masses of the girls in a comparative bar chart. You could do the same thing for the heights. You could also find the mean mass or modal mass for the boys and compare it with the same average for the girls. You could do the same thing with the heights.

4 a 18   **b** 15   **c** $290 \div 20 = 14.5$

Exercise 6.1

1 a continuous   **b** categorical

c discrete

2 a discrete   **b** discrete

c continuous   **d** continuous

e categorical

3 For example:

a colour, type of brakes, fuel used

b number of doors, number of cylinders, number of seats

c length, width, engine size, fuel consumption

4 a It does not say whether 1 means very clean or very dirty.

b 53   **c** 5

5 a For example: too vague, no time period, does not include less than 1 hour

b For example: *How many hours of homework did you do on Monday? Tick one box.*

Less than 1 hour ☐

At least 1 hour but less than 2 hours ☐

At least 2 hours but less than 3 hours ☐

3 hours or more ☐

6 a–c Learner's own answers.

7 a i The gender and the estimate for each person. These need to be recorded together.

ii The teacher could have two separate tally charts: one for boys and one for girls.

iii The teacher could draw a joint bar chart for the boys and girls. She could calculate an average for the boys and another for the girls.

b Learner's own answer.

8 a For example: ask friends, use a questionnaire, send emails to contacts, use social media.

b For example: bar chart, waffle diagram, pie chart.

9 a It is difficult to see the frequency for each number.

b You could use a tally chart. Here are the frequencies:

Total	2	3	4	5	6	7	8	9	10	11	12
Frequency	3	5	11	12	8	17	12	14	15	3	0

c
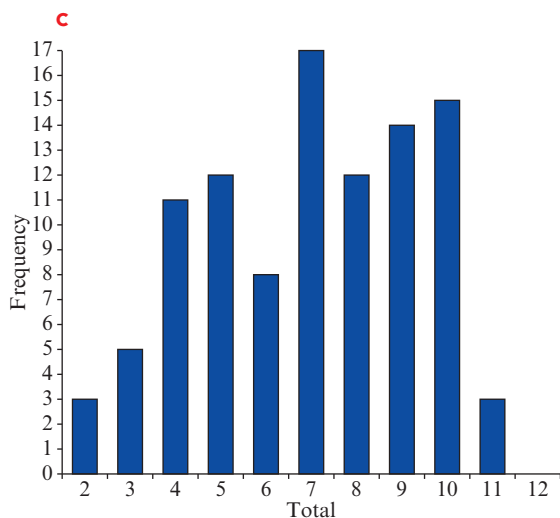
d Sofia's prediction is correct. 7 is the mode.

e Zara's prediction is not correct. There are big differences.

10 a–d Learner's own answers.

Exercise 6.2

1 a Wei can ask people or she can give them a questionnaire.

b A sample takes less time. It might be difficult to see everyone in the population.

c How much time each person took to do their homework. Wei should ask about a particular evening or perhaps several particular evenings.

d For example:

Hours spent doing homework each evening
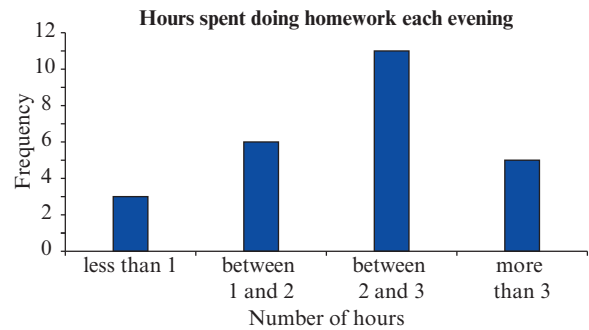
e 16 out of 25 learners took at least 2 hours, which is 64%. This supports Wei's prediction.

2 a The whole population is too large.

b Sofia needs to know the month of birth. She could get the data from school records.

c Sofia wants to know the total for each season. It would be better to use a tally chart, as shown here. Each season is three months.

Season	Tally	Frequency
Spring		
Summer		
Autumn		
Winter		

d 820

e The numbers are similar for each season. It does not support Sofia's prediction.

3 a For example: 'The service was helpful' or 'The service was not helpful'.

b Numbers are easier to analyse than words. You can find the frequency for each score. You can find an average score.

c Not everyone will fill in the questionnaire. Only those people who used the helpline during a particular time period can be asked.

d Depends on learner's prediction. The majority of users of the helpline are not satisfied. The mode is 2 out of 5. 22 out of 33 users or 67% gave a score of only 1 or 2. Only five users out of 33 or 15% gave a score of 4 or 5.

4 a All the words in book A and all the words in book B.

b For example: Dakarai could open the book to a page at random. He could ask a friend to give him a page number in the correct range. He could use a calculator or a spreadsheet to generate a random page number.

c Dakarai could use a tally chart. If he has a partner's help he can call out the length and the partner can fill in the tally.

d For example: bar chart or pie chart.

e The mean is the best average to use because it uses all the word lengths. The median could also be used because it is easier to calculate.

f If book A has a larger average than book B, then Dakarai's prediction is probably correct.

g A typical page in a book could have about 300 words. That is probably enough. If there are a lot fewer words for some reason, then Dakarai should use more than one page.

5 a There is not enough data to say whether the prediction is correct or not. A sample size of 20 is too small.

b If the dice is fair the frequencies should be similar. The average of 100 throws would be 16 or 17. There is variation in these frequencies but not enough to give support to Emily's prediction.

c Learner's own answer.

d 100 is quite a small sample in this case. A larger sample would be better.

6 a A large sample will be more representative of all the patients. A small sample might not represent all opinions.

b A large sample will take longer and will cost more.

c Learner's own answer.

d For example: find an average or draw a chart.

e Learner's own answer.

7 a Learner's own answer.

b For example: by email or in person when they come to the theatre or using social media.

c Learner's own answer.

d Learner's own answer. For example: discuss the type of chart they will draw or an average they will calculate.

Reflection:
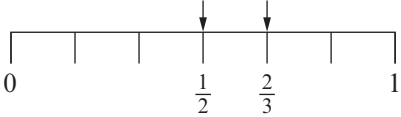
a A large sample size will be more representative.

b Plan how you will analyse and present the data before you start. Decide how much time it will take and how much it will cost. Make some predictions to test.

Check your progress

1 a continuous   **b** discrete

c categorical   **d** continuous

2 For example:

a number of brothers; shoe size; age, in years

b height, mass, time spent doing homework

c hair colour, eye colour, favourite sport

3 a For example: The meal was good value. The customers enjoyed the meal. The service was good. The customers liked the atmosphere in the restaurant. The customers will recommend the restaurant to their friends.

b The numbers can be analysed in a way that words cannot.

c You can draw a chart, such as a bar chart. You can calculate an average, for example, the mean number of stars.

4 **a** The 10 people might not be representative of all the members.

   b This would take a long time. You might not be able to see members who do not come to the gym often.

   c For example: You could choose members at random from the membership list. You could ask a few members at different times of day. You could choose every 10th or 20th member until you have 50.

   d For example: You could give members a paper questionnaire when they visit the gym. You could send a questionnaire electronically, using an email or social media.

Unit 7 Getting started

1 **a**

   b $\frac{2}{3}$

2 **b** <   **c** >   **d** <

   e <   **f** <

3 **a** $1\frac{2}{3}$ **b** $1\frac{2}{5}$ **c** $1\frac{2}{9}$ **d** $3\frac{3}{4}$

4 **a** $1\frac{1}{10}$ **b** $1\frac{7}{12}$

5 **a** 6   **b** 10   **c** 18

Exercise 7.1

1 **a** ≠   **b** =   **c** ≠

   d ≠   **e** =   **f** ≠

2 **b** <   **c** <   **d** >

   f <   **g** >   **h** >

3 **a** Marcus. Advantage: have to compare only simple fractions; disadvantage: have to first convert both fractions to mixed numbers.

   Arun. Advantage: have to convert the fractions to give only a common denominator; disadvantage: might end up with large numbers to calculate.

   b Learner's own answers.

Reflection: Learner's own answers.

4 **a** $\frac{47}{6}$ **b** $\frac{42}{5}$ **c** $\frac{33}{10}$

5 Learner's own answer. Order of cards:
$\frac{1}{4}, \frac{7}{12}, \frac{13}{10}, \frac{7}{5}$

6 As many decimal places as are needed to put the decimals in order of size.

7 **a** **i** $0.8\dot{3}$

   ii $0.\dot{7}\dot{2}, 1.\dot{7}\dot{2}.$

   iii $0.\dot{8}, 1.\dot{8}$

   b $\frac{19}{11}, \frac{11}{6}, \frac{17}{9}$

8 **a** $\frac{7}{3} = 2.33\ldots, \frac{16}{7} = 2.28\ldots, \frac{58}{25} = 2.32, \frac{9}{4} = 2.25$

   b $\frac{9}{4}, \frac{16}{7}, \frac{58}{25}, \frac{7}{3}$

9 $\frac{37}{10}, 3\frac{5}{7}, \frac{15}{4}, 3\frac{4}{5}$

10 First mark: any two of $\frac{5}{3}, \frac{13}{8}, \frac{17}{10}, \frac{27}{16}, \frac{33}{20}, \frac{67}{40}, \frac{69}{40},$
$\frac{129}{80}, \frac{131}{80}, \frac{133}{80}, \frac{137}{80}, \ldots$

   Second mark: any two of $\frac{9}{5}, \frac{11}{6}, \frac{15}{8}, \frac{16}{9}, \frac{43}{24}, \frac{65}{36},$
$\frac{67}{36}, \frac{127}{72}, \frac{131}{72}, \frac{133}{72}, \ldots$

Exercise 7.2

1 **a** $3\frac{8}{9}$ **b** $10\frac{1}{2}$ **c** $8\frac{2}{7}$

2 $16\frac{2}{3}$ m

3 **a** $3\frac{3}{4}$ **b** $7\frac{1}{2}$ **c** $5\frac{1}{6}$

4 **a** $4\frac{3}{8}$ m   **b** Yes, $4\frac{3}{8} < 4\frac{1}{2}$

5 $18\frac{5}{12}$ km

6 **a** $\frac{29}{24} = 1\frac{5}{24}$, not $1\frac{4}{24}$ **b** $13\frac{5}{24}$

7
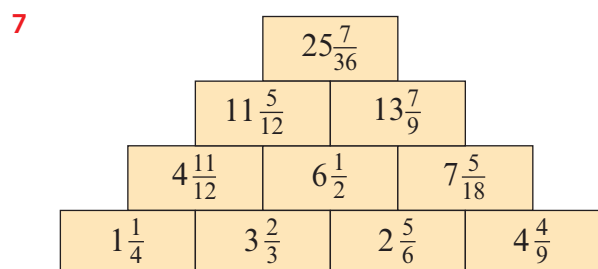
8 a $5\frac{1}{2}x$ **b** $9\frac{1}{10}y + 2\frac{2}{3}x$

  c $8\frac{13}{24}a + 9\frac{1}{14}b$ **d** $1\frac{13}{15}p + 10\frac{7}{40}q$

9 a $5\frac{2}{3}$ is between 5 and 6, $7\frac{7}{8}$ is between 7 and 8. So $5\frac{2}{3} + 7\frac{7}{8}$ is between $5 + 7$ (12) and $6 + 8$ (14). Zara is correct.

  b–d Learner's own answers.

10 $13\frac{11}{36}$ m

Exercise 7.3

1 a $\frac{1}{8}$ **b** $\frac{3}{16}$ **c** $\frac{2}{15}$

  d $\frac{8}{25}$ **e** $\frac{9}{28}$ **f** $\frac{14}{27}$

2 a $\frac{3}{10}$ **b** $\frac{1}{2}$ **c** $\frac{3}{10}$

  d $\frac{2}{9}$ **e** $\frac{1}{4}$ **f** $\frac{2}{11}$

3 $\frac{1}{3}$ cup cashew nuts, $\frac{1}{6}$ cup of water, $\frac{1}{8}$ cup of vinegar, 1 tablespoon of honey, $\frac{1}{4}$ teaspoon of salt

4 $\frac{2}{45}$ m^2

5 $\frac{9}{16}$ m^2

6 For example: $\frac{3\times 3}{4\times 4}$ or $\frac{3^2}{4^2}$ or 0.75×0.75, etc.

7 a $\frac{4}{9}$ **b** $\frac{4}{7}$ **c** $\frac{5}{21}$ **d** $\frac{20}{63}$

8 a $\frac{9}{20}$ **b** $\frac{3}{20}$

9 $\frac{1}{6}$

10 Yes; a proper fraction is always less than 1. Multiplying two numbers that are both smaller than 1 will always give a number smaller than 1.

11 a <u>Estimate</u> $\frac{2}{3}$ is greater than $\frac{1}{2}$, but is less than 1.

       $\frac{1}{2}$ of $\frac{1}{8}$ is $\frac{1}{16}$ and $1\times\frac{1}{8} = \frac{1}{8}$.

So, the answer to $\frac{2}{3}\times\frac{1}{8}$ must be greater than $\frac{1}{16}$ but is smaller than $\frac{1}{8}$.

  <u>Accurate</u> $\frac{2}{3}\times\frac{1}{8} = \frac{2\times 1}{3\times 8} = \frac{2}{24} = \frac{1}{12}$

       $\frac{1}{12}$ is greater than $\frac{1}{16}$ but is smaller than $\frac{1}{8}$. ✓

b <u>Estimate</u> $\frac{2}{9}$ is greater than zero, but is less than $\frac{1}{2}$.

       $0\times\frac{1}{4} = 0$ and $\frac{1}{2}$ of $\frac{1}{4}$ is $\frac{1}{8}$.

So, the answer to $\frac{2}{9}\times\frac{1}{4}$ must be greater than zero but is smaller than $\frac{1}{8}$.

  <u>Accurate</u> $\frac{2}{9}\times\frac{1}{4} = \frac{2\times 1}{9\times 4} = \frac{2}{36} = \frac{1}{18}$

       $\frac{1}{18}$ is greater than zero but is smaller than $\frac{1}{8}$. ✓

c <u>Estimate</u> $\frac{5}{8}$ is greater than $\frac{1}{2}$, but is less than 1.

       $\frac{1}{2}$ of $\frac{4}{9}$ is $\frac{2}{9}$ and $1\times\frac{4}{9} = \frac{4}{9}$.

So, the answer to $\frac{5}{8}\times\frac{4}{9}$ must be greater than $\frac{2}{9}$ but is smaller than $\frac{4}{9}$.

  <u>Accurate</u> $\frac{5}{8}\times\frac{4}{9} = \frac{5\times 4}{8\times 9} = \frac{20}{72} = \frac{5}{18}$

       $\frac{5}{18}$ is greater than $\frac{2}{9} = \frac{4}{18}$ but is smaller than $\frac{4}{9} = \frac{8}{18}$. ✓

12 Mental maths is fun

13 $\frac{73}{80}$ m^2

Reflection: Learner's own answers.

Exercise 7.4

1 a $\frac{4}{15}$ b $\frac{7}{9}$

2 a $\frac{3}{8}$ b $\frac{5}{6}$ c $\frac{21}{32}$

   d $7\frac{1}{5}$ e $3\frac{3}{10}$ f $2\frac{7}{10}$

3 a $1\frac{1}{2}$ b $2\frac{2}{3}$ c $1\frac{1}{4}$

   d $1\frac{1}{3}$ e 2   f $1\frac{1}{6}$

4 a Isaac did not turn the second fraction upside down.
      Isaac turned the first fraction upside down rather than the second.

   b $1\frac{1}{9}$

5 $\frac{4}{9}$ m

6 $\frac{5}{6}$

7 a–c Learner's own answers.

Activity 7.1

   Learner's own answers.

8 No; any number divided by a larger number gives an answer smaller than 1. Any number divided by a smaller number gives an answer greater than 1.

9 $\frac{1}{2} \times \frac{1}{3} \div \frac{1}{4} \times \frac{1}{5} \div \frac{1}{6} \times \frac{1}{7} \div \frac{1}{8} \times \frac{1}{9} \div \frac{1}{10} = 1\frac{1}{63}$

Exercise 7.5

1 a 14   b 130   c 15   d 50

2 Learner's own answer.

3 a 27   b 25   c 35   d 12

4 a 68   b 64

5 a 54   b 64   c 126   d 128

6 a 55   b 285

   c 315   d 3850

7 a $\frac{5}{9}$ b $\frac{6}{17}$

8 a $\frac{5}{16}$ b $\frac{13}{35}$ c $\frac{14}{25}$ d $\frac{8}{19}$

9 No; $8 \times 3 = 24$, not 8×4. The answer is $\frac{5}{33}$.

10 a Arun works out $\frac{1}{6}$ and multiplies that answer by the numerator (5) to give $\frac{5}{6}$ of 180.

    b Sofia works out $\frac{1}{6}$ and takes it away from the whole to leave $\frac{5}{6}$ of 180.

    c i 240   ii 840

    d Learner's own answer.

    e Arun. Advantage: by dividing first, you use small numbers; disadvantage: doing this mentally could be difficult, especially the multiplication.

       Sofia. Advantage: subtraction might be easier than multiplication; disadvantage: not so easy for more complicated fractions, such as when the numerator is 2 or is smaller than the denominator.

    f Learner's own answer.

    g i 1710   ii 768   iii 2080

11 a Zara

    b Sofia did not use order of operations rules and did the addition before the multiplication.

12 a $1\frac{1}{8}$ b $\frac{11}{15}$ c $\frac{11}{32}$

Check your progress

1 a ≠   b =   c ≠

2 a >   b <   c >

3 a $7\frac{3}{4}$ b $8\frac{7}{20}$

4 a $\frac{7}{15}$ b $1\frac{1}{9}$

5 a 125   b 168   c 5800

Unit 8 Getting started

1

radius circumference diameter centre
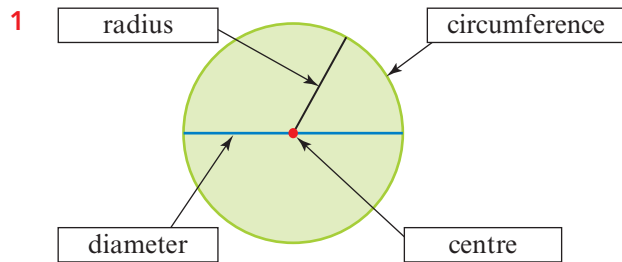
2 a same **b** same

3 a 2 **b** 2 **c** 90
   d 2 **e** 2

4 a cube **b** cuboid
   c cylinder **d** sphere
   e cone **f** tetrahedron
   g square-based pyramid
   h triangular prism

Exercise 8.1

1 a

b

c

d

e

f

g

h

i

j

k

l
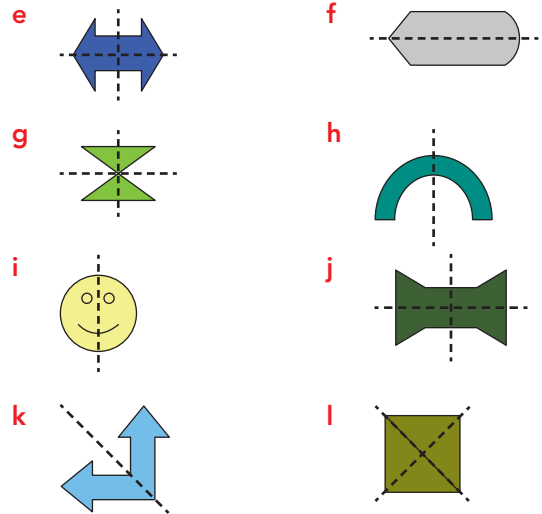
2 a 2 **b** 2 **c** 1
   d 4 **e** 2 **f** 1
   g 2 **h** 1 **i** 1
   j 2 **k** 1 **l** 2

3 a 6 **b** 0 **c** 8
   d 0 **e** 8 **f** 5
   g 4 **h** 0

4 a 6 **b** 1 **c** 8
   d 1 **e** 8 **f** 5
   g 4 **h** 2
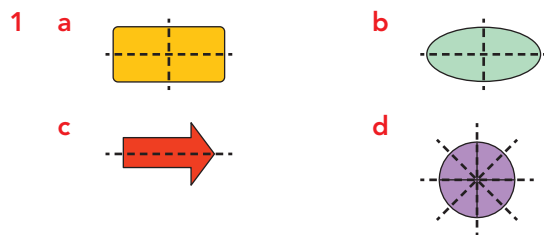
5

Shape	square	rectangle	rhombus	parallelogram	kite	trapezium	isosceles trapezium
Number of lines of symmetry	4	2	2	0	1	0	1
Order of rotational symmetry	4	2	2	2	1	1	1

6 a i 3 **ii** 3

 b i 1 **ii** 1

 c i 0 **ii** 1

 d i 1 **ii** 1

7 a A circle has an infinite number of lines of symmetry.

 b A circle has an infinite order of rotational symmetry.

8 a i

 ii

 iii
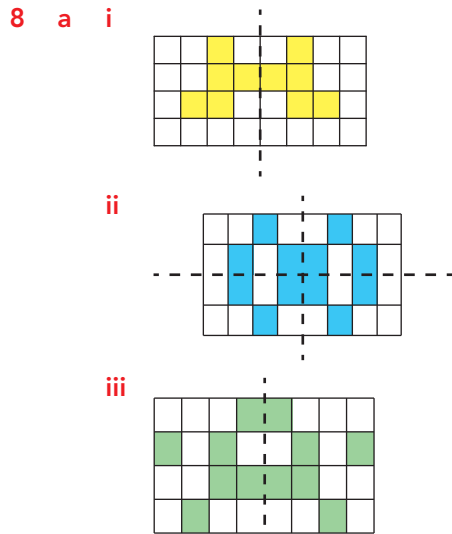
 b i 1 **ii** 2 **iii** 1

9 a Ritesh

 b Ali didn't reflect all of the shape. Some of the shape has just been redrawn.

10 a i, ii

 iii horizontal

 b i, ii

 iii diagonal

 c i, ii

or

 iii vertical or horizontal

d i, ii

 iii diagonal

11
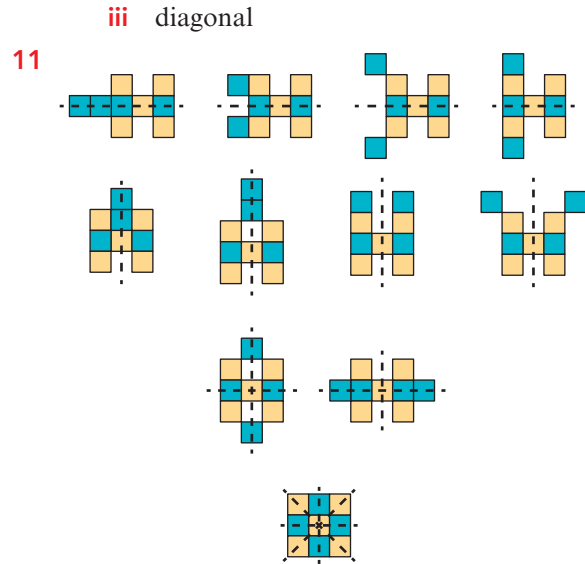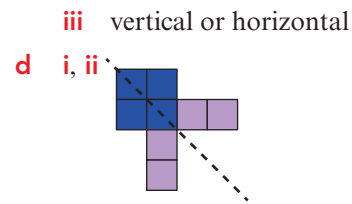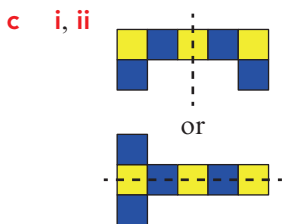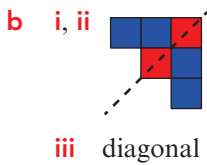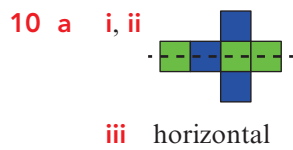
12 a, b Learner's own answers.

13 a
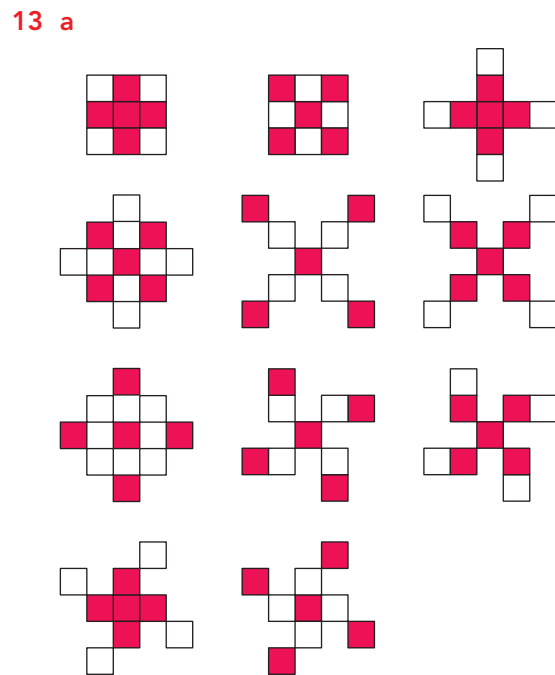
 b 4

Activity 8.1

a

Road sign	a	b	c	d	e	f	g	h	i	j	k	l
Number of lines of symmetry	4	2	0	4	0	1	1	2	0	1	INF	2
Order of rotational symmetry	4	2	1	4	3	1	1	2	1	1	INF	2

b   Learner's own answer.

Exercise 8.2

1   a   A, B, G

b   C, D, E, F

2
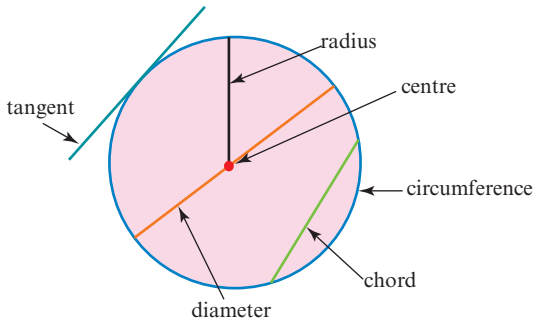
3   a–d Learner's own answers.

e   The angle between a tangent and a radius is always 90°.

4   a–c Learner's own diagrams.

5   a–c Learner's own answers.

d   The longest chord is always the diameter.

6   a
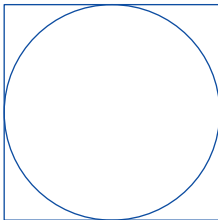
b   Two pairs of parallel sides; four sides of equal length; all angles are 90°; four lines of symmetry; rotational symmetry of order 4.

7   a
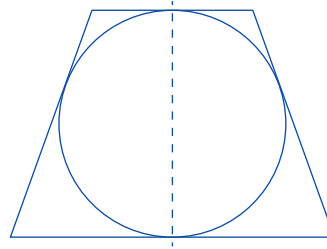
b   Different length sides; one pair of parallel sides; different-sized angles; order 1 rotational symmetry.

8   a
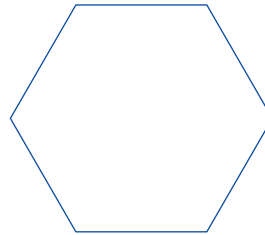
b   Six sides the same length; six angles the same size; six lines of symmetry; order 6 rotational symmetry

9   10, 10, 10, 10

10   Learner's own answers.

11   a
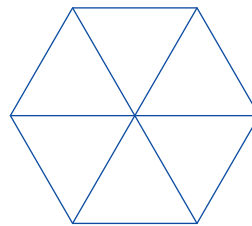
There are six identical triangles.

b

Name of regular polygon	Number of identical triangles inside
pentagon	5
hexagon	6
heptagon (7 sides)	7
octagon	8
nonagon (9 sides)	9
decagon	10

c   Learner's own answer.

Reflection: A tangent is on the outside of the circle (touching the circumference just once). A chord is on the inside of the circle (touching the circumference at the start and end of the line).

It's inside the circle, and it touches the circumference at the start and end of the line.

It's not on the outside of the circle and touches the circumference twice.

Exercise 8.3

1 D, G

2 D, G

3 **a** 8 cm   **b** 3 cm

4 **a** **i** 5 cm   **ii** 12 cm   **iii** 13 cm

   b 55°

   c **i** 55°   **ii** 35°

   d **ii** *EF*   **iii** *DF*   **iv** *DEF*

      v *EDF*   **vi** *DFE*

5 **a** **i** 3.1 cm   **ii** 6.5 cm   **iii** 7.8 cm

   b **i** 23°   **ii** 62°   **iii** 95°

6 180° − 57° − 42° = 81°, not 84°, which is what it would be if they were congruent.

7 Sofia is incorrect. Even though all the angles are the same size, the side lengths of the equilateral triangles can be different and so the triangles are not congruent.

8 Sofia is correct. If all the sides are the same length, then the triangle has to be congruent because the angles will all be the same.

9 **a** Yes, Arun is correct. Congruent shapes are identical in shape and size, so they must have the same perimeter.

   b The areas of congruent shapes are the same.

10 There are different ways to group the shapes. For example:

Group 1, circles: A, I, L

Group 2, squares: B, N, P

Group 3, congruent hexagons: E, J

Group 4, congruent isosceles triangles: C, G, K

Group 5, congruent trapezia: H, Q

Group 6, right-angled triangles: D, F, M

Exercise 8.4

1 b, A and iii

   c, D and i

   d, B and iv

2 six congruent square faces; 12 edges; eight vertices

Activity 8.2

   a–c Learner's own answers.

4 **a** J   **b** G   **c** K

   d I   **e** L   **f** H

5 **a**

Original shape	Number of sides	Shape of prism	Number of faces	Number of vertices	Number of edges
triangle	3	triangular	5	6	9
rectangle	4	rectangular	6	8	12
pentagon	5	pentagonal	7	10	15
hexagon	6	hexagonal	8	12	18
heptagon	7	heptagonal	9	14	21
octagon	8	octagonal	10	16	24

b Yes; a face for each edge of the front face of the prism (e.g. 3 for a triangle) + 2 (the two congruent front faces, e.g. two triangles).

c **i** Double the number of sides to give the number of vertices.

ii $2S = V$ or $V = 2S$.

d **i** Triple the number of sides to give the number of edges.

ii $3S = E$ or $E = 3S$.

e The number of edges of a prism is always a multiple of 3.

6 Learner's own answers.

7 **a** cuboid

b pentagonal prism

c cone

d square-based pyramid

8 top view   front view   side view
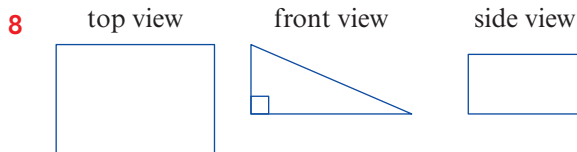
9 cube, sphere

10 A: pentagonal prism because it has only two faces showing.

B: octagonal prism. C: hexagonal prism; the centre face for both the octagonal and hexagonal prisms are the same, but the faces either side of the centre face are at different angles, where the octagonal prism has the steeper faces, so appear narrower from above.

11 **a** **i** side view   **ii** top view

iii front view

b **i**

front view   side view   top view

ii

front view   side view   top view

iii

front view   side view

top view

iv
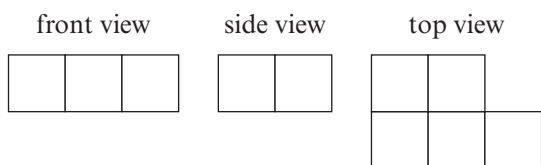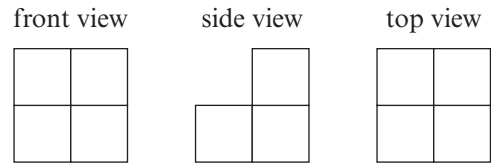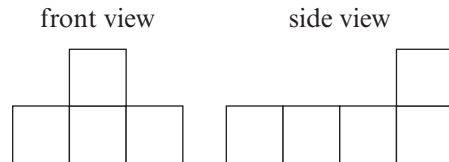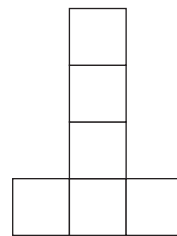
front view   side view
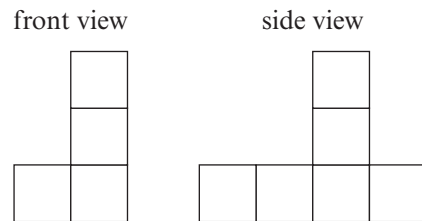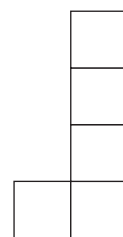
top view

Reflection: Learner's own answers.

Check your progress

1 **a** **i** 1   **ii** 2

iii 0   **iv** 6

b **i** 1   **ii** 2

iii 1   **iv** 6

2
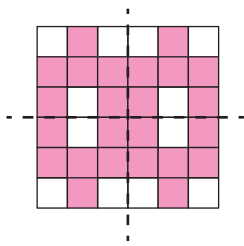
3 7, 7, 7, 7

4 a 7.2 cm

b 33°

c 120°

5 a five faces (one square and four isosceles triangles); eight edges; five vertices

b

top view	front view	side view
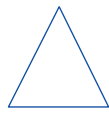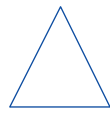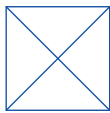
Unit 9 Getting started

1 a 14 **b** 12 **c** 4 **d** −3

e 35 **f** 4 **g** −18 **h** −5

2 a 7 **b** 5 **c** 9

d 6 **e** 3 **f** 14

g 4 **h** 8 **i** 10, −5

3 a 17 **b** 27 **c** 8 **d** 5

e 13 **f** 7 **g** 4 **h** −7

4 a 10 **b** 18 **c** 11 **d** −2

Exercise 9.1

1 a Add 4; 23, 27

b Subtract 5; 20, 15

2 a i Add 2. **ii** 10, 12

b i Add 3. **ii** 13, 16

c i Add 4. **ii** 21, 25

d i Add 5. **ii** 23, 28

e i Subtract 2. **ii** 22, 20

f i Subtract 3. **ii** 5, 2

3 a 1, 6, 11 **b** 45, 38, 31

c 6, 12, 24 **d** 60, 30, 15

4 a 8, 14 **b** 23, 29, 41

c 20, 17, 11 **d** 74, 58, 42

e 16, 24, 48, 56 **f** 38, 33, 18, 13

5 a infinite **b** finite

c finite **d** infinite

6 a 4, 9, 19 **b** 10, 12, 24

c 24, 16, 12

7 A, c and iv; B, d and ii; C, f and v; D, a and vi; E, b and i; F, e and iii

8 Multiply by 2 would give 4, 8, 16 (and the third term is 20). Add 4 would give 4, 8, 12 (and the third term is 20). Sofia and Zara must look further than the first two terms and check that their rule works for the whole sequence and not just the first two terms. Term-to-term rule: Multiply by 3 then subtract 4.

9 a You need at least three terms.

b For example:

2, 6, . . . could be + 4 or × 3 or × 4 then − 2 or × 5 then − 4, etc.

3, 10, . . . could be + 7 or × 2 then + 4 or × 3 then + 1 or × 4 then − 2, etc.

10 a 19, 19, 55

b For example: Add 4: 12, 16. Multiply by 2: 16, 32. Multiply by 3 then subtract 4: 20, 56. Divide by 2 then add 6: 10, 11.

c For example: Add 7: 16, 23. Multiply by 2 then add 5: 23, 51. Multiply by 3 then add 3: 30, 93. Multiply by 4 then add 1: 37, 149.

d For example: Add 10: 27, 37. Multiply by 2 then add 3: 37, 77. Multiply by 3 then subtract 4: 47, 137. Add 1, then multiply by 2, then add 1: 37, 77.
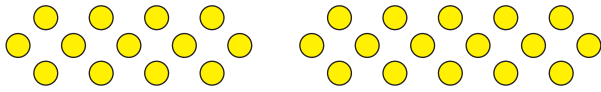
11 8

Reflection: Learner's own answer.

Activity 9.1

Learner's own answer.

Exercise 9.2

1 a

b 4, 7, 10, 13, 16, . . .

c Add 3.

d Three extra dots are added to the end of the previous pattern.

2 a

b 14, 17

c Add 3.

d i 20 **ii** 26

3 a Sofia adds two dots to each pattern to get the next pattern. She counts the number of dots in each pattern and records the numbers in the table.

b Advantage: easy way to show each pattern and the number of dots; disadvantage: takes a long time to draw and fill in the grid.

c Learner's own answer.

4 Learner's own answers.

5 a 4, 8, 12, 16, 20

b No, 42 is not a multiple of 4.

c 93 is an odd number and no odd number is a multiple of 4.

d For example: multiple of 4.

Activity 9.2

Learner's own answers

6 a
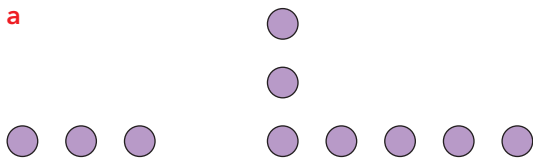
b 15

7 Marcus; $1 \times 2 + 3 = 5$, $2 \times 2 + 3 = 7$, $3 \times 2 + 3 = 9$, $4 \times 2 + 3 = 11$, and so $20 \times 2 + 3 = 43$.

Exercise 9.3

1 a 6; nth term $= 6n$

b i 60 **ii** 90

2 a $5n$ **b** $8n$

c $15n$

3 a i 40 **ii** 100

b i 64 **ii** 160

c i 120 **ii** 300

4 a 5; $n + 5$

b i 25 **ii** 40

5 a $n + 9$ **b** $n + 4$

c $n + 21$ **d** $n + 42$

6 a i 17 **ii** 29

b i 12 **ii** 24

c i 29 **ii** 41

d i 50 **ii** 62

7 Yes; $1 - 6 = -5$, $2 - 6 = -4$, $3 - 6 = -3$

8 Learner's own answer.

9 a $-3, -2, -1, 0, 1, \ldots$

b 9, 10, 11, 12, 13, . . .

c 10, 20, 30, 40, 50, . . .

10 A and iii; B and v; C and i; D and vi; E and ii; F and iv

11

nth term rule	5th term in sequence	10th term in sequence	20th term in sequence
nth term $= n + 12$	17	22	32
nth term $= n - 5$	0	5	15
nth term $= 4n$	20	40	80
nth term $= n + 35$	40	45	55
nth term $= n - 15$	-10	-5	5
nth term $= 16n$	80	160	320

12 a B; 20 = 14th, 22 = 16th, 36 = 30th, 40 = 34th, 63 = 57th, 100 = 94th term.

b 36 and 63. A: $9 \times 4 = 36$ and $9 \times 7 = 63$; B (see part **a**); C: $16 + 20 = 36$ and $43 + 20 = 63$.

Also 40 and 100. B (see part **a**); C: $20 + 20 = 40$ and $80 + 20 = 100$; D: $20 \times 2 = 40$ and $20 \times 5 = 100$.

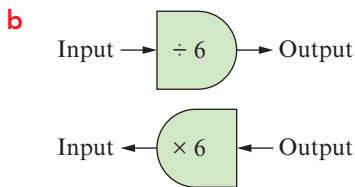**c** A has only 36 and 63; B has all the numbers; C has 22, 36, 40, 63 and 100; D has 20, 40 and 100.
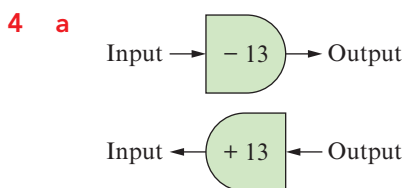
Reflection: Learner's own answer.

Exercise 9.4

1 a 8 and 9   **b** 5 and 3

   c 18 and 30   **d** 5 and 10

2 a inputs: 5, 9; output: 9

   b inputs: 10, 15; output: 2

   c inputs: 5, 10; output: 12

   d inputs: 12, 18; output: 4

3 a Learner's own answers.

   b

Input → ÷ 6 → Output

Input ← × 6 ← Output

Input	24	54	120
Output	4	9	20

4 a

Input → − 13 → Output

Input ← + 13 ← Output

Input	20	25	51
Output	7	12	38

b

Input → × 8 → Output
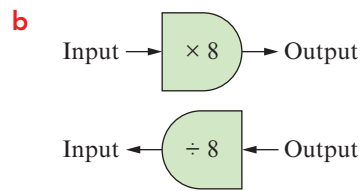
Input ← ÷ 8 ← Output

Input	3	7	15
Output	24	56	120

c

Input → + 9 → Output

Input ← − 9 ← Output
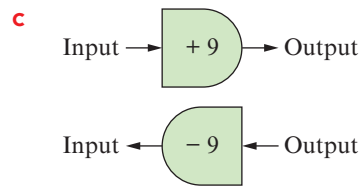
Input	8	15	36
Output	17	24	45

5 a i + 4   **ii** ÷ 2

   b i

input   0 1 2 3 4 5 6 7 8 9 10

output   0 1 2 3 4 5 6 7 8 9 10

    ii

input   0 1 2 3 4 5 6 7 8 9 10

output   0 1 2 3 4 5 6 7 8 9 10
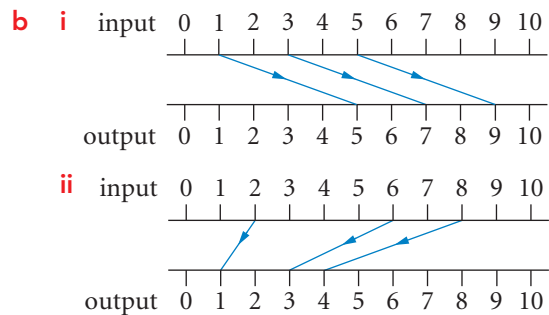
6

Input	7	8	10
Output	1	2	4

Input → − 6 → Output
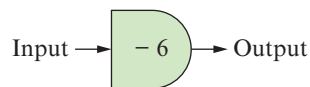
Learner's own answer. Example: I filled in the table of values first, using the mapping diagram. Then I compared the input values and output values and noticed that the output values were all 6 less than the input values.

7 a $4 + 8 = 12$ **b** × 3

   c Two. Learner's own answer. Example: If you only have one input and output value there could be at least two possible functions. As soon as you have two input and output values, only one of the possible functions will work and the other(s) won't.
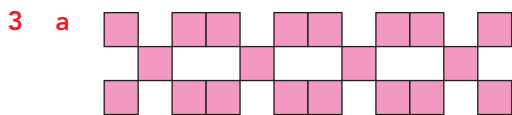
   d Learner's discussions.

8

Input	0	1	2
Output	0	4	8

Input → ×4 → Output
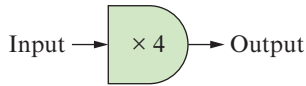
Check your progress

1 a i Add 2. **ii** 14, 16 **iii** 24

 b i Add 6. **ii** 33, 39 **iii** 63

 c i Subtract 3 **ii** 16, 13

 iii 1

2 5, 10, 25, 70

3 a

 b

Pattern number	1	2	3	4	5
Number of squares	5	10	15	20	25

 c Add 5. **d** 50

4 a $3n$ **b** $n+7$

5 a 30 **b** 17

6 a 5, 10, 15, 20 **b** $-6, -5, -4, -3$

7 input: 8; outputs: 5, 7

8

Input	0	1	2
Output	0	4	8

Input → ×4 → Output
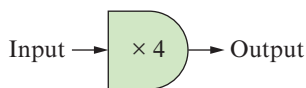
Unit 10 Getting started

1 a $\frac{3}{5}$ **b** $\frac{5}{6}$ **c** $\frac{4}{3}$ **d** $\frac{1}{3}$

2 a 0.625 **b** 1.6

3 a 9 **b** 9

4 a 30 people **b** $36

Exercise 10.1

1 a Divide the numerator and the denominator by 10, or by 5 and then 2, or by 2 and then 5.

 b Learner's own answers.

2 a $\frac{3}{5}$ **b** $\frac{61}{100}$ **c** $\frac{31}{50}$

 d $\frac{16}{25}$ **e** $\frac{13}{20}$ **f** $\frac{7}{10}$

3 a Because $0.3 = \frac{3}{10} = \frac{30}{100} = 30\%$.

 b $0.03 = \frac{3}{100} = 3\%$

4 a 0.4 and $\frac{2}{5}$ **b** 0.04 and $\frac{1}{25}$

 c 0.09 and $\frac{9}{100}$ **d** 0.9 and $\frac{9}{10}$

 e 0.05 and $\frac{1}{20}$

5 a 25% **b** 40% **c** 80%

 d 14% **e** 35% **f** 28%

6 a $\frac{3}{10}$, 30%, 0.3 **b** $\frac{2}{5}$, 40%, 0.4

 c $\frac{12}{25}$, 48%, 0.48 **d** $\frac{4}{25}$, 16%, 0.16

 e 13.5 cm² **f** 12 cm²

7 $4\% = \frac{1}{25} = 0.04$; $6\% = \frac{3}{50} = 0.06$; $30\% = \frac{3}{10} = 0.3$; $40\% = \frac{2}{5} = 0.4$; $60\% = \frac{3}{5} = 0.6$

8 a–c Learner's own answers.

9 a 30 g **b** 45 g **c** 48 g

 d 42 g **e** 33 g

10 a $150 **b** $60 **c** $90 **d** $45

11 a 25% = 10 m; 50% = 20 m; 20% = 8 m; 10% = 4 m

 b, c Learner's own answers.

12 a You could say 60% is 2 × 30% and so 60% of $70 is 2 × $21 = $42.

 b, c Learner's own answers.

13 a 25% **b** 12.5% (i.e. half of 25%)

 c $\frac{3}{8} = 37.5\%$; $\frac{5}{8} = 62.5\%$; $\frac{7}{8} = 87.5\%$

Exercise 10.2

1 Learner's own answers.

2 **a** $0.075 = \frac{3}{40}$ **b** $0.625 = \frac{5}{8}$

c $0.015 = \frac{3}{200}$ **d** $0.475 = \frac{19}{40}$

e $0.325 = \frac{13}{40}$

3

100%	$80	$300	$90	$64
50%	$40	$150	$45	$32
5%	$4	$15	$4.50	$3.20
0.5%	$0.40	$1.50	$0.45	$0.32

4 **a** $\frac{1}{50}$ **b** $\frac{1}{500}$ **c** $\frac{2}{25}$

d $\frac{1}{125}$ **e** $\frac{7}{100}$ **f** $\frac{7}{1000}$

5 **a** **i** 6 kg **ii** 9 kg

iii 21 kg **iv** 13.2 kg

b The other answers are easy to find when you know 1%.

6 **a** 70 m

b **i** 140 m **ii** 35 m

iii 7 m **iv** 21 m

7 Learner's own answer.

8 **a** $33\frac{1}{3}$ or 33.333. . . **b** $33\frac{1}{3}\%$

c The answer is rounded to the nearest whole number.

d The answer is rounded to one decimal place.

e $66\frac{2}{3}\%$ or 66.666. . .%

9 **b** 125% **c** 175% **d** 130%

e 170% **f** 225%

10 **a** 20%

b **i** 120% **ii** 160%

iii 180% **iv** 260%

11 **a** $18

b, c Learner's own answers.

d 170%

12 **a** 80%

b 125%

13 **a** 40% **b** 24% **c** 36%

14 **a** 62.5% **b** 20% **c** 17.5%

15 **a** 38% **b** 36%

16 **a** **i** $80 **ii** $120

b 3

17 **a** **i** 15 g **ii** 20 g

b 4

18 **a** 105% **b** 180%

19 160% because $125 \times 1.6 = 200$.

20 Learner's own answers.

Check your progress

1 **a** $\frac{7}{10}$ **b** 0.09

c 62.5% **d** 105%

2 **a** $34.50 **b** $11.40

3 **a** $46.35 **b** $1.35

4

100%	30	2500	800	48
120%	36	3000	960	57.6
12.5%	3.75	312.5	100	6
0.5%	0.15	12.5	4	0.24

Reflection: Write 80% as $\frac{4}{5}$ and then

$\frac{4}{5} \times 65 = 65 \div 5 \times 4 = 52$ kg

Learner's own answers.

5 **a** 75% **b** 10%

6 5

Unit 11 Getting started

1 **a** $A(7, 3)$, $B(2, 3)$, $C(2, -2)$, $D(7, -2)$

b $(2, 0)$

c $(-4, -2)$

2 **a** 9 **b** 6.5

c 3 **d** −4

3 **a** 8 **b** 28

c −12 **d** −20

Exercise 11.1

1 a i 8   **ii** 12

   iii 20   **iv** 24

  b 2s years

  c $a = 2s$

2 a 30 kg

  b Learner's own answers.

  c $y = \frac{3}{4}x$ or $y = 0.75x$

3 a i $16   **ii** $20   **iii** $23

  iv $18.50 **v** $24.95

  b $(x + 10)$

  c $y = x + 10$

4 a 15 cm

  b 60 cm

  c The perimeter is the length of one side multiplied by 3.

  d $p = 3s$

5 a i Learner's own rectangles. For example: the sides could be 4 cm and 7 cm, or 5 cm and 8 cm, etc.

  ii $l = w + 3$ or $w = l - 3$

  b i Learner's own rectangles. For example, the sides could be 2 cm and 6 cm, or 3 cm and 9 cm, etc.

  ii $l = 3w$

  iii $p = 8w$, where p is the length of the perimeter.

  c Learner's own answers.

  d Learner's own answers.

6 a Learner's own answers. For example: $x = 6$ and $y = 1$ or $x = 13$ and $y = 8$, etc.

  b Learner's own answer. For example: they could be the ages of two children or the masses of two objects or two times, etc.

  c Learner's own answers.

7 a 1500 yen   **b** $y = 150x$

8 a 21 pesos   **b** $y = 21x$

9 a You can exchange 1 dollar for 1.5 dinars.

  b Multiply 570 by 1.5.

  c Divide 570 by 1.5.

Exercise 11.2

1 a

x	−3	−2	−1	0	1	2	3
y	−2	−1	0	1	2	3	4

  b
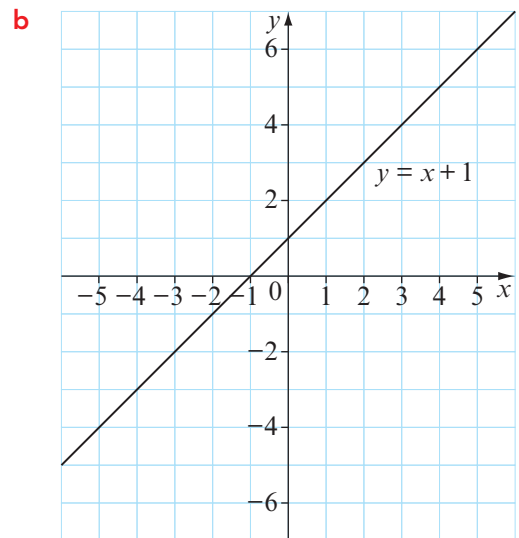
  c When $x = -20$, $y = x + 1 = -20 + 1 = -19$.

  d When $x = 20$, $y = x + 1 = 20 + 1 = 21$, so (20, 21) is on the line but (20, 19) is not on the line.

2 a

x	−4	−2	0	2	4	6
y	−6	−4	−2	0	2	4

  b
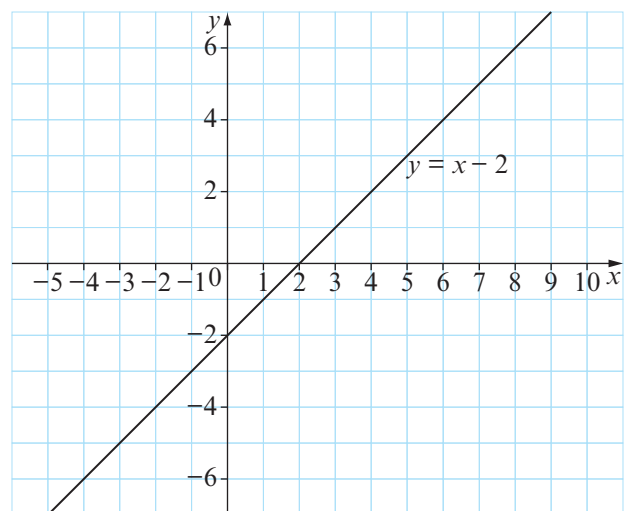
c When $x = 25$, $y = x - 2 = 25 - 2 = 23$, so the point is on the line.

3 **a**

x	−3	−2	−1	0	1	2	3	4
y	5	6	7	8	9	10	11	12

b
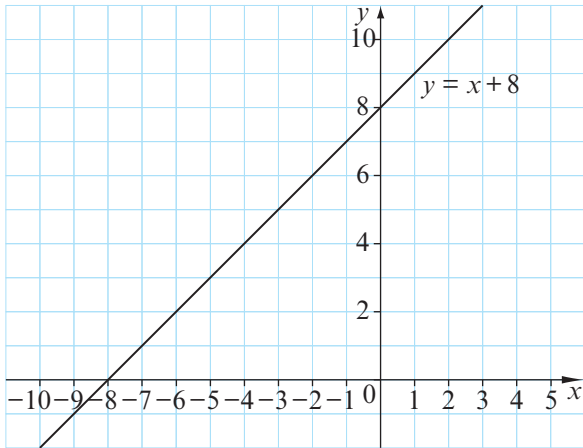
c (20, 28) and (−20, −12)

4 **a**

x	−3	−2	−1	0	1	2	3
y	−6	−4	−2	0	2	4	6

b
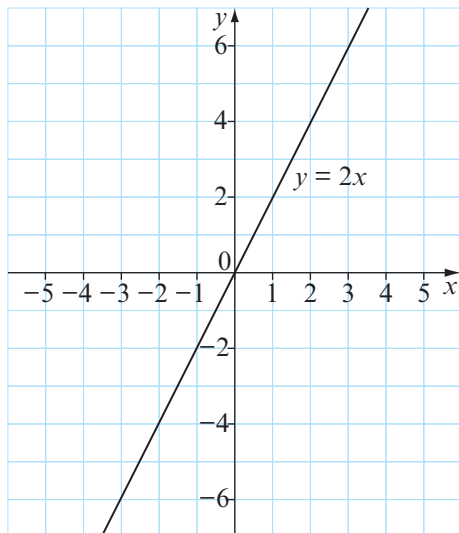
c **i** (4.5, 9) **ii** (−5, −10)

iii (8.5, 17) **iv** (−8, −16)

d **i** above **ii** above

iii above **iv** below

5 **a**

x	−2	−1	0	1	2	3	4
y	−10	−5	0	5	10	15	20

b
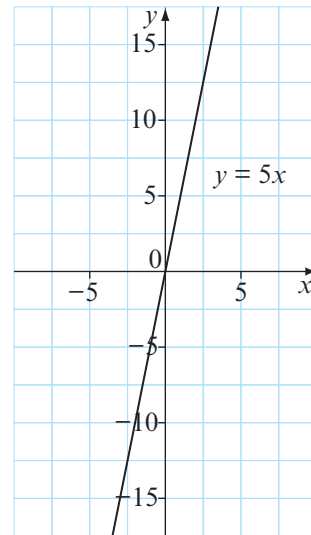
6 **a** 35

b

US$	1	2	3	4	5	6	7
HK$	7	14	21	28	35	42	49

c $y = 7x$

d 350

Reflection: For example: Use one pair of values to plot a point on a grid. Draw a straight line that passes through that point and the origin.

7 **a, b**
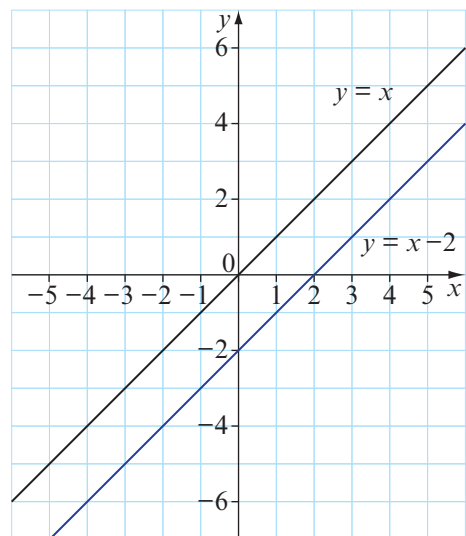
c, d Learner's own answers.

e For example: The lines are all parallel. The angle with the x-axis is always 45°. The line crosses the y-axis at c. The line crosses the x-axis at $-c$.

8 a, b
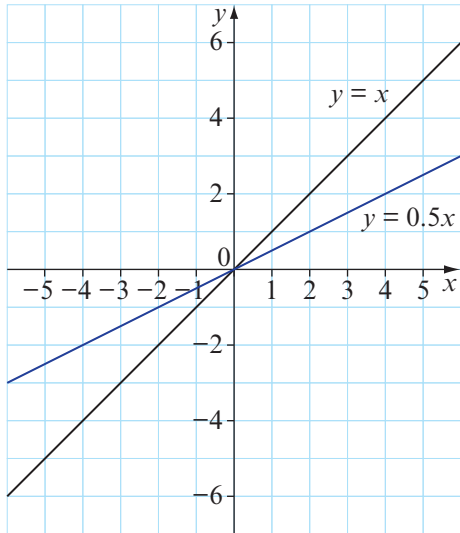
c Learner's own answers.

d For example: The line goes through the origin (0, 0). The larger the value of m, the steeper the line.

9 a
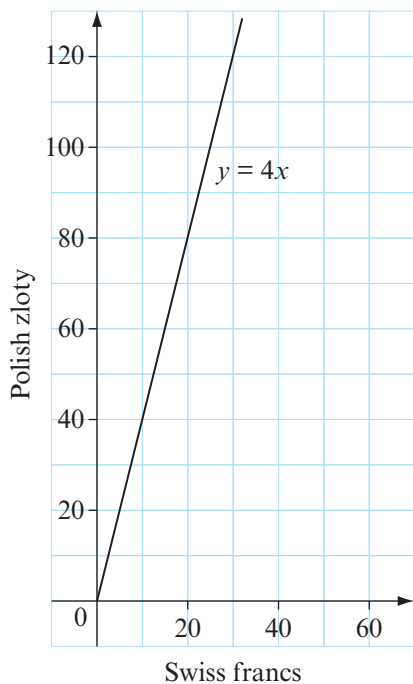
Learners could draw the axes the other way around. Learners might have a different scale on each axis.

b $z = 4s$ or $s = 0.25z$

10 a
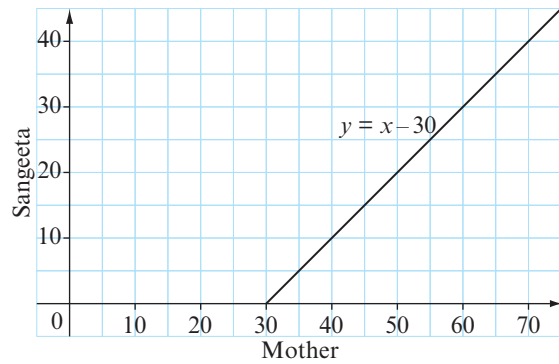
b $y = x - 30$

11 a
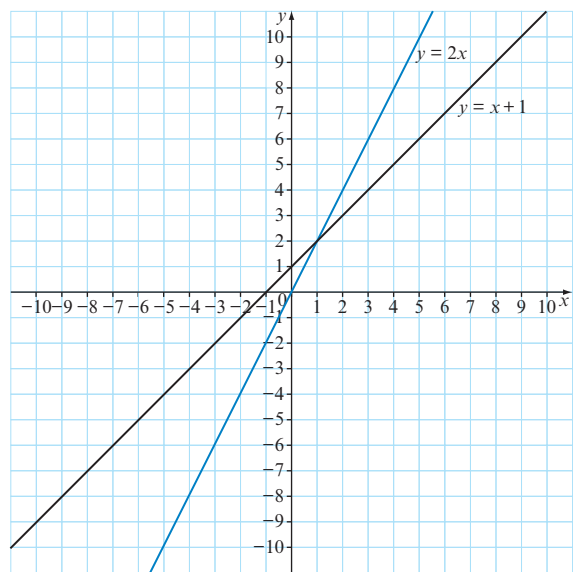
b The lines cross at (1, 2).

c For example: When $a = 3$, the lines $y = 2x$ and $y = x + 3$ meet at (3, 6).

Exercise 11.3

1 a For example:

i
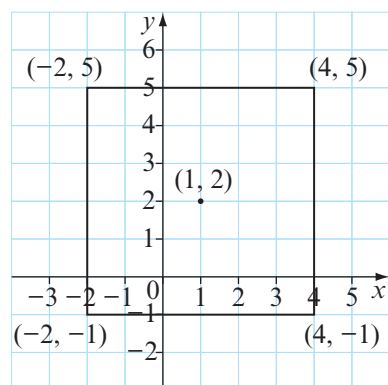
    ii $x = 4$, $x = -2$, $y = 5$, $y = -1$

  b, c Learner's own answers.

2 a
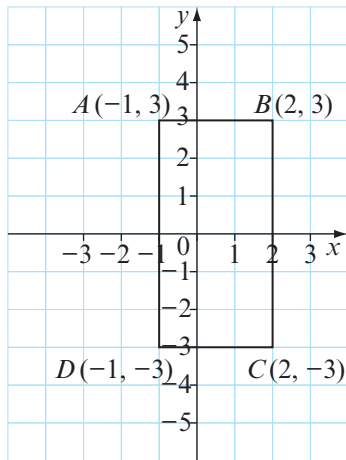
  b $y = 3$

  c Any two points with a y-coordinate of 3.

  d $x = -1$

  e $y = -3$

3 a
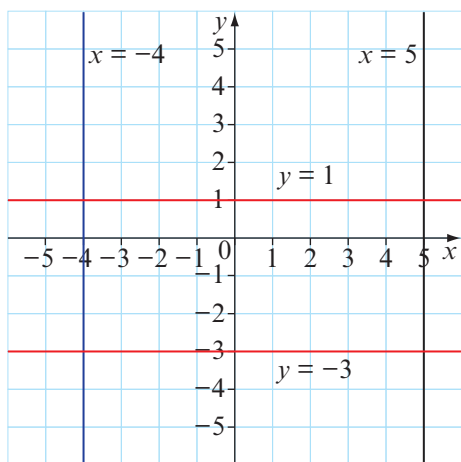
  b $(5, 1)$, $(5, -3)$, $(-4, 1)$, $(-4, -3)$

4 For example: $(1, 6)$, $(5, 6)$, $(5, 2)$ or $(1, -2)$, $(5, -2)$, $(5, 2)$, or $(1, 6)$, $(-3, 6)$, $(-3, 2)$ or $(1, -2)$, $(-3, -2)$, $(-3, 2)$, etc.

5 a
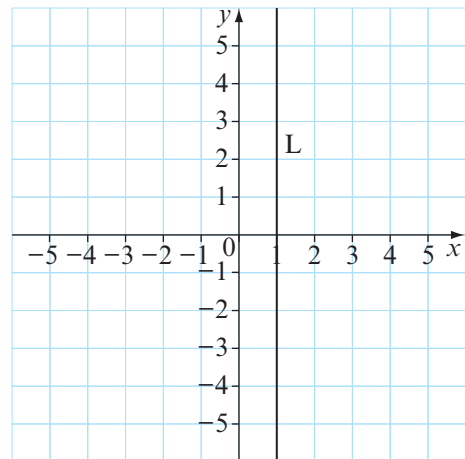
  b There are two possible lines. They are both shown here:
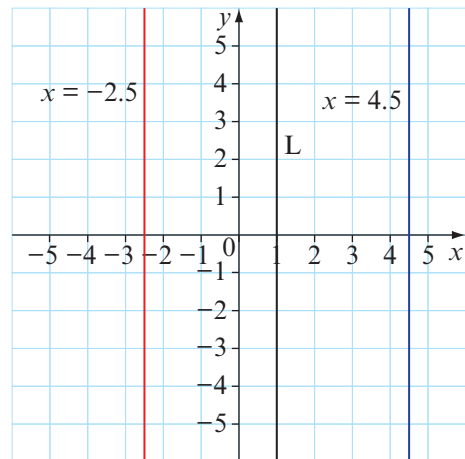
  c Either $x = 4.5$ or $x = -2.5$.

  d, f

  e $y = 4.5$

  f $y = 1.5$

6 **a**

b 36

c Learner's own answers.

d Learner's own answers.

e Learner's own answers.

f For example (but using learner's equations): The lines are $x = -2$, $x = 7$, $y = 3$ and $y = 5$. The length of the rectangle is $7 - -2 = 9$ and the width is $5 - 3 = 2$, so the area is $9 \times 2 = 18$.

7 **a** A **b** B and E

c F **d** C and F

8 **a** $x = 4$, $y = 4$, $x = -4$ and $y = -4$

b Learner's own answer.

c Learner's own answer.

Exercise 11.4

1 **a** 400 m

b

Time (min)	1	2	3	4	5	6	7
Distance (m)	80	160	240	320	400	480	560

c 80 metres per minute

d 800 m **e** $d = 80t$

f For example: In 12 minutes the boy walks $12 \times 80\,\text{m} = 960\,\text{m}$, which is less than 1 kilometre. So he takes more than 12 minutes.

g positive

2 **a** 30 litres **b** 21 litres

c 6 litres per hour

d 5 hours from the start

e negative

3 **a** $4.80

b The cost of electricity for each hour is the same.

c $0.20 **d** $33.60

e positive

4 **a** 13 cm

b

Time (min)	0	10	20	30	40
Length (cm)	13	12	11	10	9

c 1 mm or 0.1 cm

d 130 minutes or 2 hours 10 minutes

e negative

5 **a** The line meets the cost axis at $4.

b

Time (min)	10	20	30	40
Cost ($)	10	16	22	28

c $0.60

d Learner's own answer.

e Learner's own answer.

f positive

6 **a** 70°C

b It slopes downwards from left to right. As the time increases, the temperature decreases.

c

Time (min)	0	5	10	15	20	25
Temperature (°C)	70	52	40	33	30	31

d The water cools most quickly during the first 10 minutes and then cools more slowly as time passes. The graph shows this because it is steepest at the start and gets less steep as time increases.

e About 30°C is a reasonable estimate.

f **i** for the last 7 or 8 minutes

ii for the first 20 minutes

iii between about 20 and 22 minutes

7 **a** 16 cm **b** after 37.5 seconds

c 0.8 cm per second

d The vase will fill more slowly where it is wider and will fill more quickly where it is narrower.

e graph Y

f For example:

W   X   Z
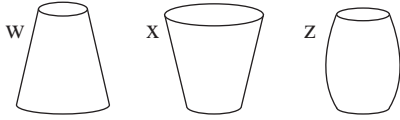
g, h Learner's own answers.

8 a 80 km/h   **b** 50 km/h

c 9 seconds

d from 0 to 26 km/h

e Between 4 and 6 seconds as the curve is climbing most steeply during that period.

Check your progress

1 a The final column has the learner's own numbers.

Jeff ($)	2	3	4	5	6
Larissa ($)	6	7	8	9	10

b
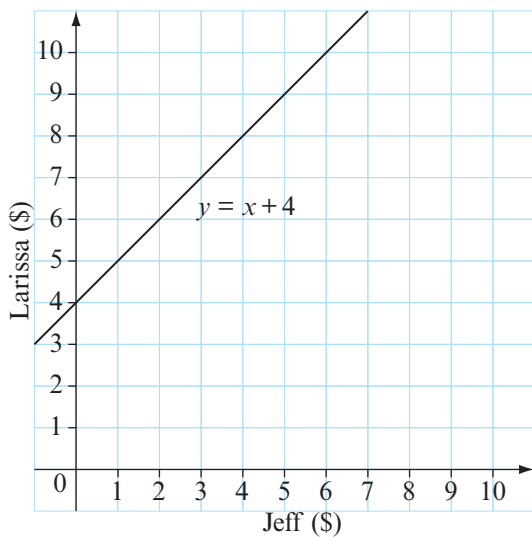
c $y = x + 4$

2 a $x = 4$, $x = -2$ and $y = 1.5$

b $y = -4.5$

3 $x = -9.5$ and $y = 7.5$

4 a, b
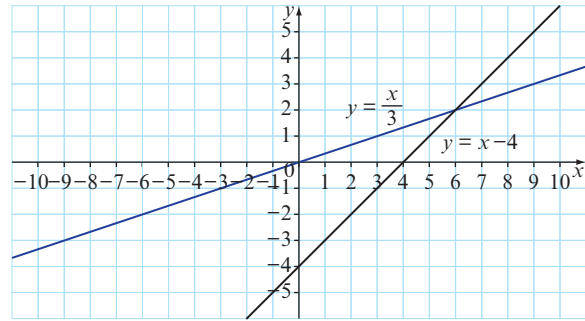
c (6, 2)

5 $y = x - 5$ and $y = 0.2x$

6 a 10 cm

b i 12.5 cm   **ii** 15 cm

iii 17.5 cm

c The graph is a straight line.

d 0.25 cm

Unit 12 Getting started

1 a 1:2 **b** 2:3   **c** 1:5   **d** 1:2

2 2:4, 7:14, 10:20

3 1:3 and 2:6; 4:1 and 12:3; 2:5 and 6:15; 3:2 and 6:4

4 a $1.60 **b** $4   **c** $16

5 60 square metres

Exercise 12.1

1 b 2:1   **c** 2:3   **d** 1:1

2 b A   **c** C   **d** B

3 a 1:4   **b** 1:6   **c** 1:2

d 1:5   **e** 1:2   **f** 1:3

g 5:1   **h** 12:1   **i** 6:1

j 2:1   **k** 3:1   **l** 6:1

4 2:1

5 108:1

6 a B   **b** C   **c** A

7 a 2:7   **b** 4:5   **c** 4:7

d 12:5   **e** 7:3   **f** 7:3

8 a It should be $1:4$, not $4:1$.

b 'The ratio of margarine to flour is $1:4$.' Or 'The ratio of flour to margarine is $4:1$.'

Reflection: a–c Learner's own answers.

9 $3:8$

10 Bryn has the darker blue paint.

11 Melania. One method is to change $2:5$ to $6:15$ and change $1:3$ to $5:15$, then compare.

12 a $1:4$ **b** $3:14$

c Avondale; compare $7:28$ and $6:28$.

13 Borrowdale; Borrowdale has a ratio women : men of $22:66$. Avondale has a ratio women : men of $24:66$.

14 a Correct; both can be divided by $5x$.

b Learner's own answer.

Exercise 12.2

1 a 5; 5, 9; 9, $9; 9, $36

b

	Number of parts	Amount
Ethan	1	$9
Julie	4	$36
Total	5	$45

2 a $8 and $16 **b** $13 and $52

c $36 and $12 **d** $25 and $5

e $3 and $18 **f** $56 and $8

Reflection: a, b Learner's own answers.

3 Raine pays $40, Abella pays $32. Check: $40 + 32 = \$72$

4 a $14 and $21 **b** $21 and $28

c $20 and $12 **d** $63 and $27

5 a i $\frac{4}{9}$ **ii** $\frac{5}{9}$

b Learner's own answer.

6 a 15 **b** $\frac{3}{7}$

Activity 12.1

Learner's own answers.

7 a Simplify the ratio from $80:40$ to $2:1$.

b Total parts: $2 + 1 = 3$
Each part: $\$630 \div 3 = \$210$
Brad gets $2 \times \$210 = \$420$
Lola gets $1 \times \$210 = \$210$
Check: $\$420 + \$210 = \$630$

c Learner's own answer.

8 a Mass; for example: closer to half each.

b Age: Arun gets $112. Mass: Arun gets $116. Yes, Arun gets most when the mass ratio is used.

9 This year the youngest gets $96. In 5 years' time the youngest gets $128. $\$128 - \$96 = \$32$.

10 a $\frac{cE}{c+d}$ or $\frac{E}{c+d} \times c$ or $\frac{c}{c+d} \times E$

b $\frac{dE}{c+d}$ or $\frac{E}{c+d} \times d$ or $\frac{d}{c+d} \times E$

Exercise 12.3

1 125 g, 125 g and 1000 g or 1 kg

2 a $1.20 **b** $6

3 a 14 ZAR **b** 84 ZAR

4 $85.05

5 $48

6 270 g

7 a–e Learner's own answers.

8 Learner's own answers.

9 a 5, 5, 4000 **b** 400, 400, 1200

10 a $480 **b** $2400

11 Irene forgot to add on the rice for six people. She worked out the mass for nine people, not 15. 750 g of rice is needed.

12 No, it's $112. Possibly, the teacher accidentally mixed the digits of 112 to get 121.

Check your progress

1 a $2:3$ **b** $5:2$

2 a $1:3$ **b** $6:1$ **c** $2:3$ **d** $3:2$

3 Kim. Guy's ratio $1:4$ is equivalent to $2:8$, so has more parts of water than Kim's.

4 **a** $5 and $10 **b** $20 and $5

    c 27 kg and 18 kg **d** 15 litres and 9 litres

5 **a** $0.70 or 70 cents **b** $3.50

6 **a** 4.8 kg **b** 4 kg

Unit 13 Getting started

1 **a** throw less than 5

    b even chance or 50-50

    c Throw a 6 and throw less than 5 because only one of them can happen.

2 **a** The numbers are not all equally likely. Some numbers are more likely than others.

    b **i** 10 out of 50 or 20%

        ii 15 out of 50 or 30%

        iii 4 out of 50 or 8%

    c 2

3 **a** 0.8 and 80% **b** 0.3 and $\frac{3}{10}$

Exercise 13.1

1 **a** Learner's own answers.

    b For example: extremely unlikely, 50-50, more likely than not

2 **a** even chance **b** certain

    c very unlikely

    d Learner's own answer, depending on where they live.

    e Learner's own answer.

3 E, A, C, D, B

4 **a** rain $\frac{1}{4}$; sun $\frac{3}{5}$

    b
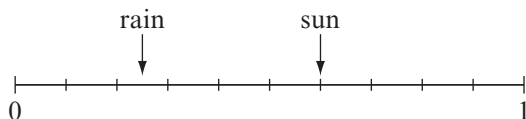
5 **a** United, because 0.7 = 70%, which is larger than the other two probabilities.

    b Rovers

6 P 15% or 0.15 or $\frac{3}{20}$; Q 40% or 0.4 or $\frac{2}{5}$; R 65% or 0.65 or $\frac{13}{20}$; S 95% or 0.95 or $\frac{19}{20}$

7 **a**
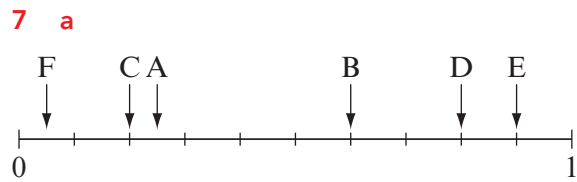
    b Learner's own answer.

8 Learner's own answers

Reflection: Learner's own answers.

9 **a** Weather forecasts are based on detailed measurements of the current situation. These measurements are used to run computer models on supercomputers.

    b Learner's own answers.

10 Statement A is correct. The probability is 50%. The coin has no memory. It cannot be influenced by what happened in the past.

Exercise 13.2

1 **a** heads or tails **b** yes **c** yes

2 **a** There can be rain and wind at the same time.

    b Because rain is less likely than wind. They have different probabilities.

3 **a** $\frac{1}{6}$ **b** $\frac{1}{6}$

    c $\frac{1}{2}$ or 50% **d** $\frac{1}{2}$ or 50%

    e $\frac{2}{3}$ **f** 0

4 **a** $\frac{1}{11}$ **b** $\frac{2}{11}$ **c** $\frac{1}{11}$

    d $\frac{2}{11}$ **e** 0 **f** $\frac{4}{11}$

5 **a** Pink $\frac{5}{12}$, yellow $\frac{1}{6}$, blue $\frac{1}{3}$, green $\frac{1}{12}$

    b $\frac{5}{12} + \frac{2}{12} + \frac{4}{12} + \frac{1}{12} = 1$

6 **a** **i** $\frac{1}{6}$ **ii** $\frac{1}{2}$ **iii** $\frac{1}{3}$

Reflection: $\frac{1}{6}+\frac{3}{6}+\frac{2}{6}=1$. They form three mutually exclusive events and one of them must happen.

7 a i 0.1 **ii** 0.6 **iii** 0.4

    iv 0.9 **v** 1

  b Because 150% of 0.4 is 0.6. The probabilities could be written as fractions or as percentages.

8 Marcus is incorrect because the three outcomes are not equally likely.

9 a i $\frac{1}{20}$ or 5% **ii** 30%

    iii 50%

    iv 35% (there are seven factors)

  b i 5% **ii** 25% **iii** 70%

  c They are three mutually exclusive events and one of them must happen.

  d i For example: a number greater than 5.

    ii For example: multiples of 6.

10 a i $\frac{7}{8}$ or 87.5% or 0.875

    ii 1 **iii** $\frac{1}{4}$ or 0.25 or 25%

  b i $\frac{1}{8}$ **ii** $\frac{3}{8}$ **iii** $\frac{3}{4}$

  c They are not mutually exclusive outcomes. 5 is included in every outcome. The sum of the probabilities is more than 1.

11 a 1% **b** 18% **c** 81%

12 a–d Learner's own answers.

Exercise 13.3

Answers in this exercise could be given as percentages, decimals or fractions.

1 a 35% **b** 65%

2 a 5% **b** 30%

  c 70% **d** 65%

3 a 64% **b** 36%

4 a $\frac{3}{40}$ or 7.5% **b** 92.5%

5 a 24% **b** 76%

6 a $\frac{15}{20}=75\%$

  b For example: The chance of winning depends on how good the opposing team is. This will vary from match to match.

  c Learner's own answer.

7 a i 97% **ii** 70% **iii** 72%

  b The two are not mutually exclusive. You may have counted some students twice.

8 a 50% or 0.5 or $\frac{1}{2}$

  b heads 60%, tails 40%

  c Toby thinks that the probabilities should be close to 50%. The sample size of 40 is too small to justify Toby's statement.

9 a white 20%, black 20%, red 60%

  b white 12%, black 16%, red 72%

  c The most likely number is five red balls. If there are five red balls, then the theoretical probabilities are white 14%, black 14%, red 72%, and these are close to the experimental probabilities.

10 a 0.1 **b** 0.2 **c** 0.125

  d The values, rounded to three decimal places (where necessary), are 0.117, 0.113, 0.1, 0.117, 0.121, 0.119, 0.117, 0.125.

  e Learner's own answer.

  f Learner's own answer.

11 Learner's own answer.

Check your progress

1 a For example: 90%

  b zero **c** 50%

  d For example: 25%

2 a i 0.1 **ii** 0.2

    iii zero **iv** 0.5

  b Any two letters that have the same probability. For example: A and C, or E and R, or I and T. Learners could give these answers as fractions or percentages.

3 a green $\frac{1}{8}$ or 12.5%; pink $\frac{1}{4}$ or 25%; blue $\frac{5}{8}$ or 62.5%

b green 9%; pink 27%; blue 64%

c The experimental probabilities are similar to the theoretical probabilities.

d green 10.8%; pink 24%; blue 65.2%. Learner's own comments.

4 In soil A, the probability that a seed grows successfully is $\frac{83}{120} = 69\%$. In soil B, the probability that a seed grows successfully is $\frac{62}{75} = 83\%$. This shows that soil B has a better success rate.

Unit 14 Getting started

1 a 4 m   **b** 8000 m   **c** 3.25 km

2 a–c
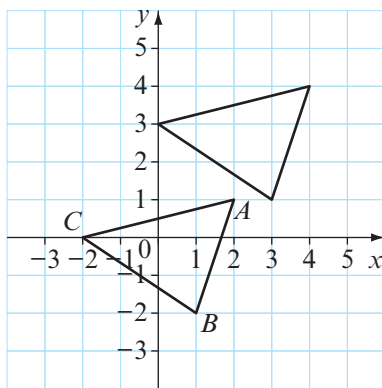
3
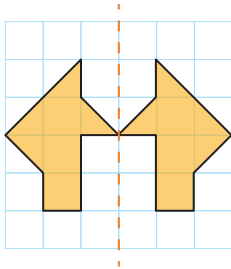
4 C

Exercise 14.1

1 a 2 cm on the drawing represents $2 \times 3 = 6$ m in real life.

b 5 cm on the drawing represents $5 \times 3 = 15$ m in real life.

c 8 cm on the drawing represents $8 \times 3 = 24$ m in real life.

2 a 8 m in real life represents $8 \div 4 = 2$ cm on the drawing.

b 12 m in real life represents $12 \div 4 = 3$ cm on the drawing.

c 20 m in real life represents $20 \div 4 = 5$ cm on the drawing.

3 a 180 m   **b** 8 cm

4 a 1.9 cm   **b** 76 km

5 Sofia is correct because she is the only person who uses the same units for the 1 and the 20. The scale 1 to 20 means that 1 cm on the scale drawing represents 20 cm in real life, or 1 mm represents 20 mm, or 1 m represents 20 m, etc.

6 a i 3 m   **ii** 1.5 m   **iii** 1 m
    iv 0.5 m   **v** 2 m   **vi** 2 m

b 2 cm

c 7 cm

7 a 3 km

b 48 cm

8 a Learner's own answer. For example:

Aika   Advantage: easier to divide by 100 and 1000 after the multiplication; disadvantage: dealing with large numbers.

Hinata Advantage: first does the conversion between units; disadvantage: dealing with decimal numbers.

b Learner's own answer.

9 a 1.1 cm

b 0.88 km

c 15 cm

10 a Faisal should multiply 8.5 by 50 000, he should not divide. He must then divide by 100 and then 1000 to do the units conversion.

b $8.5 \times 50\,000 = 425\,000$ cm

$425\,000 \div 100 = 4250$ m

$4250 \div 1000 = 4.25$ km

They are 4.25 km apart.

Activity 14.1

a

	3 cm	6 cm	7.5 cm	10 cm	12.8 cm
1:12 000	0.36 km	0.72 km	0.9 km	1.2 km	1.536 km
1:15 000	0.45 km	0.9 km	1.125 km	1.5 km	1.92 km
1:30 000	0.9 km	1.8 km	2.25 km	3 km	3.84 km
1:200 000	6 km	12 km	15 km	20 km	25.6 km

b

	4.5 km	6 km	7.5 km	9 km	15 km
1:12 000	37.5 cm	50 cm	62.5 cm	75 cm	125 cm
1:15 000	30 cm	40 cm	50 cm	60 cm	100 cm
1:30 000	15 cm	20 cm	25 cm	30 cm	50 cm
1:200 000	2.25 cm	3 cm	3.75 cm	4.5 cm	7.5 cm

11 C

Reflection: a, b Learner's own answers.

Exercise 14.2

1 **a** 6 units **b** 7 units

2 **a** 6 units **b** 9 units

3 **a** B **b** C **c** C

4 Learner's own answers. For example:

 a Sofia is correct. The distance is 8 units. -8 is incorrect, as you cannot have a negative distance.

 b Agree. As long as the answer given is positive, it doesn't matter which way you do the subtraction. It is usually easier, however, to do largest number $-$ smallest number.

5 **a** G and I **b** E and H

 c C and J **d** A and D

Activity 14.2

 Learner's own answers.

6 **a**
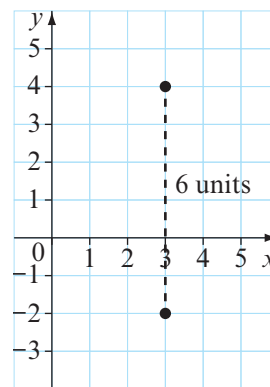
 b $4+2=6$, or $4--2=6$, so distance $=6$.

 c Learner's own answer.

7 **a** 8 units **b** 6 units

 c 14 units **d** 10 units

8 **a** Learner's own answer

 b Learner's own answer. For example: as both x-coordinates are negative, it's easier just to do $9-4=5$.

9 A and iii; B and i; C and v; D and iv; E and ii

10 **a** 4 units, A to $B=7-3=4$ or B to $C=9-5=4$.

 b (3, 9); y-coordinate: A to $D=5+4=9$ and x values the same or x-coordinate: C to $D=7-4=3$ and y values the same.

11 **a** **i** 8 m **ii** 4 m

 b C and GK

c i GA, WD and GD

  ii GA → WD = 12 m, WD → GD = 6 m, GA → GD = 18 m

d
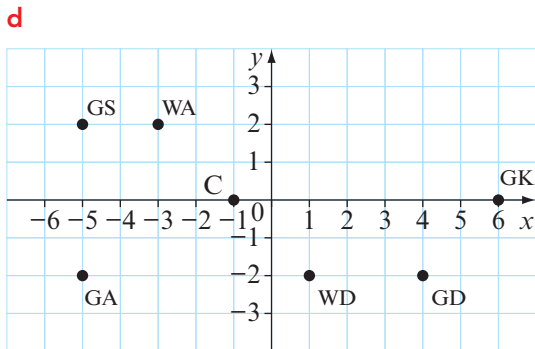
Exercise 14.3

1 $A'(6, 6)$, $B'(11, 6)$, $C'(6, 10)$

2 A and iii; B and ii; C and i; D and iv

3 $P'(2, 4)$, $Q'(7, 4)$, $R'(9, 7)$, $S'(4, 7)$

4 a A'

  b Learner's own answer. For example: B' is $(8, 3)$. Dan added 4 to the y-coordinate, not subtracted 4. C' is $(11, 2)$. Dan did $(5 - 4, 6 + 6)$, not $(5 + 6, 6 - 4)$.

  c Learner's own answer. For example: Dan should show some working and not try to do all of the working in his head.

  d Learner's own answer. For example: Draw a grid or reverse the translation.

5 a $J'(4, 1)$, $K'(6, 1)$, $L'(6, 3)$, $M'(5, 5)$, $N'(4, 3)$

  b i–iii
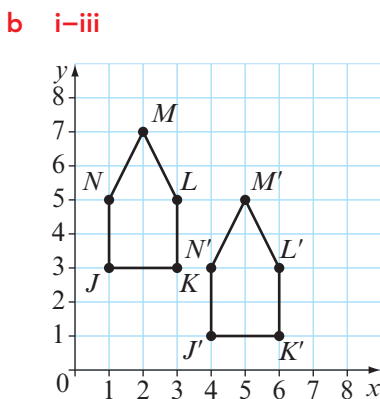
  iv Learner's own answer.

6 a K'

  b 3 squares left and 5 squares up.

  c 5 squares right and 3 squares down.

7 a i $B'(-2, 3)$

  ii $C(2, -8)$

  iii $D(-3, -8)$

  b Learner's own answer.

Reflection: Learner's own answers.

Exercise 14.4

1 a

  b

  c

2 b

a

c
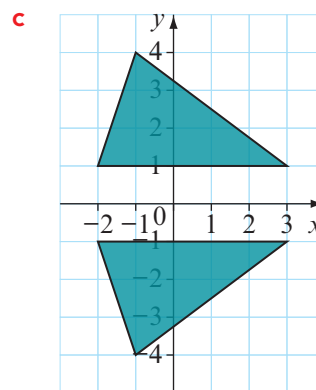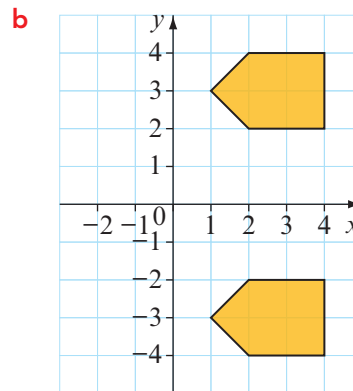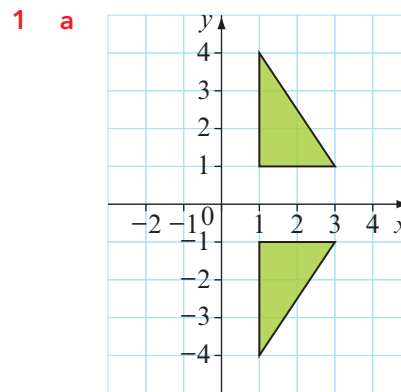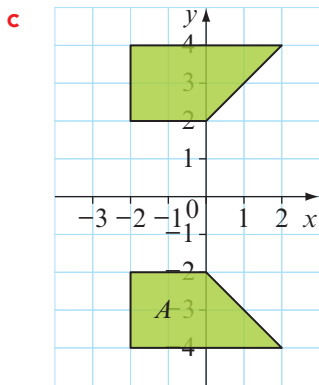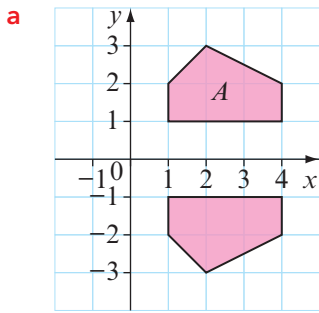
3 a

Object	A(1, 2)	B(2, 4)	C(3, 4)	D(5, 2)
Image	A'(1, −2)	B'(2, −4)	C'(3, −4)	D'(5, −2)

b Zara is correct. The *x*-coordinates of the vertices will be the same for the object and the image.

Example of reason: A reflection in the *x*-axis means the shape is being transformed only vertically and not horizontally.

Sofia is incorrect. The *y*-coordinates of the vertices for the image will be the negative of the *y*-coordinates for the object.

Example of reason: A reflection in the *x*-axis means the vertices of the image will be the same distance from the *x*-axis, but in the opposite direction as those of the object.

4 a
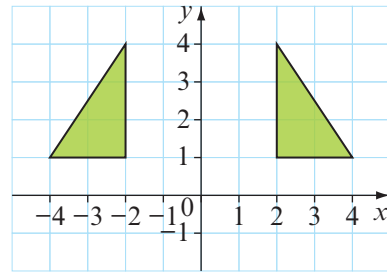
b
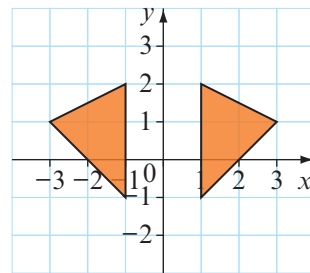
c

5 a is correct.

b

c

6 a
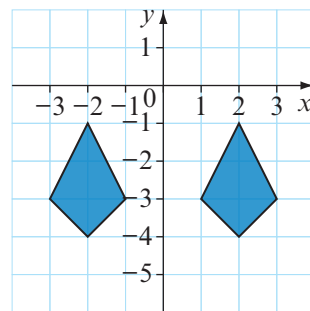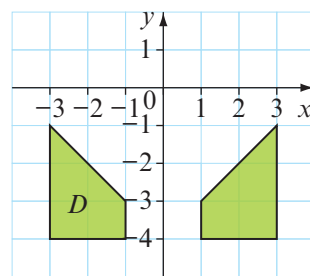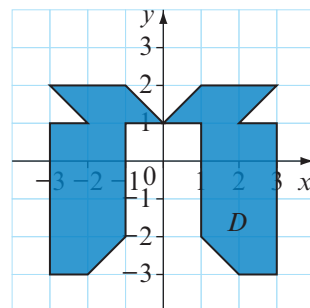
	A	B	C	D	E
Object	(−4, 3)	(−1, 3)	(−1, 1)	(−3, −2)	(−4, 2)
Image	A′ (4, 3)	B′ (1, 3)	C′ (1, 1)	D′ (3, −2)	E′ (4, 2)

b The *x*-coordinates of the vertices of the object and its image are the negative of each other.

c The *y*-coordinates of the vertices of the object and its image are the same.

d Yes. Example of reason: A reflection in the *y*-axis means the shape is being transformed only horizontally and not vertically, so the *y*-coordinates stay the same. However, the *x*-coordinates are the negative of each other because the image will be the same distance from the *y*-axis, but in the opposite direction as those of the object.

e Yes. Example of reason: There is no change in the size of the shape during the reflection, so the object and the image are always congruent.

7 a E is a reflection of A in the *y*-axis.

b F is a reflection of H in the *x*-axis.

c C is a reflection of H in the *y*-axis.

d G is a reflection of B in the *y*-axis.

e D is a reflection of A in the *x*-axis.

Activity 14.3

Learner's own answer.

8 a For example: easy to use this method and not likely to make a mistake.

b For example: no.

c


Exercise 14.5

1 a

b

c

d
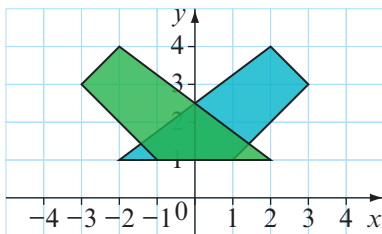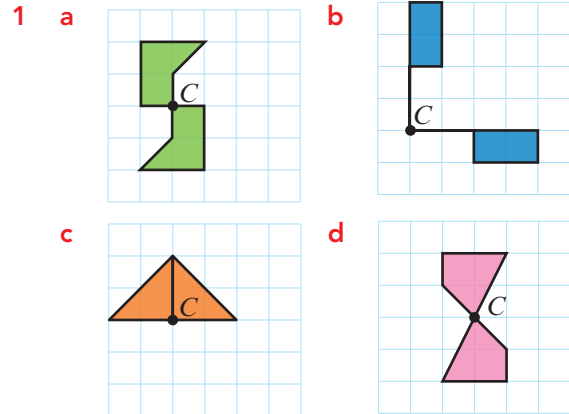
2 Comment: When you rotate a shape, the object and the image are always congruent.

For example: a rotation doesn't change the size of the shape, it changes only the position.

Comment: When you rotate a shape 180°, it doesn't matter whether you turn the shape clockwise or anticlockwise, aa you will end up with the same image.

For example: A full turn is 360°, so a 180° turn is the same as a half turn. Whether you turn clockwise or anticlockwise, the shape will end up in the same place.

3 a

b

c

d
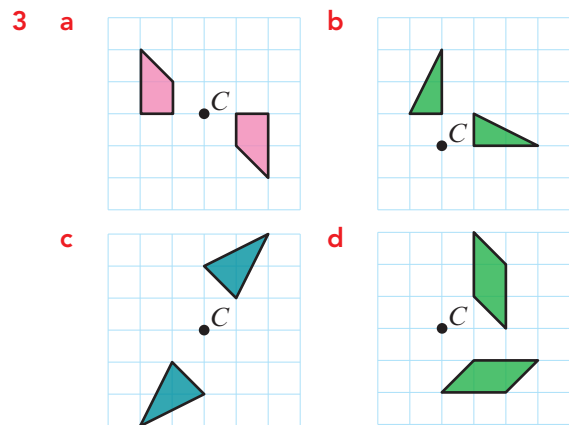
4 a Maksim has rotated the kite 90° clockwise and not 90° anticlockwise about centre *C*.

b

5 **a**

b

b

Exercise 14.6
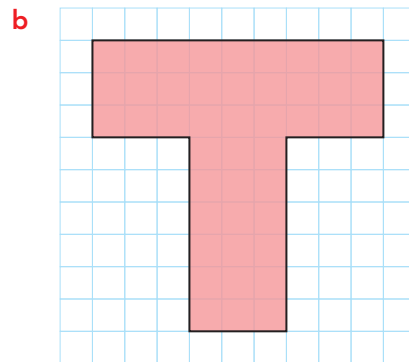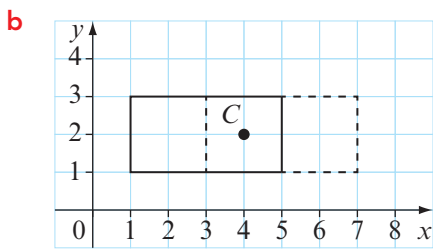
1 **a**

c

b

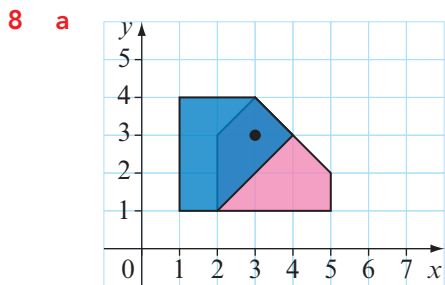**2** **a**
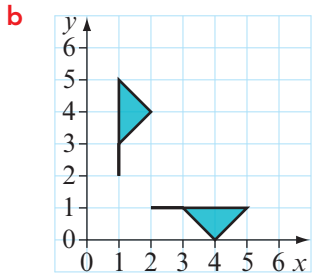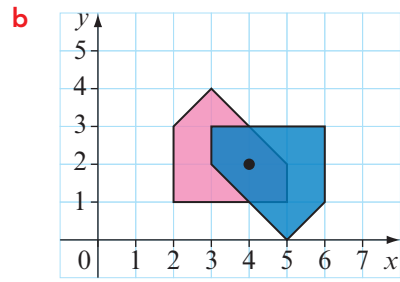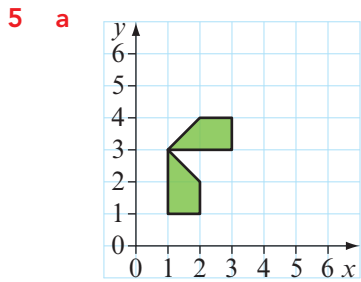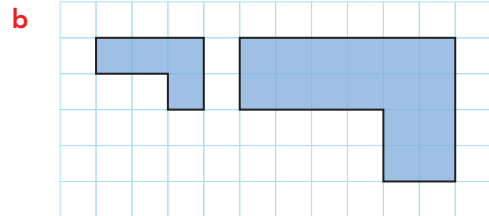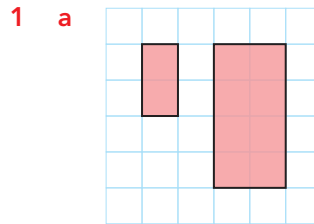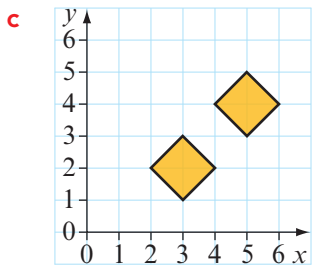
6 **a** 6 cm² **b** 12 cm² **c** 12 cm²

d No. For example: If you use a centre of rotation inside the rectangle, the image will overlap the object and so the combined area will be less than 12 cm².
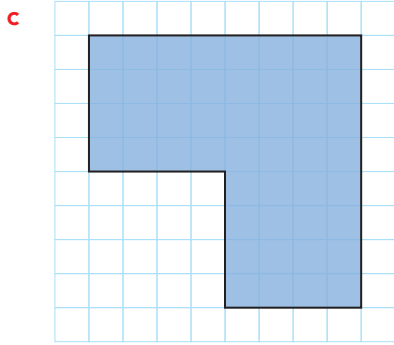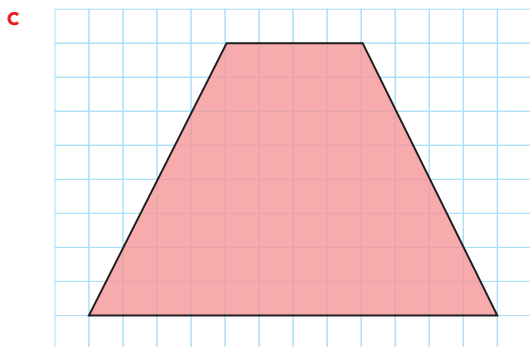
7 **a** 8 cm²

b

b

c 12 cm²

8 **a**

c
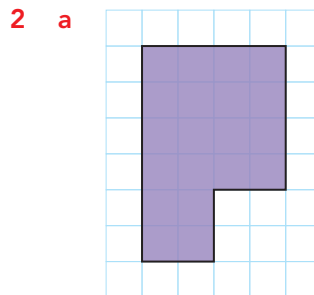
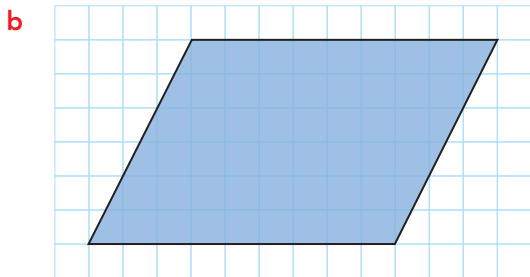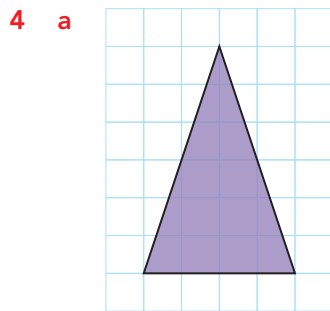**3 a** Example method: Enlarge straight edges first. Then, for each sloping edge, count the number of squares across and down (or up) and double these. Don't try to draw the sloping edges straight away but count squares across and down, put a point for the vertex, then join this point to the end of the previous edge.

b, **c** Learner's own answers.

4 a

b

c

5 a The bottom right vertex is in the incorrect place. Compared to the top right vertex,

it should be 3 squares right and 6 squares down, but it is actually 2 squares right and 6 squares down.

b
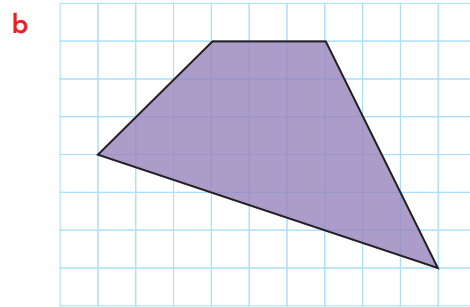
Activity 14.4

Learner's own answers.

6 scale factor 3

7 a The height of C is three times the height of A, but the base of C is <u>not</u> three times the base of A. $1 \times 3 = 3$ cm and $2 \times 3 = 6$ cm, not 5 cm.

b The height of D is four times the height of A, and the base of D is four times the base of A. $1 \times 4 = 4$ cm and $2 \times 4 = 8$ cm

8 a i 2   **ii** 3   **iii** 4

**b i** 6 cm   **ii** 12 cm

iii 18 cm   **iv** 24 cm

c

Rectangles	Scale factor of enlargement	Ratio of lengths	Ratio of perimeters
A : B	2	1 : 2	6 : 12 = 1 : 2
A : C	3	1 : 3	6 : 18 = 1 : 3
A : D	4	1 : 4	6 : 24 = 1 : 4

d The ratio of lengths is the same as the ratio of perimeters.

e Yes. For example: The perimeter is the total length of all the sides, so if all the lengths are multiplied by any scale factor, then the total will also be multiplied by the same scale factor.

Yes. For example: It doesn't matter what the shape is, the perimeter is always the total length of all the sides, and if the sides are all enlarged by a scale factor, then the perimeter will also increase by this scale factor.

Check your progress

1 a 4.8 m   **b** 14 cm

2 a 9 units   **b** 3 units

3 $P'(5, 6)$, $Q'(6, 8)$, $R'(5, 10)$, $S'(4, 8)$

4 a, b

5 a

b

6
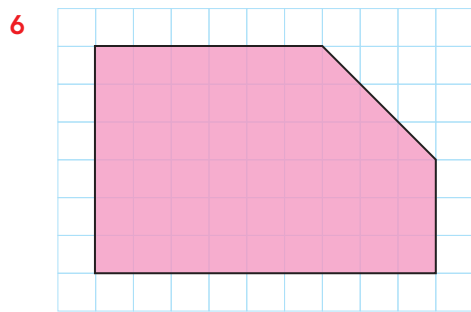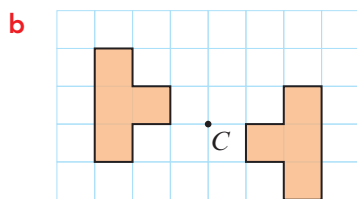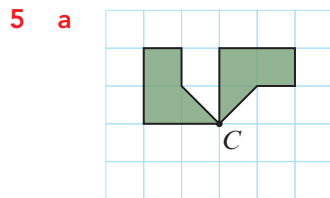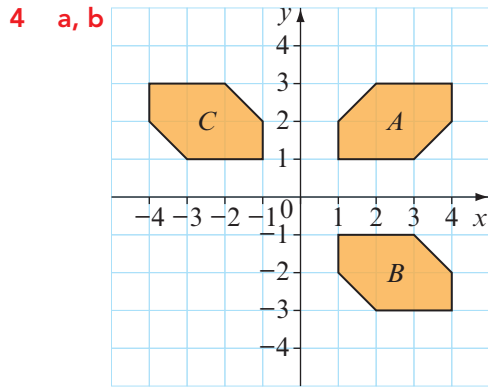
Unit 15 Getting started

1 a 700   **b** 2940   **c** 67

   d 45   **e** 2.5   **f** 0.07

2 a 2000   **b** 72 000   **c** 80 000

   d 37 000   **e** 6.78   **f** 0.54

3 a 36 cm^2 **b** 18 cm^2

Exercise 15.1

1 a mm^2 **b** cm^2

   c m^2 **d** m^2

2 a 800 mm^2 **b** 75 mm^2

   c 6 cm^2 **d** 0.45 cm^2

3 a 30 000 cm^2 **b** 81 000 cm^2

   c 7 m^2 **d** 0.078 m^2

4 Learner's own answer.

5 a 600   **b** 720   **c** 30 000

   d 54 000   **e** 9   **f** 8.65

   g 2   **h** 4.8   **i** 12.5

6 a Suyin is correct.

   b When Tam converted from mm^2 to cm^2, he divided by 10 instead of by 100.

   c Learner's own answer.

7 a 960 mm^2 **b** 9.6 cm^2

8 a 3560 mm^2 **b** 35.6 cm^2

9 No; $0.25 \times 1000 \times 1000 = 250\,000$.

10 a–c Learner's own answers.

Exercise 15.2

1 a 60 000 m^2 **b** 112 000 m^2

   c 6300 m^2

2 a 46 000 m^2 **b** 8000 m^2

   c 7500 m^2 **d** 250 m^2

3 a 7 ha   **b** 13.5 ha   **c** 0.8 ha

4 a 8.9 ha   **b** 24 ha

   c 0.09 ha   **d** 126.5 ha

5 a 429 000 m^2 **b** 42.9 ha

6 a 2.8 hectares

   b Yes, it will cost $34 720, which is more than $34 000.

7 a 7800 m^2 **b** 65 m

8 580 m^2

9 a, b Learner's own answers.

10 Area of land is 950 ha, which costs $4.94 million. The company can afford it because $4.94 million is less than $5 million.

Reflection: a, b Learner's own answers.

Exercise 15.3

1 a 5; 30 cm²   **b** 20; 70 m²

2 a 30 cm²   **b** 150 mm²

   c 88 m²   **d** 30 cm²

3 Yes, they will get the same answer because it doesn't matter when you divide by 2, as long as you do it once.

4 If one of the dimensions is an even number, it's easier to halve this first and then do the multiplication, so:

   a Marcus   **b** Sofia

   c Arun   **d** Marcus or Sofia

5 a 54 cm²   **b** 105 m²   **c** 17.5 cm²

6 a Budi has used the height as 9 cm and not 8 cm. The height must be the perpendicular height.

   b 48 cm²

7 400 mm²

8 5, 25; 6, 60; $25 + 60 = 85$ cm²

9 a 39 cm²   **b** 52 cm²

10 a 32 500 m²   **b** 585 kg   **c** $468

11 Natasha is correct; $20 \times 15 - 0.5 \times 18 \times 9 = 219$ cm².

12 18.5 cm²

13 No. If you double the base length of a triangle and double the height of the triangle, the area of the triangle will be four times as big because you are doubling both dimensions.

Exercise 15.4

1 a 27 cm³   **b** 125 m³

2 a 240 cm³   **b** 480 mm³

3 a 56 cm³   **b** 90 cm³   **c** 54 cm³

4 Steph didn't change 35 mm to 3.5 cm; volume = 378 cm³.

5

	Length	Width	Height	Volume
a	5 cm	12 mm	6 mm	3600 mm³
b	12 cm	8 cm	4 mm	38.4 cm³
c	8 m	6 m	90 cm	43.2 m³
d	1.2 m	60 cm	25 cm	180 000 cm³

6 a 4 cm

   b Top cuboid: $V = l \times w \times h = 5 \times 4 \times 3 = 60$ cm³

   Bottom cuboid: $V = l \times w \times h = 11 \times 4 \times 6 = 264$ cm³

   Volume of shape: $60 + 264 = 324$ cm³

7 a 786 m³   **b** 582 mm³

Activity 15.1

Learner's own answers.

8 a For example: Can take a long time, especially if the height is not an integer.

   b Divide by 21 or divide by 3 and then divide by 7.

9 5 mm

10 a 120 cm³

   b Any cuboid with volume 120 cm³.

   For example: 12 cm by 2 cm by 5 cm, 3 cm by 8 cm by 5 cm, 6 cm by 2 cm by 10 cm, 6 cm by 8 cm by 2.5 cm

11 26

12 a

Side length of cube	Volume of cube		
2 cm	2 × 2 × 2	2³	8 cm³
3 cm	3 × 3 × 3	3³	27 cm³
4 cm	4 × 4 × 4	4³	64 cm³
5 cm	5 × 5 × 5	5³	125 cm³

   b Yes; to find the volume of a cube, you work out the cube of the side length. So if you know the volume, you do the opposite and take the cube root of the volume to get the side length.

   c i 10 cm   **ii** 6 cm

Reflection: Learner's own answer.

Exercise 15.5

1 **a** $54\,cm^2$ **b** $150\,cm^2$

2 **a** x^2 or $x \times x$

b $6x^2$ or $6 \times x \times x$

c Learner's own answer.

3 **a** $82\,cm^2$ **b** $432\,mm^2$

4 **a** $228\,cm^2$

b $76\,cm^2$

c $160\,cm^2$

5 **a** Yes. You get the same answer when you add together the area of the three different faces then double the result as when you double all the areas of the three different faces then add them together.

b Learner's own answer.

6 **a** $1620\,mm^2$ **b** $16.2\,cm^2$

7 **a** 66 tins **b** $560.34

Activity 15.2

$1056\,cm^2$

8 **a** $64\,m^2$ **b** $8\,m$

9 $4\,cm$

10 Yes; $h = 900 \div 10 \div 15 = 6\,mm$, $2 \times 15 \times 6 + 2 \times 10 \times 6 + 2 \times 15 \times 10 = 600\,mm^2$.

Reflection: Learner's own answer.

Check your progress

1 **a** $800\,mm^2$

b $50\,000\,cm^2$

c $4.2\,cm^2$

2 **a** $30\,000\,m^2$ **b** $46\,000\,m^2$

c $8000\,m^2$ **d** $2\,ha$

e $9.4\,ha$ **f** $0.56\,ha$

3 **a** $54\,cm^2$ **b** $155\,mm^2$

4 **a** $144\,cm^3$ **b** $180\,cm^2$

5 Nawaf added the dimensions instead of multiplying; the units should be mm^3, not mm; volume $= 1440\,mm^3$.

Unit 16 Getting started

1 **a** 6 **b** banana **c** 25

2 **a** 8 **b** 7 **c** 25

3 **a** 13 **b** $200-400\,g$

c 5 **d** 50

4 **a** **i** 12 **ii** 15

b August **c** February to March

d For example: Sales in skateboards are increasing each month from January to August, then decreasing each month until December.

5 **a** Monday **b** Wednesday

c Tuesday and Thursday

d No. For example: the pie chart shows the proportion of emails Preety received, not the actual number.

6 **a** 24 years **b** 16 years

c 12 years **d** 30 years

7 Shape has two lines of symmetry and all angles are 90°: Rectangle, square Shape doesn't have two lines of symmetry and not all angles are 90°: Rhombus, trapezium, kite, parallelogram

8 **a** 19 **b** 21 **c** 7 **d** 12 **e** 9

Exercise 16.1

1 **a** 4 **b** 6 **c** 30 **d** 14

2

	Yes	No	Total
Men	16	7	23
Women	22	5	27
Total	38	12	50

3 No, there is enough information. The completed table is:

	Scarlets	Blues	Dragons	Total
Girls	8	4	3	15
Boys	5	8	4	17
Total	13	12	7	32

4 a

	Maths	Science	English	Other subject	Total
Girls	8	4	5	1	18
Boys	6	5	1	2	14
Total	14	9	6	3	32

b 5   **c** 3

5 Learner's own answers. Examples of answers are:

a Zara is correct, as there is only one set of data.

b Sofia could represent her data in a bar chart, showing months along the horizontal axis and number of books on the vertical axis.

Activity 16.1

Learner's own table. For example:

	2 p.m.	6 p.m.	Total
Adult	110	240	350
Child	325	125	450
Total	435	365	800

Learner's own answer.

6

	Car	Bus	Bicycle	Total
Male	7	8	5	20
Female	10	9	3	22
Total	17	17	8	42

7

	Brown	Blue	Other colour	Total
Girls	96	64	32	192
Boys	144	128	16	288
Total	240	192	48	480

Reflection: Learner's own answers.

Exercise 16.2

1 a Beth   **b** Duyen   **c** 2

d Learner's own answers.

e Yes, they all played ten matches. You add the number of matches each girl won and lost.

Activity 16.2

Learner's own table. For example:

	January	April	July	October
Harare	20°C	18°C	14°C	22°C
Cairo	12°C	20°C	28°C	20°C

2 a

Hair colour of the students in Miss Awan's class

b Learner's own answers.

3 a

How students in class 7P travel to school
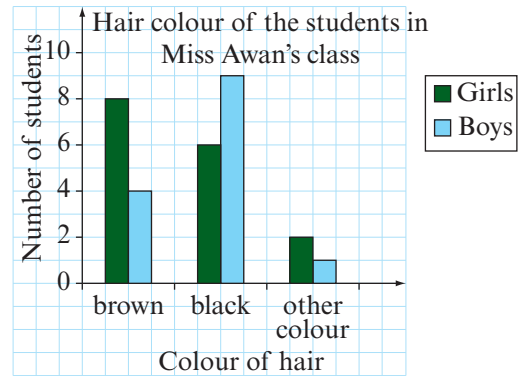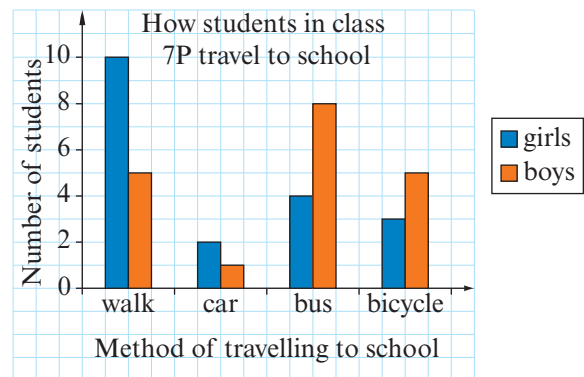
b Learner's own answers.

4 a Learner's own answer.

b Learner's own answer. For example: $42 - 28 = 14$

c Learner's own answer.

5 a i 4 hours   **ii** 4 hours

b 3 hours
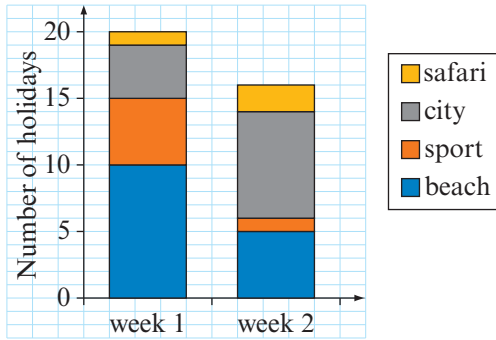
c 3 hours

6 a test 3

b tests 1 and 5

c Learner's own answers.

d Learner's own answer. For example: Chinara is better because she got a greater total score than Adaku OR Adaku is better because she got more consistent scores.

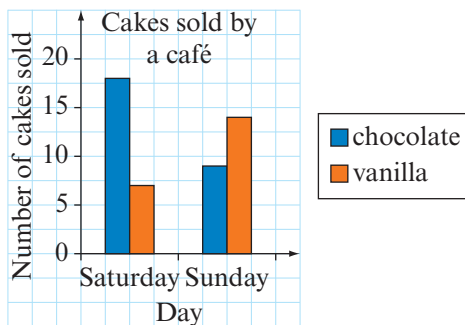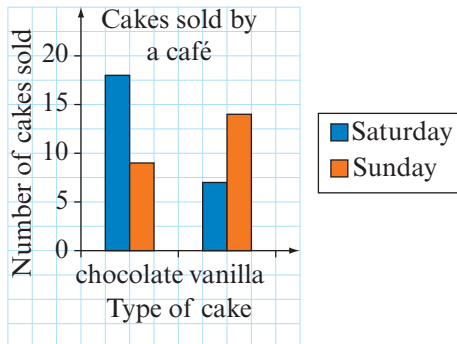**e** **i** $\frac{35}{50} = \frac{7}{10}$ **ii** 70%
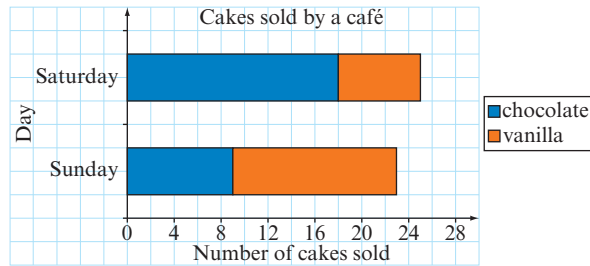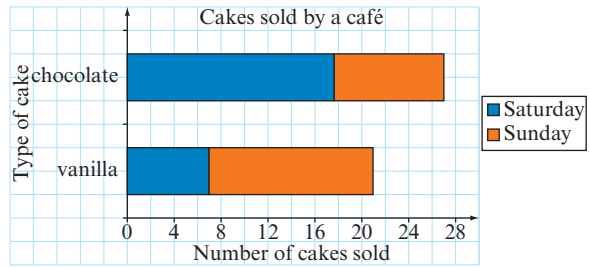
7

Number of holidays sold over two weeks

8

	Won	Lost	Drawn	Total
Barcelona	19	12	4	35
Real Madrid	16	9	10	35
Valencia	18	5	12	35
Total	53	26	26	105

9 **a** **i** Learner's own chart. For example:

ii Learner's own answer.

b **i** Learner's own chart. For example:

ii Learner's own answer.

c Learner's own answer.

Exercise 16.3

1 **a** Total number of cars $= 12 + 18 + 10 + 20 = \underline{60}$ cars

Number of degrees per car $= 360 \div \underline{60} = \underline{6}°$

Number of degrees for each sector:

Ford $= 12 \times \underline{6} = \underline{72}°$ Vauxhall $= 18 \times \underline{6} = \underline{108}°$

Toyota $= 10 \times \underline{6} = \underline{60}°$ Nissan $= 20 \times \underline{6} = \underline{120}°$

b **Different makes of car in a car park**

2 **Type of music**

b **Colour of car**
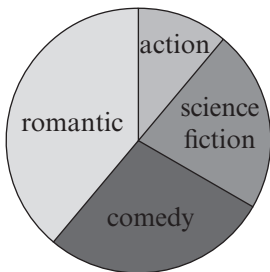

- red
- blue
- green
- yellow
- white
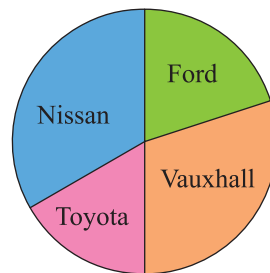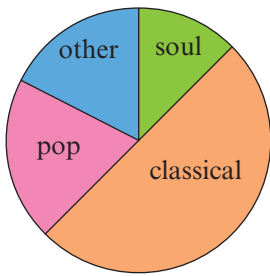
3 a almond   **b** $\frac{1}{3}$

 **c** 25%   **d** 30 litres

4 a **Favourite type of film**

b i Learner's own answer. For example: No, all you need is the number of degrees to draw the pie chart. There is only one value missing and you know the total is 360°, so the missing value is 140°.

  ii Learner's own answer. For example: Looking at action − 2 people = 40°, so 1 person = 20°. Science fiction: 80 ÷ 20 = 4 people; comedy: 100 ÷ 20 = 5 people.

  iii 18

5 a
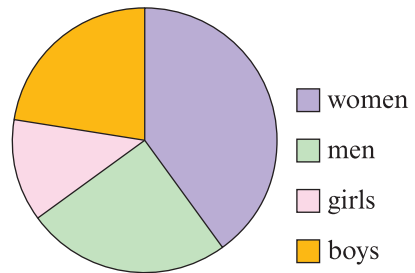
Colour of car	Number of cars
red	3
blue	5
green	8
yellow	1
white	7
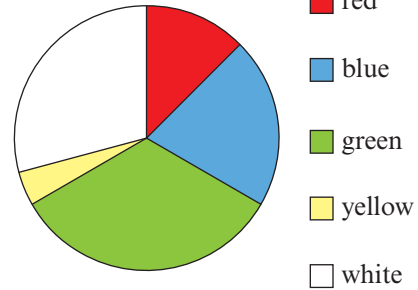
6 a **People at a tennis tournament**

- women
- men
- girls
- boys

b i Learner's own answer. For example: There is a total of 120 people in this diagram, so I worked out that it is 3° per person. (Other methods are to work out the fraction or percentage for each group, then work out the degrees.)
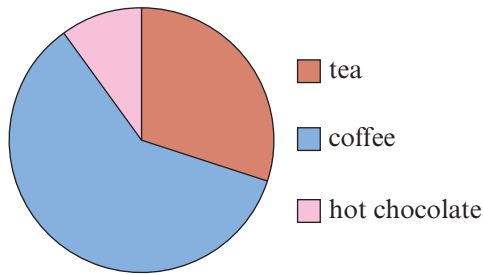
  ii, iii Learner's own answers.

7 a

Hot drink	Number of drinks	Percentage of total	Number of degrees
tea	45	$\frac{45}{150} \times 100 = 30\%$	30% of 360 = 108
coffee	90	$\frac{90}{150} \times 100 = 60\%$	60% of 360 = 216
hot chocolate	15	$\frac{15}{150} \times 100 = 10\%$	10% of 360 = 36
Total	150	100%	360

b Learner's own answer.

c   **Type of hot drinks sold in a café**

■ tea

■ coffee

■ hot chocolate

8   120° = 180 students, so 180 ÷ 120 = 1.5 students per degree.

120 + 42 + 90 + 38 = 290° so Other = 360 − 290 = 70°

70 × 1.5 = 105 students

Exercise 16.4

1 **a** India **b** 4.8 million tonnes

   c India produces 4.7 million tonnes <u>more</u> bananas than Brazil.

2 **a** 15% **b** 5%

   c No, half is 50%. 45% of trains arrive on time, this is less than half.

3 **a** 120 **b** 140 **c** crocodile

4 **a** **i** 84% **ii** 16%

      iii 12% **iv** 15%

   b 16 years old

   c Russia

   d India

   e South Korea has six times as many cars per 1000 people as China.

5 **a** 29% **b** relationships

   c **i** Speech bubbles get bigger as the percentage gets bigger.

      ii Learner's own answer.

6 Learner's own answer. For example: The youngest group has the largest percentage that don't visit the dentist. This could be because they don't think they need to or they don't have any problems with their teeth. As the people get older, they visit the dentist more often. This could be because they start to have problems with their teeth or they want to keep their teeth in good condition as they get older. The oldest

group has the largest percentage that have two or more visits to the dentist in a year.

7 Learner's own answers. For example: There is no key for the pictogram, so it is impossible to say how many people, or what percentage of people, missed a doctor's appointment. The chart for the missed nurses' appointments is very misleading because the heights of the cylinders do not represent the size of the percentages.

Activity 16.3

Learner's own answers.

Exercise 16.5

1 **a** Bar chart. For example: Discrete data. Easy to compare heights of bars.

   b Scatter graph. For example: Two sets of data points to compare. Easy to see if there is any correlation between the two sets of data.

   c Compound bar chart. For example: Easy to compare the total number of cakes, sandwiches and drinks sold in the café on the two different days. Can also compare the individual amounts.

   d Pie chart. For example: Shows clearly the proportions of students who travel to college by car, bus, bicycle or on foot.

2 **a** Learner's own Venn diagram.

   b Learner's own answer. For example: Best diagram to use to sort data into groups.

   c Learner's own answer. For example: Chloe is the only one who plays all three sports.

3 **a**

Amount of air in scuba tank over time
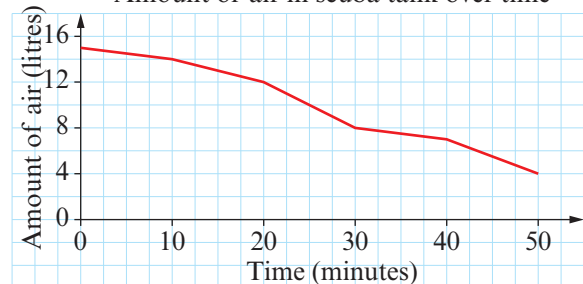
b Learner's own answer. For example: Line graph is best to show how something changes over time.

c Learner's own answer. For example: The 10-minute interval when the most air is used is between 20 and 30 minutes.
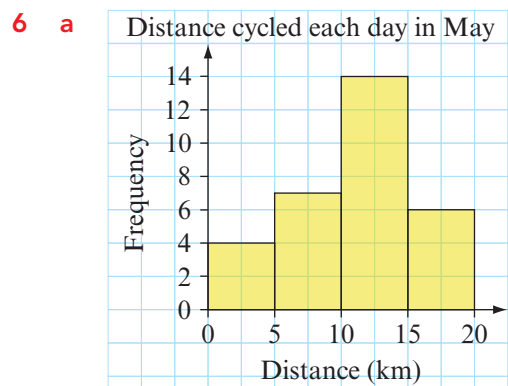
4 Learner's own answers. For example:

a i Easier to compare the individual types of appointments.

ii More difficult to compare the total number of appointments.

b i Easier to compare the total number of appointments.

ii More difficult to compare the individual types of appointments.

c i In general, to compare total amounts it is best to use a <u>compound chart</u>.

ii In general, to compare individual amounts it is best to use a <u>dual bar chart</u>.

5 a Learner's own answer. Example: You have two sets of data to compare.

b

Length and mass of 10 hedgehogs
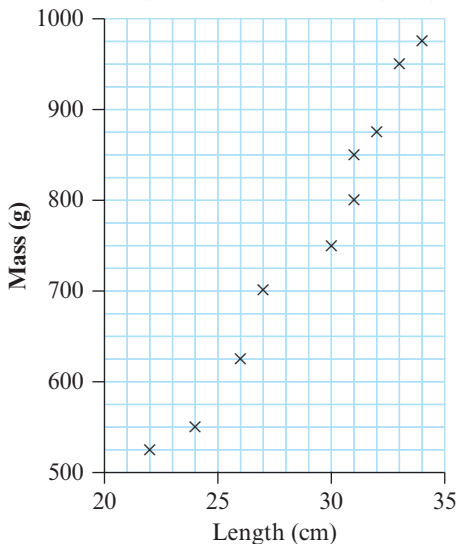
c Student's line of best fit.

d Correct reading from student's line of best fit.

6 a

Distance cycled each day in May

b Learner's own answer. For example: Data are continuous.

c Learner's own answer. For example: Most often Javed cycled between 10 and 15 km each day.

Activity 16.4

Learner's own answers. For example: Q1 infographic or pie chart; Q2 bar chart or pie chart; Q3 frequency diagram; Q4 Venn diagram. Learner's own poster. Learner's own answers.

7 a

Time to run 100 m and spelling test score
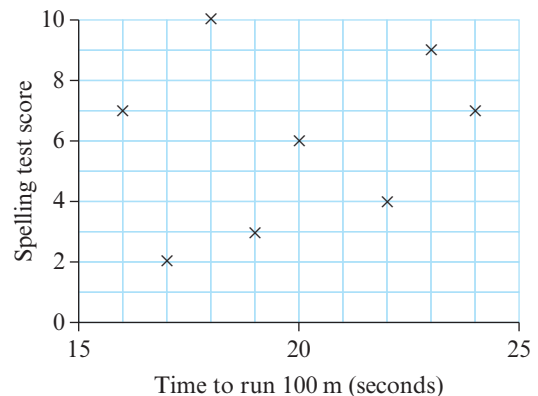
b Student's explanation. Example: You have two sets of data to compare.

c Student's comment. Example: The time it takes to run 100m doesn't seem to have any effect on the spelling test score.

Exercise 16.6

1 a i 2 minutes

ii 5 minutes

iii 5.3 minutes

b Learner's own answer, but either the median or the mean chosen (not the mode). Nine of the times are above 5 minutes and nine are below 5 minutes, so either 5 or 5.3 sit nicely in the middle of the data.

c 8 minutes

d May

2 a i 51 years

ii 53.5 years

iii 54 years

b Learner's own answer, but agree with Marcus. The median (53.5) and mean (54) sit nicely in the middle of the data, but the mode (51) is at the lower end of the data and doesn't represent the whole of the data.

c 9 years

d first

3 a Mode is zero days; median is 1 day; mean is 2.03 days.

b Learner's answers. For example: Choose the median, as there are as many values above as below. The mean is 2.03 but is affected by a few high values. The mode is too low, as there are 22 values higher than the mode and only 13 values that are lower than the mode.

c The median and the mean formulae are used in both.

4 Learner's own answer. For example: The most useful average is the mode, which is 38 cm because it is the most commonly sold belt (median = 38 cm, mean = 38.77).

5 a 20

b The modal number of people per car is 1 not 28; 28 is the largest frequency, not the number of people in the car.

c There are 60 cars. Half of 60 is 30. The first 28 cars have one person per car and the next 20 have two people per car. Therefore, the median must be 2 people.

d $1 \times 28 + 2 \times 20 + 3 \times 3 + 4 \times 6 + 5 \times 2 + 6 \times 1 = 117$, $117 \div 60 = 1.95$

e Learner's own answer. Could choose mean, median or mode with an appropriate reason.

6 mode = 10, median = 9, mean = 8.4

a i 40 **ii** none **iii** 70

b Learner's own answer, but mean or median chosen. For example: Mean is best because there are 70 above and 50 below the mean, so it sits quite centrally in the whole data. For example: Median is best because there are 40 above and 50 below, so it sits quite centrally in the whole data.

7 a 2 **b** 12

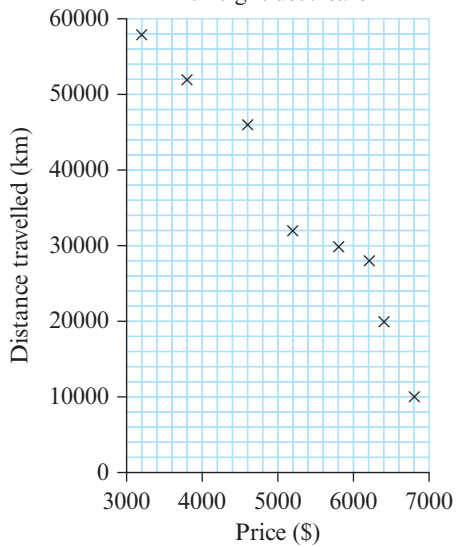**c–g** Learner's own answers

Check your progress

1 a

	Red	Blue	Green	Other colour	Total
Girls	9	4	3	2	18
Boys	4	8	1	3	16
Total	13	12	4	5	34

b 1 **c** 5

2 a 5 **b** 2 **c** 2 **d** 32

e i chocolate **ii** vanilla

iii chocolate

3 a Pie chart. For example: Clearly shows the proportions.

b Line graph. For example: Shows how the sales of DVDs change over time.

c Bar chart. For example: Discrete data. Easy to compare heights of bars.

d Frequency diagram. For example: Data are continuous.

4 a mango juice **b** lime juice

c 150 mL **d** 100 mL

e $\dfrac{1}{3}$

5 **Favourite type of transport**

- car
- bus
- train
- bicycle
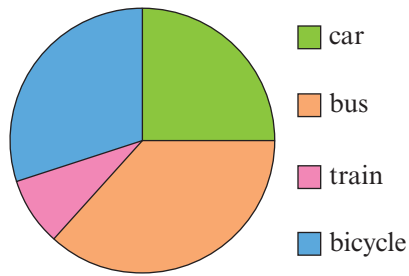
6 **a**

Price and distance travelled of eight used cars

b Learner's own answers. Example: There are two sets of data to compare.

c Learner's own comment. Example: The further the car has travelled, the cheaper the price of the car.

7 **a** **i** 40%   **ii** 20%

b 340 000

c China produces three times as much electricity from wind power as USA.

8 **a** There are three modes: $26 000, $29 000 and $30 000. The median is $29 500. The mean is $32 700.

b Learner's own answer, but median chosen. For example: Median is best because there are five salaries above and five below, so it sits centrally in the whole data. The mean is too high, as it has been affected by two very high values. There are three modes, so these aren't useful.