

Learner's Book

answers

Unit 1 Getting started

- 1 a 144 b 9
c 125 d 4
- 2 a 512 b 128
- 3 a 15^7 b 15^3
- 4 a 4 and 3000 and $\sqrt{225}$
b All of them.
- 5 10^6

Exercise 1.1

- 1 a integer 3 b irrational
c irrational d integer 7
e irrational
- 2 a $\sqrt{1}$, $7\frac{5}{12}$, -38 and $-\sqrt{2.25}$ are rational.
b $\sqrt{200}$ is the only irrational number.
- 3 a integer b surd c surd
d integer e integer f surd
- 4 a irrational because $\sqrt{2}$ is irrational
b rational because it is equal to $\sqrt{4} = 2$
c irrational because $\sqrt[3]{4}$ is irrational
d rational because it is equal to $\sqrt[3]{8} = 2$
- 5 a Learner's own answer. For example: $\sqrt{2}$ and $-\sqrt{2}$.
b Learner's own answer. For example: $\sqrt{2}$ and $2 - \sqrt{2}$
- 6 a i 4 ii 6
iii 10 iv 6
b They are all positive integers.
c Learner's own answer.
d Learner's own answer.
- 7 a $7^2 = 49$ and $8^2 = 64$
b $4^3 = 64$ and $5^3 = 125$
- 8 a The square root of any integer between 16 and 25 is a possible answer.
b The square root of any integer between 144 and 169 is a possible answer.
- 9 a 14
b 6
- 10 a i 1 ii 2 iii 3
b $(\sqrt{5} + 1) \times (\sqrt{5} - 1) = 4$, and so on
c $(\sqrt{N} + 1) \times (\sqrt{N} - 1) = N - 1$
d Learner's own answer.
- 11 a No. It is not a repeating pattern.
b Learner's own answer.

Reflection:

- a i true ii true iii false
b No. It might be a repeating pattern or it might not.

Exercise 1.2

- 1 a 3×10^5 b 3.2×10^5
c 3.28×10^5 d 3.2871×10^5
- 2 a 6.3×10^7 b 4.88×10^8
c 3.04×10^6 d 5.2×10^{11}
- 3 a 5400 b 1410000
c 23 370 000 000 d 87 250 000
- 4 Mercury 5.79×10^7 km; Mars 2.279×10^8 ; Uranus 2.87×10^9
- 5 a Russia b Indonesia
c The largest country is approximately 9 times larger than the smallest country.
- 6 a 7×10^{-6} b 8.12×10^{-4}
c 6.691×10^{-5} d 2.05×10^{-7}

- 7 a** 0.0015 **b** 0.00001234
c 0.000000079 **d** 0.0009003
- 8 a** 30 **b** 9.11×10^{-25} kg
- 9 a** z **b** y
- 10 a** 65 is not between 1 and 10.
b 6.5×10^5
c 4.83×10^7
- 11 a** 1.5×10^{-2}
b 2.73×10^{-3}
c 5×10^{-8}
- 12 a** 6.1×10^6
b 6.17×10^5
c 1.75×10^5
- 13 a** 7.6×10^{-6}
b 8.02×10^{-5}
c 1.6×10^{-7}
- 14 a i** 7×10^6 **ii** 3.4×10^7
iii 4.1×10^{-4} **iv** 1.37×10^{-3}
b To multiply a number in standard form by 10, you add 1 to the index.
c To multiply a number in standard form by 1000, you add 3 to the index. To divide a number in standard form by 1000, you subtract 3 from the index.

Reflection: You can compare them easily. You can write the number without using a lot of zeros. You can enter them in a calculator.

Exercise 1.3

- 1 a** $\frac{1}{4}$ **b** $\frac{1}{8}$ **c** $\frac{1}{81}$
d $\frac{1}{216}$ **e** $\frac{1}{10\,000}$ **f** $\frac{1}{32}$
- 2** 3^{-3} , 2^{-4} and 4^{-2} are equal, 5^{-1} , 6^0
- 3 a** 2^{-1} **b** 2^{-2} **c** 2^6
d 2^{-6} **e** 2^0 **f** 2^{-3}
- 4 a** 10^2 **b** 10^3 **c** 10^0
d 10^{-1} **e** 10^{-3} **f** 10^{-6}
- 5 a** 64^{-1} **b** 8^{-2}
c 4^{-3} **d** 2^{-6}
- 6 a** 3^{-4} or 9^{-2} or 81^{-1}
b The three ways in part a.

- 7 a** 36 **b** $\frac{1}{36}$ **c** 1 **d** $\frac{1}{216}$
- 8 a** $\frac{1}{81}$ **b** $\frac{1}{225}$ **c** 1 **d** $\frac{1}{400}$
- 9 a i** 2 **ii** $4\frac{1}{4}$ **iii** $9\frac{1}{9}$
b i $x=5$ **ii** $x=10$
- 10 a i** 3^5 **ii** 3^9
iii 3^{10} **iv** 3^6
b i 3 **ii** 3^{-1} **iii** 3^2
iv 3^{-2} **v** 3^{-3}
c Learner's own answers.
d Learner's own answers.
- 11 a** 5^6 **b** 5^2 **c** 5^{-2} **d** 5^{-6}
- 12 a** 6^{-1} **b** 7^3
c 11^{-10} **d** 4^{-4}
- 13 a** $x=4$ **b** $x=6$
c $x=-2$ **d** $x=5$
- 14 a i** 2^2 **ii** 4^3
iii 5^1 or 5 **iv** 2^3
b Learner's own answers.
c Learner's own answers.
- 15 a** 6^{-3} **b** 9^{-1}
c 15^{-4} **d** 10^{-5}
- 16 a** 2^5 **b** 8^7
c 5^{-6} **d** 12^2
- 17 a** 2^6 **b** 2^{-6} **c** 3^6
d 3^{-6} **e** 9^3 **f** 9^{-3}

Check your progress

- 1 a** rational **b** irrational
c rational **d** irrational
e rational
- 2 a** rational because it is equal to $\sqrt{25} = 5$
b irrational because it is $3 + \sqrt{7}$ and $\sqrt{7}$ is a surd
- 3** $n=3$
- 4 a** 8.6×10^{10} **b** 6.45×10^{-6}
- 5** C, D, A, B
- 6 a** $\frac{1}{49}$ **b** $\frac{1}{81}$ **c** $\frac{1}{128}$

- 7 a 5^3 b 5^0 c 5^{-2}
 8 a 6^5 b 12^{-5}
 c 4^{-6} d 15^2

Unit 2 Getting started

- 1 $\frac{x}{3} + 7$
 2 a $3^2 \times 3^4 = 3^6$ b $\frac{5^{12}}{5^9} = 5^3$
 c $(7^2)^5 = 7^{10}$
 3 a $x^2 + 2x$ b $12y^2 - 21yw$
 4 a $4(x+3)$ b $2x(2x+7)$
 5 a $\frac{17}{12}$ or $1\frac{5}{12}$ b $\frac{6}{5}$ or $1\frac{1}{5}$
 6 a $F=25$ b $a=\frac{F}{m}$
 c $a=6$

Exercise 2.1

- 1 a $x - 2y = 3 - 2 \times 5$
 $= 3 - 10$
 $= -7$
 b $x^3 + xy = 3^3 + 3 \times 5$
 $= 27 + 15$
 $= 42$
 c $y^2 - \frac{10x}{y} = (5)^2 - \frac{10 \times 3}{5}$
 $= 25 - \frac{30}{5}$
 $= 25 - 6$
 $= 19$
 2 a 9 b 4 c 9
 d 8 e 8 f 30
 g 5 h 47 i -30
 j -4
 3 a Learner's own answers. For example:
 i $a=3, b=10, c=12, d=2$
 ii $a=-3, b=-10, c=-12, d=-2$
 iii $a=3, b=4, c=-36, d=3$
 b Learner's own answers.
 c Learner's own answers.

- 4 a Learner's own answers.
 For example: Part a is incorrect as -3^2 should be written as $(-3)^2$, which is 9 and not -9; part b is incorrect as $(-2)^3$ is -8 and not 8.
 b Learner's own answer.
 5 a $x=1$ and $y=14$, $x=2$ and $y=11$, $x=3$ and $y=6$
 b Learner's own answer. For example: $x=-4$ and $y=-1$, $x=-5$ and $y=-10$, $x=-6$ and $y=-21$
 c Learner's own answer. For example: $x=-1$ and $y=14$, $x=-2$ and $y=11$, $x=-3$ and $y=6$ or $x=4$ and $y=-1$, $x=5$ and $y=-10$, $x=6$ and $y=-21$
 6 a $4(m+2p) = 4(2+2 \times -4)$
 $= 4(2-8)$
 $= 4 \times -6$
 $= -24$
 b $p^3 - 3mp = (-4)^3 - 3 \times 2 \times -4$
 $= -64 + 24$
 $= -40$
 c $\left(\frac{p}{m}\right)^5 + (p)^3 = \left(\frac{-4}{2}\right)^5 + (-4)^3$
 $= (-2)^5 - 64$
 $= -32 - 64$
 $= -96$
 7 a 21 b 36 c 16
 d 64 e 68 f -18
 g 14 h -25 i -7
 j 82

Activity 2.1

Learner's own answer.

- 8 Learner's own counter-examples.
 a For example: When $x=2$,
 $3x^2 = 3 \times 2^2 = 3 \times 4 = 12$, and
 $(3x)^2 = (3 \times 2)^2 = 6^2 = 36$, and $12 \neq 36$
 b For example: When $y=2$, $(-y)^4 = (-2)^4 = 16$
 and $-y^4 = -2^4 = -16$, and $16 \neq -16$
 c For example: When $x=3$ and $y=4$,
 $2(x+y) = 2(3+4) = 2 \times 7 = 14$ and
 $2x+y = 2 \times 3 + 4 = 10$, and $14 \neq 10$
 9 a 26
 b 49

$$10 \quad 5a^2 - 9(b-a) + \frac{2}{b^5} + 7ab = 5 \times (-2)^2 - 9(-1 - -2) +$$

$$\frac{2}{(-1)^5} + 7 \times -2 \times -1$$

$$= 5 \times 4 - 9 \times 1 + \frac{2}{-1} + 14$$

$$= 20 - 9 - 2 + 14$$

$$= 23$$

$$\frac{-5a}{b} - 6a^3 - (ab)^4 + \frac{9}{b^2 - a^3} = \frac{-5 \times -2}{-1} - 6(-2)^3 -$$

$$(-2 \times -1)^4 + \frac{9}{(-1)^2 - (-2)^3}$$

$$= \frac{10}{-1} - 6 \times -8 - (2)^4 + \frac{9}{1+8}$$

$$= -10 + 48 - 16 + \frac{9}{9}$$

$$= 22 + 1$$

$$= 23$$

Reflection: Learner's own answers.

Exercise 2.2

1 a $n + 5$

b $5n - 5$

c $\frac{n}{5} + 5$

d $5(n+5)$

e $\frac{n-5}{5}$

f $5 - n$

2 a $7x$

b $20 - x$

c $2x + 9$

d $\frac{x}{6} - 4$

e x^2

f $\frac{100}{x}$

g $5(x-7)$

h \sqrt{x}

i x^3

j $\sqrt[3]{x}$

k $(3x)^2 + 7$ or $9x^2 + 7$

l $(2x)^3 - 100$ or $8x^3 - 100$

3 a i $2x + 2y$

ii xy

b i $6x + 2y$

ii $3xy$

c i $6x + 4y$

ii $6xy$

d i $4x$

ii x^2

e i $8x$

ii $4x^2$

f i $2x^2 + 4x$

ii $2x^3$

4 a Perimeter = $2(x+5) + 2(2x) = 2x + 10 + 4x = 6x + 10$

b Learner's own answer.

c Length of rectangle = $x + 5 = 3 + 5 = 8$

Width of rectangle = $2x = 2 \times 3 = 6$

Perimeter = $2 \times \text{length} + 2 \times \text{width} = 2 \times 8 + 2 \times 6 = 28$

Area = length \times width = $8 \times 6 = 48$

d Perimeter = $6x + 10 = 6 \times 3 + 10 = 28$

Area = $2x^2 + 10x = 2 \times 3^2 + 10 \times 3 = 18 + 30 = 48$

e Learner's own answer.

5 a i $P = 2x + 10$

ii $A = 3x + 6$

iii When $x = 4$, $P = 18$ and $A = 18$

b i $P = 2y - 4$

ii $A = 4y - 24$

iii When $y = 10$, $P = 16$ and $A = 16$

c i $P = 4n + 8$

ii $A = n^2 + 4n$

iii When $n = 6$, $P = 32$ and $A = 60$

d i $P = 2p^2 + 8p$

ii $A = 4p^3$

iii When $p = 2$, $P = 24$ and $A = 32$

6 a i 2 red + 2 yellow = 4 green;
both = $8x + 4$

ii 3 red + 3 yellow = 6 green;
both = $12x + 6$

iii 4 red + 4 yellow = 8 green;
both = $16x + 8$

b n red + n yellow = $2n$ green (or similar explanation given in words)

c i 6 red + 2 yellow = 12 blue;
both = $12x + 12$

ii 9 red + 3 yellow = 18 blue;
both = $18x + 18$

iii 12 red + 4 yellow = 24 blue;
both = $24x + 24$

d $3n$ red + n yellow = $6n$ blue (or similar explanation given in words)

e Learner's own answer.

7 a $(3w)^2 = 36$, $2v(3v-2w) = 30$, $5w(w+v) = 50$

b 116

c $(3w)^2 + 2v(3v-2w) + 5w(w+v) = 9w^2 + 6v^2 - 4vw + 5w^2 + 5vw = 14w^2 + vw + 6v^2$

d 116

- 8 a** $3a^2 - 7b = 61$, $8b - 3a = 31$, $a^2 + 6b = 37$,
 $4(a + 3b) = 4$
b 133
c $3a^2 - 7b + 8b - 3a + a^2 + 6b + 4(a + 3b) =$
 $4a^2 + 7b - 3a + 4a + 12b = 4a^2 + a + 19b$
d 133
e 11
f Not valid because although the perimeter is positive, three of the side lengths are negative, which is not possible.
- 9 a** $2(3x^2 + 4) + 2(5 - x^2)$ or
 $3x^2 + 4 + 3x^2 + 4 + 5 - x^2 + 5 - x^2$
b $2(3x^2 + 4) + 2(5 - x^2) =$
 $6x^2 + 8 + 10 - 2x^2 = 4x^2 + 18 = 2(2x^2 + 9)$
or $3x^2 + 4 + 3x^2 + 4 + 5 - x^2 + 5 - x^2 =$
 $4x^2 + 18 = 2(2x^2 + 9)$
c Arun is correct. Learner's own explanation.
 For example: The variable x only appears in the expression for the perimeter when it is squared. When you square 2 and -2 you get the same answer.
or: $2(2(-2)^2 + 9) = 2(2 \times 4 + 9) =$
 $2(8 + 9) = 34$
and $2(2(2)^2 + 9) = 2(2 \times 4 + 9) =$
 $2(8 + 9) = 34$

- 10 a** Side length $= \sqrt{25} = 5$ cm,
 Perimeter $= 4 \times 5 = 20$ cm
b Side length $= \sqrt{49} = 7$ cm,
 Perimeter $= 4 \times 7 = 28$ cm
c Perimeter $= 4 \times \sqrt{x}$ or $4\sqrt{x}$
- 11 a** Volume $= x^3$
b Side length $= \sqrt[3]{y}$

Exercise 2.3

- 1 a** $x^4 \times x^5 = x^{4+5}$
 $= x^9$
b $y^2 \times y^4 = y^{2+4}$
 $= y^6$
c $u^8 \div u^6 = u^{8-6}$
 $= u^2$
d $w^5 \div w = w^{5-1}$
 $= w^4$
e $(g^3)^2 = g^{3 \times 2}$
 $= g^6$
f $(h^5)^{12} = h^{5 \times 12}$
 $= h^{60}$
g $5m^3 + 3m^3 = 8m^3$
h $8n^2 - n^2 = 7n^2$

- 2 a** m^{14} **b** n^{12} **c** p^7
d q^5 **e** r^3 **f** t^5
g x^{21} **h** y^{10} **i** z^{12}
j $5t^7$ **k** $5g^2$ **l** $-h^9$

- 3 a** Sofia is correct. $x^2 \div x^2 = x^{2-2} = x^0 = 1$

b Learner's own answer.

c $x^2 \div x^2 = 1$

d All the answers are 1. Learner's own explanations. For example:

When simplified, all the expressions have an index of 0, and anything to the power of 0 = 1.

or Any expression divided by itself, always gives an answer of 1.

- 4 a** $6x^5$ **b** $12y^9$ **c** $30z^7$
d $4m^7$ **e** $4n^{13}$ **f** $8p^3$

5 a Learner's own answer.

b Learner's own answer.

c Learner's own answer.

Sasha's method would be easiest to use to simplify these expressions:

$$4x^5 \div 6x^3 = \frac{4x^5}{6x^3} = \frac{2x^2}{3},$$

$$12y^7 \div 8y^6 = \frac{12y^7}{8y^6} = \frac{3y}{2} \text{ and}$$

$$6z^9 \div 36z^4 = \frac{6z^9}{36z^4} = \frac{z^5}{6}.$$

- 6 a** $3q^4$ **b** $3r^4$ **c** $3t^6$
d $2u^5$ **e** $2v^4$ **f** $5w$
- 7 a** **D** $\frac{1}{2}x^3$ **b** **A** $\frac{2}{5}y^6$
c **C** $\frac{5}{3}k$ **d** **B** $3\frac{1}{3}$

8 a Arun is correct. Learner's own explanation. For example:

$$(3x^2)^3 = 3^3 \times (x^2)^3 = 27 \times x^6 = 27x^6$$

$$\text{or } (3x^2)^3 = 3x^2 \times 3x^2 \times 3x^2 =$$

$$3 \times 3 \times 3 \times x^2 \times x^2 \times x^2 = 27 \times x^6 = 27x^6$$

or $(3x^2)^3$ means everything inside the bracket must be cubed. That means the 3 must be cubed as well as the x^2 .

- b i** $16x^{10}$ **ii** $125y^{12}$
iii $16z^{28}$

Activity 2.3

- a** Learner's own spider diagram.
b There are many possible expressions.
 For example:

$$3x^2 \times 12x^{10}$$

$$4x^8 \times 9x^4$$

$$36x^{14} \div x^2$$

$$72x^{20} \div 2x^8$$

$$(6x^6)^2$$

$$36(x^3)^4$$

- c** Learner's own answers.

9 a $q^{-3} = \frac{1}{q^3}$ **b** $r^{-2} = \frac{1}{r^2}$

c $t^{-5} = \frac{1}{t^5}$ **d** $v^{-1} = \frac{1}{v}$


- 10 a** **A** and **iii**, **B** and **iv**, **C** and **i**, **D** and **vii**,
E and **vi**, **F** and **v**.


- b** Learner's own answer. Any expression
 that simplifies to give $\frac{1}{6y^7}$.


For example: $\frac{5y^2}{30y^9}$


Reflection: Learner's own answers.

Exercise 2.4

1 a  $= x^2 + 1x + 4x + 4$
 $= x^2 + 5x + 4$

b  $= x^2 + 6x - 3x - 18$
 $= x^2 + 3x - 18$

c  $= x^2 - 8x + 2x - 16$
 $= x^2 - 6x - 16$

d  $= x^2 - x - 4x + 4$
 $= x^2 - 5x + 4$

2 a $x^2 + 10x + 21$ **b** $x^2 + 11x + 10$

c $x^2 + 2x - 15$ **d** $x^2 + 4x - 32$

e $x^2 - 9x + 14$ **f** $x^2 - 14x + 24$

- 3 a** Learner's own answers and explanations.
b Learner's own answers and explanations.
c Learner's own answer.

4 a $y^2 + 6y + 8$ **b** $z^2 + 14z + 48$

c $m^2 + m - 12$ **d** $a^2 - 7a - 18$

e $p^2 - 11p + 30$ **f** $n^2 - 30n + 200$

- 5 a** The plus at the end would change
 to a minus and the 9 changes to a 1.
 $x^2 + 1x - 20$

- b** The plus at the end would change to
 a minus and the 9 changes to a -1.
 $x^2 - 1x - 20$

- c** The plus in the middle would change to a
 minus. $x^2 - 9x + 20$

d i $(x+A)(x+B) = x^2 + Cx + D$

ii $(x+A)(x-B) = x^2 + Cx - D$

iii $(x-A)(x+B) = x^2 - Cx + D$

iv $(x-A)(x-B) = x^2 - Cx - D$

6 a **C** $w^2 + 12w + 27$ **b** **A** $x^2 + 2x - 35$

c **B** $y^2 - 2y - 48$ **d** **A** $z^2 - 9z + 20$

7 a $(x+2)^2 = (x+2)(x+2)$
 $= x^2 + 2x + 2x + 4$
 $= x^2 + 4x + 4$

b $(x-3)^2 = (x-3)(x-3)$
 $= x^2 - 3x - 3x + 9$
 $= x^2 - 6x + 9$

8 a i $y^2 + 10y + 25$

ii $z^2 + 2z + 1$

iii $m^2 + 16m + 64$

iv $a^2 - 4a + 4$

v $p^2 - 8p + 16$

vi $n^2 - 18n + 81$

b $(x+a)^2 = x^2 + 2ax + a^2$

9 a $(x+3)(x-3) = x^2 + 3x - 3x - 9 = x^2 - 9$

b i $x^2 - 4$

ii $x^2 - 25$

iii $x^2 - 49$

- c** There is no term in x , and the number
 term is a square number.

d $x^2 - 100$

e $x^2 - a^2$

Activity 2.4

- a** ① $33 \times 29 = 957$, ② $28 \times 34 = 952$,
 ③ $957 - 952 = 5$

- b** ① $16 \times 12 = 192$, ② $11 \times 17 = 187$,
③ $192 - 187 = 5$

c The answer is always 5.

d

n	$n + 1$
$n + 5$	$n + 6$

- e** ① $(n + 5)(n + 1) = n^2 + 6n + 5$,
② $n(n + 6) = n^2 + 6n$,
③ $n^2 + 6n + 5 - (n^2 + 6n) =$
 $n^2 + 6n + 5 - n^2 - 6n = 5$

The answer is always 5.

Learner's own answer.

Exercise 2.5

1 a $\frac{2x}{5}$ **b** $\frac{4x}{7}$

c $\frac{8}{x}$ **d** x

e $\frac{2x}{5}$ **f** $\frac{4}{x}$

2 a $\frac{2y}{5} + \frac{3y}{10} = \frac{4y}{10} + \frac{3y}{10} = \frac{7y}{10}$

b $\frac{2}{5y} - \frac{1}{25y} = \frac{10}{25y} - \frac{1}{25y} = \frac{9}{25y}$

c $\frac{3y}{4}$ **d** $\frac{3y}{8}$

e $\frac{11}{9y}$ **f** $\frac{3y}{14}$

3 a $\frac{a}{2} + \frac{a}{5} = \frac{5a}{10} + \frac{2a}{10}$
 $= \frac{5a + 2a}{10}$
 $= \frac{7a}{10}$

b $\frac{b}{4} + \frac{b}{3} = \frac{3b}{12} + \frac{4b}{12}$
 $= \frac{3b + 4b}{12}$
 $= \frac{7b}{12}$

c $\frac{5}{7c} + \frac{2}{5c} = \frac{25}{35c} + \frac{14}{35c}$
 $= \frac{25 + 14}{35c}$
 $= \frac{39}{35c}$

d $\frac{5d}{6} - \frac{3d}{5} = \frac{25d}{30} - \frac{18d}{30}$
 $= \frac{25d - 18d}{30}$
 $= \frac{7d}{30}$

e $\frac{7e}{8} - \frac{2e}{3} = \frac{21e}{24} - \frac{16e}{24}$
 $= \frac{21e - 16e}{24}$
 $= \frac{5e}{24}$

f $\frac{9}{10f} - \frac{3}{4f} = \frac{18}{20f} - \frac{15}{20f}$
 $= \frac{18 - 15}{20f}$
 $= \frac{3}{20f}$

4 a A, D, F **b** B, C, E

c G; the answer is $\frac{x}{3}$

5 a $\frac{1}{2} + \frac{2}{6} = \frac{3}{6} + \frac{2}{6} = \frac{5}{6}$

b $\frac{1+2}{2} = \frac{3}{2} = 1\frac{1}{2}$

c $\frac{5}{6} \neq 1\frac{1}{2}$

d She cannot cancel the 3 with the 6, because the expression is $3x + y$, all divided by 6, not just $3x$ divided by 6.

$$\frac{x}{2} + \frac{y}{6} = \frac{3x}{6} + \frac{y}{6} = \frac{3x + y}{6}$$

e Learner's own answer.

f i correct

ii incorrect. Learners should show that the correct answer is $\frac{4x - y}{10}$

iii correct

iv incorrect. Learners should show that the correct answer is $\frac{9x - 8}{20}$

6 a i $\frac{a+b}{5}$ **ii** $\frac{5a+9b}{12}$

iii $\frac{2a+9}{15}$ **iv** $\frac{ab+12}{4b}$

v $\frac{3ab+40}{10b}$ **vi** $\frac{8ab+27}{18b}$

b Learner's own checks.

Activity 2.5

Learner's own answers.

7 a $\frac{6 \times 3 + 2}{2} = \frac{18 + 2}{2} = \frac{20}{2} = 10$

b $3 \times 3 + 1 = 9 + 1 = 10$

c $10 = 10$

d Learner's own explanation. For example: He factorises the bracket to give $2 \times \text{bracket}$, which is then divided by 2. The $\times 2$ and $\div 2$ cancel each other out, leaving just the bracket.

e When $x = 3$, $6 \times 3 + 1 = 18 + 1 = 19$, $19 \neq 10$, so the answer is wrong.

Learner's own explanation. For example: The expression shows that $6x + 2$ must all be divided by 2.

Arun has only divided the 2 in the numerator by 2, and not the $6x$ by 2 as well.

f Learner's own answer.

8 a $2x + 1$ **b** $x + 2$

c $2x - 3$ **d** $2x - 5$

$$9 \quad \frac{6x-4}{2} + \frac{20x+25}{5} = \frac{2(3x-2)}{2} + \frac{5(4x+5)}{5} = 3x-2+4x+5=7x+3$$

$$10 \text{ a } 2(x+3)=2 \times x+2 \times 3=2x+6$$

b Learner's own choice and explanation.

c i $2(x+3)$ or $2x+6$

ii $2(x+2)$ or $2x+4$

iii $4(x-3)$ or $4x-12$

iv $3(1-3x)$ or $3-9x$

Reflection: Learner's own answers.

Exercise 2.6

1 a $S=60M$

b $S=900$

c $M=\frac{S}{60}$

d $M=22.5$

2 a i $F=60$

ii $F=-78$

b $m=\frac{F}{a}, m=12$

c $a=\frac{F}{m}, a=-1.75$

3 a

3D Shape	Number of faces	Number of vertices	Number of edges
Cube	6	8	12
Cuboid	6	8	12
Triangular prism	5	6	9
Triangular-based pyramid	4	4	6
Square-based pyramid	5	5	8

b $E=F+V-2$, or any equivalent version

c $V=E-F+2$

i $V=6$

ii $V=7$

d c i is a pentagonal-based pyramid and **c ii** is a hexagonal-based pyramid

e $F=E-V+2$, $F=0$, it is not possible to have a shape with five edges and seven vertices.

f Learner's own answer.

4 a Ben's age is $x+2$, Alice's age is $x-6$

b $T=3x-4$

c $T=53$

d $x=\frac{T+4}{3}$

e $x=22$

5 a $v=87$

b $v=125$

c $u=27$

d $u=46$

e $t=10$

f $a=2$

6 a 20%

b 60%

c 125%

7 a 65 kg

b 49.1 kg (1 d.p.)

c 95.9 kg (1 d.p.)

d 57.3 kg (1 d.p.)

8 a i $Bx=\frac{y-z}{2}$

ii $Cx=\frac{2(y+3h)}{5}$

iii $Ax=7k(y-6)$

iv $Cx=3ny+m$

v $Ax=\frac{w-y}{7}$

b Learner's own answer.

9 a $t=\frac{m-9}{7}$

b $t=5(k+m)$

c $t=pv-h$

d $t=\frac{9q+w}{5}$

10 a $A=a^2+bc$

b $A=49.5$

c $A=a^2+bc$, $A-bc=a^2$, $a=\sqrt{A-bc}$

d $a=8$

11 a 78.5 cm

b $r=\sqrt{\frac{A}{\pi}}$

c 6.25 cm

12 a $l=\sqrt[3]{V}$

b 2 cm

13 Sasha is correct as $30^\circ\text{C}=86^\circ\text{F}$ and $86^\circ\text{F}>82^\circ\text{F}$ (or $82^\circ\text{F}=27.8^\circ\text{C}$ and $27.8^\circ\text{C}<30^\circ\text{C}$).

14 a She is not underweight as her BMI is 20.05, which is greater than 18.5.

b 3.7 kg

Check your progress

1 a 39

b 161

c 12

2 perimeter = $16x+8$,
area = $5x(3x+4)=15x^2+20x$

- 3 a x^5 b q^6 c h^{10}
 d $15m^9$ e $2u^2$ f $3p^2$
- 4 a $x^2 + 7x + 10$ b $x^2 + x - 12$
 c $x^2 - 3x - 54$ d $x^2 - 14x + 40$
 e $x^2 - 64$ f $x^2 - 12x + 36$
- 5 a $\frac{2x}{3}$ b $\frac{2y}{15}$
 c $\frac{12x-y}{20}$ d $3x-5$
- 6 a $x=31$ b $z=\frac{x-y^2}{5}, z=6$
 c $y=\pm\sqrt{x-5z}, y=\pm 6$

Unit 3 Getting started

- 1 a 8 b 32.5 c 6 d 0.85
 e 90 f 625 g 700 h 32
- 2 B
- 3 a 15.4 b 640
- 4 a \$345 b \$240
- 5 63.6 cm^2 (3 s.f.)

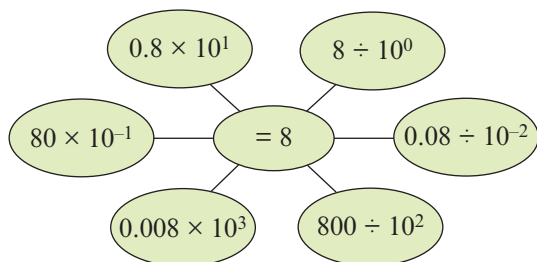
Exercise 3.1

- 1 a, D and ii; b, A and v; c, E and iv; d, C and i;
 e, B and iii
- 2 a $3.2 \times 10^3 = 3.2 \times 1000 = 3200$
 b $3.2 \times 10^2 = 3.2 \times 100 = 320$
 c $3.2 \times 10^1 = 3.2 \times 10 = 32$
 d $3.2 \times 10^0 = 3.2 \times 1 = 3.2$
 e $3.2 \times 10^{-1} = 3.2 \div 10 = 0.32$
 f $3.2 \times 10^{-2} = 3.2 \div 100 = 0.032$
 g $3.2 \times 10^{-3} = 3.2 \div 1000 = 0.0032$
 h $3.2 \times 10^{-4} = 3.2 \div 10000 = 0.00032$
- 3 a Yes. Learner's own explanation.
 b i smaller ii the same
 iii greater
- 4 a 1300 b 7800 c 240
 d 85 500 e 65 f 8000
 g 17 h 0.8 i 0.085
 j 0.45 k 0.032 l 1.25
- 5 a $320 \div 10^3 = 320 \div 1000 = 0.32$
 b $320 \div 10^2 = 320 \div 100 = 3.2$

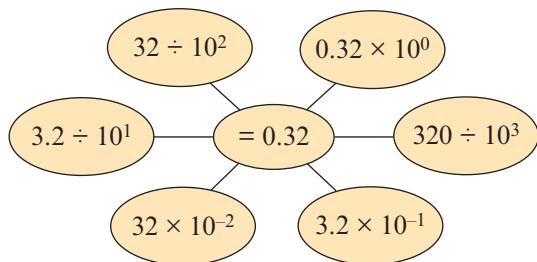
- c $320 \div 10^1 = 320 \div 10 = 32$
 d $320 \div 10^0 = 320 \div 1 = 320$
- 6 a 2.7 b 0.45
 c 0.36 d 0.017
 e 0.08 f 0.0248
 g 9 h 0.0025

- 7 a Learner's own answer.
 b i $6.8 \div 10^{-3} = 6800$
 ii $0.07 \div 10^{-4} = 700$
 c Learner's own answer.
 d Learner's own answer. For example: An alternative method is to realise that \div by 10^{-x} and \times by 10^x are the same. So, in this case $2.6 \div 10^{-2} = 2.6 \times 10^2$
 e Learner's own answer.
- 8 a $3.2 \div 10^3 = 3.2 \div 1000 = 0.0032$
 b $3.2 \div 10^2 = 3.2 \div 100 = 0.032$
 c $3.2 \div 10^1 = 3.2 \div 10 = 0.32$
 d $3.2 \div 10^0 = 3.2 \div 1 = 3.2$
 e $3.2 \div 10^{-1} = 3.2 \times 10 = 32$
 f $3.2 \div 10^{-2} = 3.2 \times 100 = 320$
 g $3.2 \div 10^{-3} = 3.2 \times 1000 = 3200$
 h $3.2 \div 10^{-4} = 3.2 \times 10000 = 32000$
- 9 a Yes. Learner's own explanation.
 b i greater ii the same
 iii smaller
- 10 a 2.5 b 47 600
 c 70 d 8.5
- 11 Do not tell anyone the secret!
- 12 a i 400 ii 40
 iii 4 iv 0.4
 v 0.04 vi 0.004
 b Smaller
 c Smaller
 d i 0.12 ii 1.2
 iii 12 iv 120
 v 1200 vi 12 000
 e Larger
 f Larger
 g Learner's own answer.

13 a



b



Activity 3.1

Learner's own answers.

Reflection: Learner's own answers.

Exercise 3.2

- 1 a 1.6 b -5.6 c -5.4
 d 6 e 0.3 f -0.66
 g 3.6 h -0.44

- 2 a 0.08×0.2 $8 \times 2 = 16$
 $8 \times 0.2 = 1.6$ $0.08 \times 0.2 = 0.016$
 b 0.4×0.007 $4 \times 7 = 28$
 $4 \times 0.007 = 0.028$ $0.4 \times 0.007 = 0.0028$

- 3 C, D, I, K (0.015); A, F, H, J (0.15);
 B, G, L (1.5); E (15)

- 4 a 20 b -50
 c -30 d 600
 e 40 f -400
 g 200 h -300

- 5 a $\frac{0.81 \times 100}{0.09 \times 100} = \frac{81}{9} = 9$
 b $\frac{6.4 \times 1000}{0.004 \times 1000} = \frac{6400}{4} = 1600$

- 6 a D b B c C d D
 7 a i 0.8 ii 2.4 iii 4
 iv 5.6 v 7.2 vi 8.8
 b i Larger ii Smaller

- c i 60 ii 30 iii 20
 iv 15 v 12 vi 10

- d i Smaller ii Larger
 e Learner's own answer.

- 8 a False b True
 c False d True

- 9 He has made a mistake. The denominator is 0.12, not 1.2; he wrote the answer with only one decimal place. Answer = 50.

- 10 a 200 b 120
 c 300 d 40

- 11 a A and iv, B and v, C and vi, D and vii,
 E and iii, F and i
 b Learner's own answer. Any question that gives an answer of 0.024. For example:
 $0.03 \times 400 \times 0.002$
 c Learner's own answer.

- 12 Learner's own answers and discussions.

For example: $28 \times 0.057 = 1.596$,
 $2.8 \times 0.57 = 1.596$, $28 \times 5.7 = 159.6$,
 $2.8 \times 5.7 = 15.96$

$15.96 \div 0.57 = 28$, $159.6 \div 0.57 = 280$,
 $15.96 \div 28 = 0.57$, $15.96 \div 280 = 0.057$

- 13 a $123 \times 57 = 7011$
 b i 701.1 ii 701.1 iii 70.11
 iv 7.011 v 7.011 vi 0.07011

- 14 a Learner's own answer.
 b Learner's own answer.
 c i Estimate: $4 \times 30 = 120$
 Accurate: 119.625
 ii Estimate: $10 \div 0.2 = 50$
 Accurate: 62
 iii Estimate: $\frac{60 \times 4}{0.01} = 24000$
 Accurate: 19200

- 15 a $0.2 \div 0.4 = 0.5$ m
 b 0.45 m
 c Learner's own answer.

Exercise 3.3

- 1 a $200 \times 1.1 = \$220$ $220 \times 1.15 = \$253$
 b $200 \times 0.9 = \$180$ $180 \times 0.85 = \$153$
 c $200 \times 1.2 = \$240$ $240 \times 0.95 = \$228$

- 2 a** Learner's choice of who they **think** is correct, with reason.
- b** Sofia is correct.
- Learner's explanation. For example: 10% of \$800 is \$80, so the value goes up to \$880. 10% of \$880 is \$88, so the value goes down to \$792. The 10% decrease is greater than the 10% increase. It is not the same value.

- c** The coin is now worth less than \$800.

Learner's explanation. For example: The 10% decrease will be \$80, but the 10% increase will be less than \$80 as it is 10% of a smaller amount than \$800.

$$\$800 - \$80 = \$720, \$720 + \$72 = \$792.$$

- d** Learner's own answer.

- 3 a i** 57.6 **ii** 57.6

- b** =

- c i** = **ii** =

- 4 a–e** Learner's own answers.

- 5 a i** 195 **ii** 64.4
b i 630 **ii** 108.864

- 6 a** 1.1235 **b** \$67.41

- 7 a i** 72 **ii** 52.8
b i 285 **ii** 48.412

- 8 a** 0.7216 **b** \$4618.24

- 9 a** **A** and **iii**, **B** and **iv**, **C** and **i**, **E** and **ii**, **F** and **v**
b **D** and 0.81

- 10 a** Zara is correct. 1.04×1.04 is the same as $(1.04)^2$, so $5000 \times 1.04 \times 1.04 = 5000 \times (1.04)^2$

b $5000 \times (1.04)^3$

c $5000 \times (1.04)^4$

- d** 8. The power on the 1.04 is the number of years.

e i $5000 \times (1.04)^{12}$

ii $5000 \times (1.04)^{20}$

iii $5000 \times (1.04)^n$

- f** 15 years

- 11 a i** 10000×0.9

ii 10000×0.9^2

iii 10000×0.9^3

- b** The population after 5 years.

- c** The population after 10 years.

d Five years. $10000 \times 0.9^4 = 6561$,
 $10000 \times 0.9^5 = 5904.9$

e 10000×0.9^n

Activity 3.3

Learner's own answers.

Exercise 3.4

- 1 a i** 25, 26, 27, 28, 29, 30, 31, 32, 33, 34

ii 25

iii 34

- b i** 85, 86, 87, 88, 89, 90, 91, 92, 93, 94

ii 85

iii 94

- c i** 265, 266, 267, 268, 269, 270, 271, 272, 273, 274

ii 265

iii 274

- d i** 845, 846, 847, 848, 849, 850, 851, 852, 853, 854

ii 845

iii 854

- 2 a** 11.5, 11.6, 11.7, 11.8, 11.9, 12.0, 12.1, 12.2, 12.3, 12.4

b 11.5

c 12.4

- 3 a i** 54.5, 54.6, 54.7, 54.8, 54.9, 55.0, 55.1, 55.2, 55.3, 55.4

ii 54.5

iii 55.4

b $42 \times 1.3 = 54.6 = \$55$

- 4 a–c** Learner's own answers.

- 5 a–c** Learner's own answers and discussions.

6 a $3.5 \leq x < 4.5$

b $11.5 \leq x < 12.5$

c $355.5 \leq x < 356.5$

d $669.5 \leq x < 670.5$

7 a $15 \leq x < 25$

b $335 \leq x < 345$

c $4745 \leq x < 4755$

d $6295 \leq x < 6305$

8 a $250 \leq x < 350$

b $1850 \leq x < 1950$

c $4650 \leq x < 4750$

d $7950 \leq x < 8050$

9 Learner's own answers and discussions.

a i 0.5 ii 5 iii 50

b The lower and upper bounds of a rounded number will always be \pm half of the degree of accuracy.

10 a i 1555 cm ii 1565 cm

b $1555 \text{ cm} \leq x < 1565 \text{ cm}$

11 a i 171.5 cm ii 172.5 cm

b $171.5 \text{ cm} \leq x < 172.5 \text{ cm}$

12 A, i and e; B, i and f; C, ii and b; D, iii and a; E, ii and c; F, iii and d

Check your progress

1 a 74 500 b 12

c 0.046 d 59

e 0.0728 f 5

g 37 h 18

2 a -1.6 b 3.6

c -0.0028 d 600

e 300 f 9

g 7.5 h 0.11

3 \$265.20

4 a i $20\,000 \times 1.08$ ii $20\,000 \times (1.08)^2$ iii $20\,000 \times (1.08)^3$

b The value of the painting after 5 years.

c The value of the painting after 20 years.

d 6 years. $20\,000 \times (1.08)^5 = 29\,386.561\,54$,
 $20\,000 \times (1.08)^6 = 31\,737.486\,46$ e $20\,000 \times (1.08)^n$ 5 a i 7150 m^2 ii 7250 m^2 b $7150 \text{ m}^2 \leq x < 7250 \text{ m}^2$

Unit 4 Getting started

1 a $x = 5$ b $x = 9$ c $y = 25$ d $y = 25$

2 a 5 b 7 c 5, 6, 7

3 a $2x > 10$ b $4x < 36$ c $y + 5 \geq 13$ d $y - 5 \leq -11$

Exercise 4.1

1 a $8x = -30 + 14$

$$8x = -16$$

$$x = \frac{-16}{8}$$

$$x = -2$$

$$\frac{2y}{3} = 11 + 5$$

$$\frac{2y}{3} = 16$$

$$2y = 16 \times 3$$

$$2y = 48$$

$$y = \frac{48}{2} = 24$$

b $15 - 10x = 9$

$$-10x = 9 - 15$$

$$-10x = -6$$

$$x = \frac{-6}{-10} = \frac{3}{5}$$

d $6y + 3y = 22 - 7$

$$9y = 15$$

$$y = \frac{15}{9}$$

$$y = \frac{5}{3}$$

$$y = 1\frac{2}{3}$$

2 a $x = -11$

$$y = 4$$

$$a = -6$$

$$g = 2$$

b $x = -3$

$$y = 8$$

$$a = -1$$

$$z = 4$$

3 a, b $x = 15$

c Learner's own answers.

4 Learner's own answers and explanations. For example:

a Substitute $x = 26$ back into the original equation and check that left hand side = right hand side.

b When he expanded the bracket on the left-hand side he didn't multiply the 8 by 2.

When he brought the $-3x$ to the left-hand side he forgot to make it $+3x$.When he brought $+8$ to the right-hand side he forgot to make it -8 .

$$2x + 16 = 18 - 3x$$

$$5x + 16 = 18$$

$$5x = 2$$

$$x = \frac{2}{5} = 0.4$$

Check: When $x = 0.4$,

$$2(0.4 + 8) = 2 \times 8.4 = 16.8 \text{ and}$$

$$3(6 - 0.4) = 3 \times 5.6 = 16.8$$

d Learner's own answer.

5 a, b $x = 13$

c Learner's own answers.

$$\begin{aligned} 6 \quad a \quad \frac{42}{c} &= 7 \\ 42 &= 7c \\ \frac{42}{7} &= c \\ c &= 6 \end{aligned}$$

$$\begin{aligned} c \quad \frac{21}{e+2} &= 7 \\ 21 &= 7(e+2) \\ \frac{21}{7} &= e+2 \\ 3 &= e+2 \\ 3-2 &= e \\ e &= 1 \end{aligned}$$

$$7 \quad a \quad a=27 \quad b \quad b=\frac{3}{7} \quad c \quad c=3 \quad d \quad d=11$$

8 a, b, c and e Learner's own answers and explanations.

$$d \quad i \quad x=14\frac{1}{4} \quad ii \quad x=6\frac{3}{5} \quad iii \quad x=-\frac{1}{5}$$

$$9 \quad a \quad i \quad A+10 \quad ii \quad A-6$$

$$b \quad A+10=2(A-6)$$

$$c \quad A=22$$

$$10 \quad a \quad 2(x+3)+7x-5+5(7-x)=48 \text{ OR } 4x+36=48$$

$$b \quad x=3$$

$$c \quad 12 \text{ cm, } 16 \text{ cm, } 20 \text{ cm}$$

$$11 \quad a \quad 9a=4a+20$$

$$b \quad a=4$$

$$c \quad \text{Triangle sides } 12 \text{ cm, rectangle sides } 7 \text{ cm and } 11 \text{ cm}$$

$$12 \quad a \quad \mathbf{B \text{ and } D}$$

$$b \quad \mathbf{A} \quad x=\frac{1}{15}; \quad \mathbf{B} \quad x=15; \quad \mathbf{C} \quad x=8640;$$

$$\mathbf{D} \quad x=15; \quad \mathbf{E} \quad x=\frac{1}{15}$$

There are 15 sectors in the pie chart.

$$13 \quad a \quad \frac{85}{y}=5 \quad b \quad \frac{152}{y+2}=8$$

$$c \quad \frac{85}{y}=5 \rightarrow y=\frac{85}{5}=17 \text{ and}$$

$$\frac{152}{y+2}=8 \rightarrow \frac{152}{8}=y+2 \rightarrow 19=y+2 \rightarrow y=17$$

$$d \quad \text{Learner's own answer.}$$

Activity 4.1

i, ii and iii Learner's answers and discussions.

$$a \quad 10x-8=5x+12, \quad x=4$$

$$b \quad 12(x-5)=4(x+1), \quad x=8$$

$$c \quad 5x-4=2x+20, \quad x=8$$

$$d \quad 5=\frac{75}{x+7}, \quad x=8$$

$$e \quad 9=\frac{126}{2x}, \quad x=7$$

$$14 \quad a \quad 54=\frac{270}{x-4}$$

$$b \quad x=9$$

$$c \quad 54^\circ, 54^\circ, 72^\circ$$

15 a Learner's own problem. For example:

i A quadrilateral has sides of length x cm, $2(x+1)$ cm, $3(x+2)$ cm, and $4(x+3)$ cm. The perimeter is 80 cm. Work out the value of x .

ii The two shorter sides of a rectangle have side lengths of $6(3a-4)$ and $3(4a-3)$. Work out the value of a .

iii There are x sweets in bag A. There are five fewer sweets in bag B than bag A. The sweets in bag B are shared between 180 people. Each person gets 15 sweets. How many sweets are in bag A?

$$b \quad i \quad x=6$$

$$ii \quad a=2.5$$

$$iii \quad x=17$$

Exercise 4.2

$$1 \quad \textcircled{1} \text{ Work out } x. \quad 5x-3=2x+15$$

$$5x-2x=15+3$$

$$3x=18$$

$$x=\frac{18}{3}=6$$

$$\textcircled{2} \text{ Work out } y. \quad y=5x-3$$

$$=5 \times 6-3$$

$$=30-3$$

$$=27$$

$$\textcircled{3} \text{ Check values are correct. } y=2x+15$$

$$=2 \times 6+15$$

$$=12+15$$

$$=27$$

$$\textcircled{4} \text{ Write the answers: } x=6 \text{ and } y=27$$

$$2 \quad x=5, \quad y=9$$

3 $x=4, y=13$

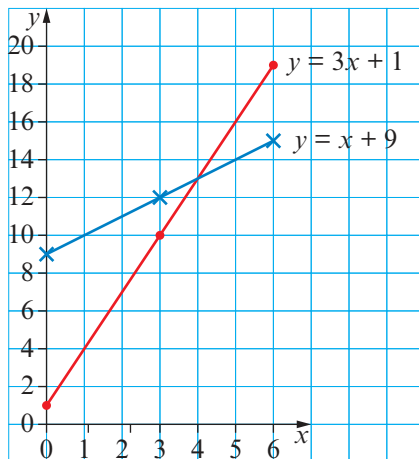
4 $x=7, y=-5$

5 a

$y=3x+1$	x	0	3	6
	y	1	10	19

$y=x+9$	x	0	3	6
	y	9	12	15

b



c (4, 13)

d The coordinates give the solution of the equations; $x=4$ and $y=13$

e Learner's own answer. For example: The solution of simultaneous equations is the point of intersection of the straight-line graphs.

6 a i $x=2, y=6$

ii $x=2, y=6$

b $x=2, y=6$

c Learner's own answers and explanations.

7 a i $x=2, y=7$

ii $x=6, y=2$

b Learner's own answers.

8 a i $x=9, y=4$ b i $x=2, y=3$

ii $x=10, y=8$ ii $x=4, y=8$

9 a $x=5, y=2$ b $x=16, y=3$

c $x=7, y=4$ d $x=3, y=6$

10 Sofia is correct, $x=-3$ and $y=6$. Zara got the signs round the wrong way.

11 a

① Add the two equations.

$$2x + y = 50$$

$$+ \quad x - y = 4$$

$$\hline 3x + 0y = 54$$

$$3x = 54, x = \frac{54}{3} = 18$$

② Substitute $x=18$ into first equation

$$2 \times 18 + y = 50$$

$$y = 50 - 36$$

$$= 14$$

③ Check in second equation

$$18 - 14 = 4$$

④ $x=18$ and $y=14$

b

① Subtract the two equations.

$$x + 4y = 41$$

$$- \quad x + 2y = 23$$

$$\hline 0x + 2y = 18$$

$$2y = 18, y = \frac{18}{2} = 9$$

② Substitute $y=9$ into first equation

$$x + 4 \times 9 = 41$$

$$x = 41 - 36$$

$$= 5$$

③ Check in second equation

$$5 + 2 \times 9 = 23$$

④ $x=5$ and $y=9$

c

① Subtract the two equations.

$$3x + 2y = 38$$

$$- \quad 3x - y = 26$$

$$\hline 0x + 3y = 12$$

$$3y = 12, y = \frac{12}{3} = 4$$

② Substitute $y=4$ into first equation

$$3x + 2 \times 4 = 38$$

$$3x = 38 - 8$$

$$3x = 30, x = \frac{30}{3} = 10$$

③ Check in second equation

$$3 \times 10 - 4 = 26$$

④ $x=10$ and $y=4$

12 a Learner's own answer.

i You can add or subtract. If you add, you eliminate the y s, if you subtract you eliminate the x s.

ii Subtract to eliminate the x s.

iii Add to eliminate the y s.

iv Subtract to eliminate the y s.

b Learner's own answer.

- c** Learner's own answer. For example:
Subtract to eliminate one of the letters when the coefficients of that letter are the same number and both positive or both negative. Add to eliminate one of the letters when the coefficients of that letter are the same number and one positive and one negative.

- d i** $x=9, y=6$ **ii** $x=-3, y=2$
iii $x=8, y=3$ **iv** $x=9, y=5$

Activity 4.2

All answers should be $x=6, y=18$

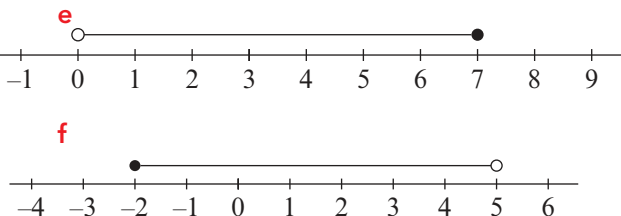
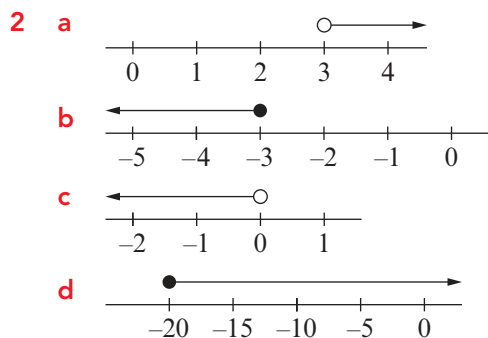
- 13 a** $x=9, y=4$ **b** $x=5, y=-2$
c $x=2, y=4$ **d** $x=7, y=1$

- 14 a** $x=2, y=2$
b $3 \times 2 + 2 = 6 + 2 = 8$ and
 $4 \times 2 + 2 \times 2 = 8 + 4 = 12$

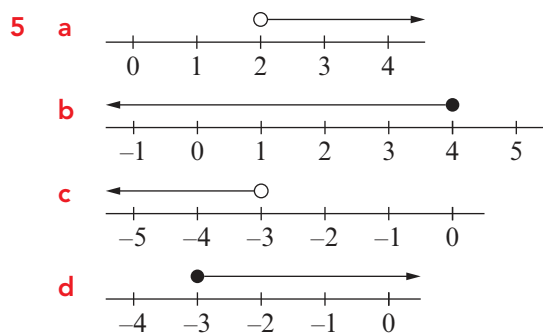
Reflection: Learner's own answers.

Exercise 4.3

- 1 a** $x \leq 2$ **b** $x > -2$
c $x \geq 10$ **d** $x < -20$
e $-2 \leq x < 2$ **f** $-10 < x \leq 15$



- 3 a** 7 **b** -4
c -2, -1, 0 or 1
4 a $x > 2$ **b** $x \leq 4$
c $x < -3$ **d** $x \geq -3$



- 6 a** $x < 3$
b, c Learner's own answers.

- 7 a** He has multiplied out the bracket incorrectly.

$$3(x+2) \leq 2x-5$$

$$3x+6 \leq 2x-5$$

$$3x-2x \leq -5-6$$

$$x \leq -11$$

- b i** $x = -12$
 $3(-12+2) \leq 2 \times -12 - 5$
 $-30 \leq -29$

True

- ii** $x = -11$
 $3(-11+2) \leq 2 \times -11 - 5$
 $-27 \leq -27$

True

- iii** $x = -10$
 $3(-10+2) \leq 2 \times -10 - 5$
 $-24 \leq -25$

False

For $x \leq -11$ the substitutions give values that are true and when $x > -11$ it gives a false value.

- 8 a** $4(2y+3) - 5y < 18 - y$
 $8y + 12 - 5y < 18 - y$
 $8y - 5y + y < 18 - 12$
 $4y < 6$
 $y < 1.5$

- b i** $y = 1$
 $4(2 \times 1 + 3) - 5 \times 1 < 18 - 1$
 $15 < 17$
True

ii $y = 1.5$
 $4(2 \times 1.5 + 3) - 5 \times 1.5 < 18 - 1.5$
 $16.5 < 16.5$
 False

iii $y = 2$
 $4(2 \times 2 + 3) - 5 \times 2 < 18 - 2$
 $18 < 16$
 False

9 a $a < 3.5$ b $b \geq 11$
 c $c \leq 6$ d $d > -27$

Learner's checks for each solution.

10 a $5n + 5 \leq 30$ b $n \leq 5$
 c 5, 12 and 13

11 a Learner's own answer. For example: To make the x positive, Sergey adds x to both sides and subtracts six from both sides. He then rewrites the final inequality with the x on the left and so he has to change the $<$ to $>$. To make the x positive, Natalia divides both sides by -1 , but this has the effect of changing the $<$ to $>$.

b Learner's own answers.

c Learner's own answer. For example:

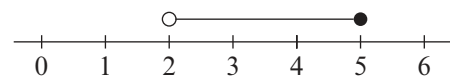
$$\begin{aligned} 2(x - 8) &\geq 4x - 26 \\ 2x - 16 &\geq 4x - 26 \\ 2x - 4x &\geq -26 + 16 \\ -2x &\geq -10 \\ 10 &\geq 2x \\ 5 &\geq x \\ x &\leq 5 \end{aligned}$$

12 a $x > -4$ or $-4 < x$
 b $x \geq 5$ or $5 \leq x$
 c $x > 6$ or $6 < x$
 d $x \leq -13$ or $-13 \geq x$
 e $x < 4$ or $4 > x$
 f $x \geq -2$ or $-2 \leq x$

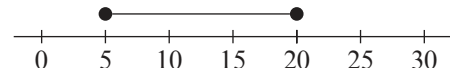
13 a $3x - 7 < 4x - 11$ b For example:
 $3x - 7 < 4x - 11$
 $-7 + 11 < 4x - 3x$
 $4 < x$
 $x > 4$

c When $x = 5$, $3 \times 5 - 7 < 4 \times 5 - 11$ $8 < 9$ True
 When $x = 4$, $3 \times 4 - 7 < 4 \times 4 - 11$ $5 < 5$ False

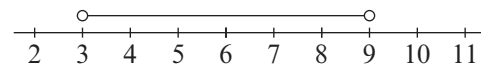
14 a $2 < x \leq 5$



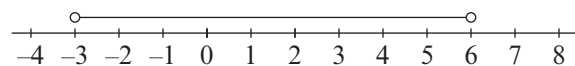
b $5 \leq y \leq 20$



c $3 < n < 9$



d $-3 < m < 6$



Check your progress

1 a $x = -4$ b $a = -2.5$ c $x = 2.4$
 d $y = 9$ e $m = 16$ f $n = 10$

Learner's own checks for each solution.

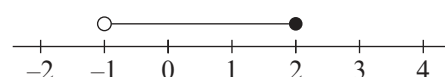
2 $x = 5$, $y = 19$

3 $x = 19$, $y = 7$

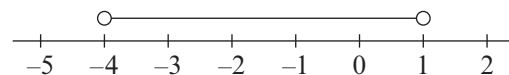
4 a $a < 2$ b $b \geq 5$
 c $c > -1$ d $d \geq -5$

Learner's own checks for each solution.

5 a $-1 < x \leq 2$



b $-4 < n < 1$



Unit 5 Getting started

1 140°

2 62°

3 a a and d OR b and e OR c and f
 b c and d
 c a and c OR d and f