

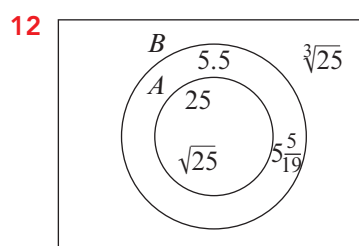
Workbook answers

Exercise 1.1

Number	Rational	Irrational
$\sqrt{36}$	✓	
$\sqrt{48}$		✓
$\sqrt{64}$	✓	
$\sqrt{84}$		✓
$\sqrt[3]{100}$		✓

- 2 a $\sqrt{27}, \sqrt{500}$ b $-36, -\sqrt[3]{8}$
- 3 a integer b surd c surd
d integer e integer f surd
- 4 a irrational because $\sqrt{3}$ is irrational
b rational because it is equal to $\sqrt{9} = 3$
c rational because it is equal to $8 + 4 = 12$
d irrational because it is $2 +$ an irrational number
- 5 a 2.25
b it is equal to 1.5
c yes, it is equal to 4.5
d yes, it is equal to 1.1
- 6 a $3^3 = 27$ and $4^3 = 64$
b $9^3 = 729$ and $10^3 = 1000$
c $1.1^2 = 1.21$ and $1.2^2 = 1.44$
- 7 Learner's own answers. For example:
a $\sqrt{5}$
b a square root between $\sqrt{36}$ and $\sqrt{49}$
c $\sqrt{2}$
- 8 a 12 b 7
- 9 a No. All fractions are rational. In fact, the repeating sequence is nine digits long.
b It is rational. It is $1\frac{4}{9}$.
- 10 a The answer is 8.
b i $\sqrt{2} \times \sqrt{18}$ is a possible answer.
ii $\sqrt{3} \times \sqrt{27}$ is a possible answer.
iii $\sqrt{5} \times \sqrt{20}$ is a possible answer.

- 11 a The number is 7.142... and there is no repeating pattern.
b Learner's own answer. For example: $\sqrt{2}$ and $5 - \sqrt{2}$.
c Because the sum of two rational numbers must be rational.
d No, because the product of two rational numbers is rational.



- 13 a i $\sqrt{20} + 2 = 6.4721...$
ii $\sqrt{20} - 2 = 2.4721...$
iii 16
b She is correct. Substitute different values to see that $(\sqrt{n} + 2)(\sqrt{n} - 2) = n - 4$ seems to be true.

Exercise 1.2

- 1 a 2.6×10^6 b 9.2×10^8
c 4.62×10^5 d 2.08×10^7
- 2 a 5.5×10^4 b 5.5×10^7
c 6.4×10^8 d 4.06×10^8
- 3 a 53 000 b 53 800 000
c 711 000 000 000 d 133 100 000
- 4 9.46×10^{12} km
- 5 a 3×10^{-5} b 6.66×10^{-7}
c 5.05×10^{-5} d 4.8×10^{-10}
- 6 a 0.0015
b 0.00001234
c 0.000000079
d 0.0009003
- 7 a 0.000008
b 0.000000482
c 0.000061
d 0.00000007007

8 $4 \times 10^{-7} \text{ m}$ and $8 \times 10^{-7} \text{ m}$

9 C, E, A, B, D

10 a 22 b $5.98 \times 10^{23} \text{ kg}$

11 a Copy and complete this sentence: 6.2×10^7 is 10 times larger than 6.2×10^6 .

b 10^6 or one million.

12 a 4.5×10^7 b 2.8×10^9

c 3×10^6 d 9.95×10^9

13 a 4.3×10^{-4} b 1.25×10^{-6}

c 7×10^{-6} d 8×10^{-9}

14 a 1.75×10^6 b 1.34×10^8

c 6.5×10^{-5} d 1.146×10^{-4}

Exercise 1.3

1 a $\frac{1}{7}$ b $\frac{1}{49}$ c $\frac{1}{125}$
d $\frac{1}{81}$ e $\frac{1}{225}$ f $\frac{1}{400}$

2 a 4^{-1} b 4^{-3} c 4^0
d 4^4 e 4^{-4} f 4^{-2}

3 a 5^{-1} b 5^2 c 5^{-2} d 5^{-3} e 5^0

4 a $\frac{1}{8}$ b $\frac{1}{27}$
c $\frac{1}{125}$ d $\frac{1}{1000}$ or 0.001

5 a 12^2 b 12^{-1}
c 12^{-3} d 12^3

6 a 5^3 b 4^{-6}
c 8^{-5} d 15^0 or 1
e 5^{-12}

7 a 7^3 b 7^{-1} c 7^6 d 7^{-1}

8 a 12^5 b 5^{-7}
c 3^{-4} d 25^1 or 25

9 a 6 b -4 c -2 d 4

10 a -2 b 4 c 6 d 7

11 a 3 b $1\frac{3}{4}$ c $1\frac{4}{9}$

12 a $11^6 = 1\,771\,561$ b $11^2 = 121$

c $11^{-3} = \frac{1}{1331}$

13 7

Exercise 2.1

1 a $2 \times x + 3 = 2 \times 10 + 3$
 $= 20 + 3 = 23$

b $x \div 2 - 4 = 10 \div 2 - 4$
 $= 5 - 4 = 1$

c $4 \times x^2 = 4 \times 10^2$
 $= 4 \times 100 = 400$

d $3 \times (x + 2) = 3 \times (10 + 2)$
 $= 3 \times 12 = 36$

2 A and iii, B and v, C and i, D and vi, E and ii, F and iv

3 a $x + y = 6 + -2 = 6 - 2 = 4$

b $x - y = 6 - -2 = 6 + 2 = 8$

c $x^2 + y^2 = 6^2 + (-2)^2 = 36 + 4 = 40$

d $3x + y = 3 \times 6 + -2 = 18 - 2 = 16$

e $x + 4y = 6 + 4 \times -2 = 6 - 8 = -2$

f $3x + 4y = 3 \times 6 + 4 \times -2 = 18 - 8 = 10$

4 a 2 b -14 c 35
d 13 e 7 f 100

5 a -4 b 5 c -8
d -26 e 94 f $-4\frac{1}{2}$

g 12 h -11

6 a Incorrect. He has worked out -1^2 and not $(-1)^2$.

Correct solution is
 $-4 \times (-1)^2 - 3 \times -4 = -4 + 12 = 8$

b Incorrect. He has worked out that $(-4)^3 = 64$ and not -64 .

Correct solution is $(-4)^3 - \frac{-4}{2 \times -1} = -64 - \frac{-4}{-2}$
 $= -64 - 2$
 $= -66$

7 Learner's own values. For example:

a $x = 3$ and $y = 7$, $x = 4$ and $y = 44$,
 $x = 5$ and $y = 105$

b $x = -1$ and $y = -21$, $x = -2$ and $y = -28$,
 $x = -3$ and $y = -47$

c $x = 0$ and $y = -20$, $x = 1$ and $y = -19$,
 $x = 2$ and $y = -12$

- 8 a 15 b 20 c -20
d 11 e 8 f -64
g 2 h -7 i 8
j 2 k -25 l 4

9 Learner's own counter-examples. For example:

- a Let $x=2$, so $10x^2=10 \times 2^2=10 \times 4=40$
and $(10x)^2=(10 \times 2)^2=20^2=400$
 $40 \neq 400$, so $10x^2 \neq (10x)^2$.
b Let $y=2$, so $(2y)^3=(2 \times 2)^3=4^3=64$ and
 $2y^3=2 \times 2^3=2 \times 8=16$
 $64 \neq 16$, so $(2y)^3 \neq 2y^3$.
c Let $x=4$ and $y=2$,
 $3x-3y=3 \times 4-3 \times 2=12-6=6$ and
 $3(y-x)=3(2-4)=3 \times -2=-6$
 $6 \neq -6$, so $3x-3y \neq 3(y-x)$.

- 10 a 18 kg b 14 kg
c

Age (A years)	1	2	3	4	5
Mass using expression ①	10.5	13	15.5	18	20.5
Mass using expression ②	10	12	14	16	18

- d Expression ②, 13.5 kg is closer to 14 kg than 15.5 kg.

- 11 a 99 b 18

$$\begin{aligned}
 12 \quad & 4d^2 - \frac{100}{c^2} - 3cd - c(c-d) \\
 &= 4 \times (-3)^2 - \frac{100}{5^2} - 3 \times 5 \times -3 - 5(5 - -3) \\
 &= 36 - 4 + 45 - 40 \\
 &= 37 \\
 & d^3 + \frac{8c}{(c+d)^2} + \left(\frac{3c}{d}\right)^2 - (-4 - c^2) \\
 &= (-3)^3 + \frac{8 \times 5}{(5 + -3)^2} + \left(\frac{3 \times 5}{-3}\right)^2 - (-4 - 5^2) \\
 &= -27 + 10 + 25 + 29 \\
 &= 37
 \end{aligned}$$

Exercise 2.2

- 1 a 6 b 12
c $x+2$ d $z+2$
2 a 2 b 5
c $y-3$ d $z-3$
3 a 10 b 20
c $5a$ d $5b$

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

5 A and iii, B and vi, C and i, D and vii, E and viii, F and ii, G and iv, H and v

- 6 a $n-10$ b $\frac{n}{1000}$
c $2n+3$ d $\frac{n}{4}-5$
e $\frac{1}{n}-1$ f $\frac{10}{2n}$
g $3(n+20)$ h $\sqrt{3n}$
i $(4n)^2-3$ j $6\sqrt[3]{n}+10$
k $\left(\frac{n}{5}\right)^3-9$

- 7 a $6x$ b $3x+10$
c $12x-2$ d $13x-4$

- 8 a xy b y^2
c x^3 d $16x^2$

- 9 a $g^2=25$, $g(8-g)=15$, $2g(3g-11)=40$
b 80
c $g^2+g(8-g)+2g(3g-11)=$
 $g^2+8g-g^2+6g^2-22g=6g^2-14g$.
d $6g^2-14g=80$

- 10 a i $2a+16$ ii $5a+15$
when $a=3$,
i $2a+16=22$ ii $5a+15=30$
b i $2b+2$ ii $5b-20$
when $b=12$,
i $2b+2=26$ ii $5b-20=40$
c i $4c-16$ ii c^2-8c
when $c=10$,
i $4c-16=24$ ii $c^2-8c=20$
d i $2d^2+14d$ ii $7d^3$
when $d=5$,
i $2d^2+14d=120$ ii $7d^3=875$

- 11 a i $2(a+3)+2(3a+1)=8a+8$,
 $4(2a+2)=8a+8$
ii $3(a+3)+3(3a+1)=12a+12$,
 $6(2a+2)=12a+12$

- iii $5(a+3) + 5(3a+1) = 20a + 20$,
 $10(2a+2) = 20a + 20$
- b n black rods + n striped rods = $2n$ white rods
 (or similar explanation given in words)
- c i $4(a+3) + 2(2a+2) = 8a + 16$,
 $8(a+2) = 8a + 16$
- ii $6(a+3) + 3(2a+2) = 12a + 24$,
 $12(a+2) = 12a + 24$
- iii $8(a+3) + 4(2a+2) = 16a + 32$,
 $16(a+2) = 16a + 32$
- d $2n$ black rods + n white rods = $4n$ grey rods
 (or similar explanation given in words)
- 12 a i \$26 ii \$46
 b \$10 c \$16
 d $16 + 10d$
- 13 a When $a=4$, $\frac{a^2}{2} + 3a = \frac{4^2}{2} + 3 \times 4 = 20$ and
 when $b=5$, $2b(b^2 - 4b - 3) =$
 $2 \times 5(5^2 - 4 \times 5 - 3) = 10(25 - 20 - 3) = 20$
 As the side lengths are both 20, it must be
 a square.
- b 80
- c i $2a^2 + 12a$
 ii $8b^3 - 32b^2 - 24b$
- d When $a=4$, $2a^2 + 12a = 80$ and when $b=5$,
 $8b^3 - 32b^2 - 24b = 80$
- e Yes. Learner's own explanations.
 For example: When a is a positive integer,
 a^2 is positive, so $\frac{a^2}{2}$ is positive. Also $3a$
 is positive. When you add two positive
 numbers, you will get a positive answer, so
 the perimeter of the rectangle will always
 be positive.
- f i -10 ii -16
 iii -18
- g No, because the perimeter cannot be a
 negative number.
 For $a < -6$ the perimeter is positive, so is a
 valid measurement.
- 14 a $2(4x^2 + 3x) + 2(2x^2 - 5x) =$
 $8x^2 + 6x + 4x^2 - 10x = 12x^2 - 4x$
- b $12x^2 - 4x = 4x(3x - 1)$
- c Arun is incorrect. When $x=3$,
 perimeter = 96 and when $x=-3$
 perimeter = 120.

- 15 a Side length = $\sqrt[3]{27} = 3$ cm, cube
 has 12 edges, so total length of
 edges = $12 \times 3 = 36$ cm
- b 48 cm c $12\sqrt[3]{x}$

Exercise 2.3

- 1 A and ii, B and iv, C and i, D and iii
- 2 A and iii, B and iv, C and ii, D and i
- 3 a True b False $y^5 \times y^4 = y^9$
 c True d False $y^9 \div y^3 = y^6$
- 4 a g^8 b h^{30}
 c i^{21} d j^{20}
- 5 a $8x^2$ b $16x^3$
 c $4y^4$ d $11y^6$
- 6 a a^7 b b^{10} c c^8
 d d^4 e e^4 f f^7
 g g^{32} h y^{14} i i^{72}
 j $13j^2$ k k^3 l $-3l^5$
- 7 a $6a^4$ b $16b^7$ c $36c^{12}$
 d $10e^{11}$ e $8g^8$ f $3h^6$
 g $5x^8$ h $5x^4$
- 8 a B b A c A d D
- 9 a When the terms are simplified, one group
 has x^6 terms and one group has x^9 terms.
 x^6 terms: $3x^3 \times 2x^3$, $9x^9 \div 3x^3$, $2x \times 3x^5$
 x^9 terms: $x^6 \times 3x^3$, $12x^{12} \div 4x^3$, $6x^6 \times x^3$
- b $9x^{12} \div x^9 = 9x^3$: this is the only card, which
 when simplified, has an x^3 term; all others
 have x^6 terms or x^9 terms.
- 10 a Zara is correct. $(2x^3)^2 = 2^2 \times x^{3 \times 2} = 4x^6$
 b i $9x^{14}$ ii $64y^{27}$ iii $32z^{15}$
- 11 a C b A c B d D
- 12 a $4^{-4} = \frac{1}{4^4}$ b $5^{-3} = \frac{1}{5^3}$
 c $8^{-5} = \frac{1}{8^5}$ d $x^{-4} = \frac{1}{x^4}$
 e $y^{-7} = \frac{1}{y^7}$ f $z^{-1} = \frac{1}{z^1} = \frac{1}{z}$
- 13 a $x^{-3} = \frac{1}{x^3}$ b $y^{-4} = \frac{1}{y^4}$
 c $m^{-8} = \frac{1}{m^8}$ d $n^{-5} = \frac{1}{n^5}$

- 14 a** A and v, B and iii, C and i, D and vii, E and ii, F and iv

- b** Any expression that simplifies to give $\frac{5}{2y^7}$.

For example: $10y^3 \div 4y^{10}$

15 $\frac{2n^2 \times 3n^5}{(2n^2)^3} = \frac{6n^7}{8n^6} = \frac{3n}{4}$

16 Yes, $\frac{6x^2 \times 3x^6 \times 2x^9}{4x^{13}} = \frac{36x^{17}}{4x^{13}} = 9x^4$ and

$$\frac{(3x^4)^4}{3x \times x^2 \times 3x^9} = \frac{81x^{16}}{9x^{12}} = 9x^4$$

Exercise 2.4

- 1 a** 23×34

\times	20	3
30	600	90
4	80	12

$$600 + 90 + 80 + 12 = 782$$

- b** 18×42

\times	10	8
40	400	320
2	20	16

$$400 + 320 + 20 + 16 = 756$$

- 2 a** $(x+2)(x+3)$

\times	x	+2
x	x^2	$+2x$
+3	$+3x$	$+6$

$$x^2 + 2x + 3x + 6 = x^2 + 5x + 6$$

- b** $(x+1)(x+4)$

\times	x	+1
x	x^2	$+x$
+4	$+4x$	$+4$

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

- c** $(x+5)(x+6)$

\times	x	+5
x	x^2	$+5x$
+6	$+6x$	$+30$

$$x^2 + 5x + 6x + 30 = x^2 + 11x + 30$$

- d** $(x+3)(x+9)$

\times	x	+3
x	x^2	$+3x$
+9	$+9x$	$+27$

$$x^2 + 3x + 9x + 27 = x^2 + 12x + 27$$

- 3 a** $(x+5)(x-3)$

\times	x	+5
x	x^2	$+5x$
-3	$-3x$	-15

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

- b** $(x+6)(x-2)$

\times	x	+6
x	x^2	$+6x$
-2	$-2x$	-12

$$x^2 + 6x - 2x - 12 = x^2 + 4x - 12$$

- c** $(x-7)(x+4)$

\times	x	-7
x	x^2	$-7x$
+4	$+4x$	-28

$$x^2 - 7x + 4x - 28 = x^2 - 3x - 28$$

- d** $(x-8)(x+2)$

\times	x	-8
x	x^2	$-8x$
+2	$+2x$	-16

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

- 4 a** $(x-1)(x-3)$

\times	x	-1
x	x^2	$-x$
-3	$-3x$	$+3$

$$x^2 - x - 3x + 3 = x^2 - 4x + 3$$

- b** $(x-4)(x-8)$

\times	x	-4
x	x^2	$-4x$
-8	$-8x$	$+32$

$$x^2 - 4x - 8x + 32 = x^2 - 12x + 32$$

5 Learner's own answer.

- 6 a $x^2 + 7x + 10$ b $x^2 + 2x - 8$
 c $x^2 - 3x - 18$ d $x^2 - 6x + 9$
 e $x^2 + 15x + 50$ f $x^2 - 13x + 40$
 g $x^2 + 5x - 50$ h $x^2 - 3x - 40$

7 a B b A c C d C

8 1 $(x+4)(x+3) = x^2 + 7x + 12$ Rohan had the final term incorrect – he added 4 and 3 to get 7, not multiplied 4 by 3 to get 12.

2 $(x+5)(x-9) = x^2 - 4x - 45$ Rohan simplified $5x - 9x$ to be $4x$ not $-4x$.

3 $(x-3)(x-2) = x^2 - 5x + 6$ Rohan had the final term incorrect – he multiplied -3 by -2 to get -6 , and it should be $+6$.

- 9 a i $a^2 + 4a + 4$ ii $a^2 - 4a + 4$
 iii $b^2 + 8b + 16$ iv $b^2 - 8b + 16$
 v $c^2 + 2c + 1$ vi $c^2 - 2c + 1$

b Learner's own answer. For example: The first and last terms are the same, the middle terms have different signs.

c $(x+y)^2 = x^2 + 2xy + y^2$ so
 $(x-y)^2 = x^2 - 2xy + y^2$

- 10 a i $a^2 - 1$ ii $a^2 - 16$
 iii $a^2 - 81$

b There is no term in a , and the number term is a square number.

- c $a^2 - 64$
 d $a^2 - b^2$

11 $(x+4)(x-3) + x(5-x) = x^2 - 3x + 4x - 12 + 5x - x^2$
 $= 6x - 12$
 $= 6(x-2)$

- 12 a i $x^2 + 12x + 36$
 ii $x^2 + 12x + 35$

b Learner's own answer. For example: There is a difference of 1.

- 13 a i $x^2 + 14x + 49$
 ii $x^2 + 14x + 48$

b Learner's own answer. For example: There is a difference of 1.

14 Learner's own answer. For example:

$(x+5)^2$ and $(x+4)(x+6)$ giving $x^2 + 10x + 25$ and $x^2 + 10x + 24$

$(x+8)^2$ and $(x+7)(x+9)$ giving $x^2 + 16x + 64$ and $x^2 + 16x + 63$.

There is still a difference of 1.

15 a $(2x+1)(3x+2) = 6x^2 + 4x + 3x + 2 = 6x^2 + 7x + 2$

- b i $12x^2 + 19x + 5$
 ii $8y^2 - 14y - 15$

Exercise 2.5

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

b $\frac{1}{5} + \frac{2}{5} = \frac{3}{5}$

c $\frac{2}{7} + \frac{3}{7} = \frac{5}{7}$

d $\frac{1}{8} + \frac{3}{8} = \frac{4}{8} = \frac{1}{2}$

e $\frac{1}{2} + \frac{2}{9} = \frac{3}{9} = \frac{1}{3}$

f $\frac{3}{10} + \frac{3}{10} = \frac{6}{10} = \frac{3}{5}$

2 a $\frac{x}{3} + \frac{x}{3} = \frac{2x}{3}$

b $\frac{x}{5} + \frac{2x}{5} = \frac{3x}{5}$

c $\frac{2y}{7} + \frac{3y}{7} = \frac{5y}{7}$

d $\frac{y}{8} + \frac{3y}{8} = \frac{4y}{8} = \frac{y}{2}$

e $\frac{m}{9} + \frac{2m}{9} = \frac{3m}{9} = \frac{m}{3}$

f $\frac{3n}{10} + \frac{3n}{10} = \frac{6n}{10} = \frac{3n}{5}$

3 a $\frac{1}{4} + \frac{3}{8} = \frac{2}{8} + \frac{3}{8} = \frac{5}{8}$

b $\frac{1}{3} + \frac{2}{9} = \frac{3}{9} + \frac{2}{9} = \frac{5}{9}$

c $\frac{2}{3} - \frac{1}{6} = \frac{4}{6} - \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$

d $\frac{11}{12} - \frac{1}{6} = \frac{11}{12} - \frac{2}{12} = \frac{9}{12} = \frac{3}{4}$

4 a $\frac{5x}{8}$

b $\frac{5y}{9}$

c $\frac{p}{2}$

d $\frac{3b}{4}$

5 a $\frac{x}{2}$

b $\frac{4x}{5}$

c $\frac{12}{x}$

d $\frac{6x}{7}$

e $\frac{5}{4x}$

f $\frac{y}{6}$

g $\frac{2y}{9}$

h $\frac{y}{18}$

i $\frac{5}{16y}$

j $\frac{17}{24y}$

6 a A, D, F all equal $\frac{1}{4}x$ or $\frac{x}{4}$ and
 B, C both equal $\frac{1}{2}x$ or $\frac{x}{2}$.

b E, which equals $\frac{1}{3}x$ or $\frac{x}{3}$.

7 a $\frac{x+y}{2}$

b $\frac{2x+y}{6}$

c $\frac{9x+y}{12}$

d $\frac{15x-y}{18}$

e $\frac{7x-8y}{12}$

f $\frac{21a+4b}{28}$

$$g \quad \frac{10a+15b}{18}$$

$$h \quad \frac{ab-35}{7b}$$

$$i \quad \frac{8ab-45}{36b}$$

$$8 \quad a \quad 17$$

$$b \quad 32$$

$$c \quad 17 \neq 32.$$

Learner's own explanation. For example: She has just crossed the 2s off and not cancelled properly.

$$d \quad \frac{8x+2}{2} = \frac{2(4x+1)}{2} = \frac{2^1(4x+1)}{2^1} = 4x+1$$

$$9 \quad a \quad 2x+1$$

$$b \quad 5x+1$$

$$c \quad 3x-4$$

$$d \quad 3x-4$$

10 Evan is correct.

$$\frac{7x-14}{7} + \frac{8x+6}{2} = \frac{7^1(x-2)}{7^1} + \frac{2^1(4x+3)}{2^1} = x-2+4x+3=5x+1$$

$$11 \quad a \quad \frac{8x+24}{4} = \frac{4^1(2x+6)}{4^1} = 2x+6 \text{ and}$$

$$\frac{8x+24}{4} = \frac{8^1(x+3)}{8^1} = 2(x+3)$$

$$b \quad i \quad 2x+4 \text{ and } 2(x+2)$$

$$ii \quad 3x+9 \text{ and } 3(x+3)$$

$$iii \quad 6x-9 \text{ and } 3(2x-3)$$

$$iv \quad 4-6x \text{ and } 2(2-3x)$$

$$12 \quad a \quad \frac{2x+3}{2}$$

$$b \quad \frac{2x+3}{5}$$

$$c \quad \frac{2x-3}{4}$$

$$d \quad \frac{5-7x}{2}$$

$$13 \quad a \quad \frac{y+x}{xy} \text{ or } \frac{x+y}{xy}$$

$$b \quad \frac{d+c}{cd} \text{ or } \frac{c+d}{cd}$$

$$c \quad \frac{y-x}{xy}$$

$$d \quad \frac{2b+a}{ab} \text{ or } \frac{a+2b}{ab}$$

$$e \quad \frac{5n-2m}{mn}$$

$$f \quad \frac{3h-4g}{gh}$$

Exercise 2.6

1 A and v, B and iv, C and ii, D and iii, E and vi, F and i

$$2 \quad a \quad i \quad 24$$

$$ii \quad 48$$

$$iii \quad 72$$

$$iv \quad 24d$$

$$b \quad H=24d=24 \times d=24 \times 10=240$$

$$3 \quad a \quad i \quad 7$$

$$ii \quad 14$$

$$iii \quad 21$$

$$iv \quad 7w$$

$$b \quad =7w, 56 \text{ days}$$

$$4 \quad a \quad i \quad 9$$

$$ii \quad 25$$

$$iii \quad 7w+d$$

$$b \quad i \quad 19$$

$$ii \quad 45$$

$$5 \quad a \quad A=bh \quad A=b \times h \quad \text{swap sides:}$$

$$b \times h = A \quad \text{reverse the } \times: \quad b = \frac{A}{h}$$

$$b \quad F=bg \quad F=b \times g \quad \text{swap sides:}$$

$$b \times g = F \quad \text{reverse the } \times: \quad b = \frac{F}{g}$$

$$c \quad T=mb \quad T=m \times b \quad \text{swap sides:}$$

$$m \times b = T \quad \text{reverse the } \times: \quad b = \frac{T}{m}$$

$$d \quad X=b+rt \quad \text{swap sides: } b+rt=X$$

$$\text{reverse the } +: \quad b=X-rt$$

$$e \quad M=b-kn \quad \text{swap sides: } b-kn=M$$

$$\text{reverse the } -: \quad b=M+kn$$

$$6 \quad a \quad i \quad D=150$$

$$ii \quad D=180$$

$$b \quad S=\frac{D}{T}, S=20$$

$$c \quad T=\frac{D}{S}, T=5.5$$

$$7 \quad a \quad \text{Polly's age: } d+3, \text{ Max's age: } d-2$$

$$b \quad T=3d+1$$

$$c \quad T=25$$

$$d \quad d=\frac{T-1}{3}$$

$$e \quad d=11$$

$$8 \quad a \quad F=25$$

$$b \quad F=54$$

$$c \quad I=40$$

$$d \quad e=5$$

$$e \quad a=7$$

$$9 \quad a \quad 50\%$$

$$b \quad 8\%$$

$$c \quad 110\%$$

$$10 \quad a \quad 450 \text{ m}$$

$$b \quad 1303 \text{ m}$$

$$c \quad 1078 \text{ m}$$

$$d \quad 1615 \text{ m}$$

$$11 \quad a \quad A$$

$$b \quad B$$

$$c \quad A$$

$$d \quad C$$

$$12 \quad a \quad n=\frac{p+8}{3}$$

$$b \quad n=7(q-k)$$

$$c \quad n=2pw-r$$

$$d \quad n=\frac{hr^2+2}{5}$$

13 Arun is correct. $20^\circ\text{C}=68^\circ\text{F}$ and $68^\circ\text{F}>65^\circ\text{F}$.

14 $F=120$. Learner's own explanation and working. For example:

Use the formula $a=\frac{v-u}{t}$ to find the value of a .

$$\text{So } a=\frac{v-u}{t}=\frac{32-12}{5}=4.$$

Then use the formula $F=ma$ to work out the value of F . So $F=30 \times 4=120$.

15 a $r = \sqrt{\frac{2A}{\pi}}$ b 4.8 cm

16 a $A = a^2 + \frac{bh}{2}$ b $A = 61$

c $a = \sqrt{A - \frac{bh}{2}}$ d $a = 12$

17 a side length of the larger cube = $2x$

b $V = 9x^3$ c $x = \sqrt[3]{\frac{V}{9}}$

d Learner's explanation and working.
Example:

Used the formula $x = \sqrt[3]{\frac{V}{9}}$ to work out the

value of x . $x = \sqrt[3]{\frac{576}{9}} = 4$ cm

Side length of larger cube is $2 \times 4 = 8$ cm

Area of one face of larger cube = $8 \times 8 = 64$ cm²

Surface area of larger cube = $6 \times 64 = 384$ cm²

Exercise 3.1

1 A and ii, B and vi, C and iv, D and i, E and iii, F and v

2 a $3.4 \times 10^2 = 3.4 \times 100 = 340$

b $4.8 \times 10^3 = 4.8 \times 1000 = 4800$

c $12.5 \times 10^1 = 12.5 \times 10 = 125$

d $5 \times 10^5 = 5 \times 100\,000 = 500\,000$

e $14 \times 10^3 = 14 \times 1000 = 14\,000$

3 A and ii, B and v, C and iv, D and i, E and iii

4 a $3.4 \times 10^{-2} = 3.4 \div 100 = 0.034$

b $8 \times 10^{-3} = 8 \div 1000 = 0.008$

c $15 \times 10^{-4} = 15 \div 10\,000 = 0.0015$

d $12 \times 10^{-1} = 12 \div 10 = 1.2$

5 a 2800 b 28 000

c 280 d 2880

e 280 000 f 0.2

g 28 h 0.2

i 0.028 j 0.28

k 0.028 l 28.8

6 a 3.4 b 3.4

c 0.034 d 0.034

e 0.034 f 0.034

g 34 h 3.4

i 3400 j 30 400

k 30 l 340

7 POWERS OF TEN – EASY!

8 a i 5000 ii 500

iii 50 iv 5

v 0.5 vi 0.05

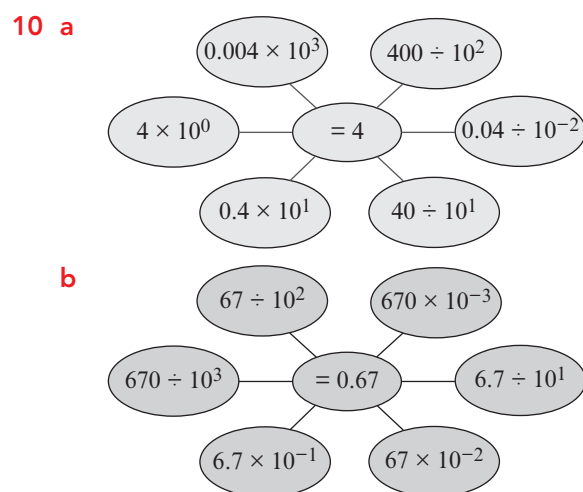
b larger

9 a i 0.099 ii 0.99

iii 9.9 iv 99

v 990 vi 9900

b smaller



11 a 45: A, D, H 4.5: B, E, J 0.45: C, G, I

b 0.045: F is spare. Learner's own answers.
For example: 45×10^{-3} , 4.5×10^{-2} , etc.

12 a ✓ b ✓ c ✗

d ✗ e ✓ f ✗

13 a 270 b 0.0048 c 125 000

14 a B b A c C d B

Exercise 3.2

1 a 4×0.3 $4 \times 3 = 12$ so $4 \times 0.3 = 1.2$

b 7×0.4 $7 \times 4 = 28$ so $7 \times 0.4 = 2.8$

c 9×-0.1 $9 \times -1 = -9$ so
 $9 \times -0.1 = -0.9$

d $-15 \times 0.2 - 15 \times 2 = -30$ so
 $-15 \times 0.2 = -3$

e 8×0.02 $8 \times 2 = 16$ so $8 \times 0.02 = 0.16$

f $-5 \times -0.04 - 5 \times -4 = 20$ so
 $-5 \times -0.04 = 0.2$

g 11×0.07 $11 \times 7 = 77$ so
 $11 \times 0.07 = 0.77$

2 a $6 \div 0.3$ $6 \times 10 = 60$
 $0.3 \times 10 = 3$ $60 \div 3 = 20$

b $8 \div 0.2$ $8 \times 10 = 80$
 $0.2 \times 10 = 2$ $80 \div 2 = 40$

c $-9 \div 0.1$ $-9 \times 10 = -90$
 $0.1 \times 10 = 1$ $-90 \div 1 = -90$

d $12 \div 0.4$ $12 \times 10 = 120$
 $0.4 \times 10 = 4$ $120 \div 4 = 30$

e $6 \div -0.02$ $6 \times 100 = 600$
 $-0.02 \times 100 = -2$ $600 \div -2 = -300$

f $8 \div 0.04$ $8 \times 100 = 800$
 $0.04 \times 100 = 4$ $800 \div 4 = 200$

g $-16 \div -0.08$ $-16 \times 100 = -1600$
 $-0.08 \times 100 = -8$ $-1600 \div -8 = 200$

3 a 1.2 **b** 2.6
c 3.6 **d** -8.1
e 3.3 **f** -0.24
g 0.28 **h** 0.45
i 1.4 **j** -5.55

4 A, C, E, I (0.024); D, G, J, L (0.24);
B, F, H, K (2.4)

5 a 20 **b** 40
c 30 **d** -40
e 200 **f** -250
g 300 **h** 3000
i 200 **j** -400

6 a B b B c C d B

7 a 0.12 **b** 1.35
c 0.072 **d** 0.15
e 0.055 **f** 30
g 9 **h** 5
i 7 **j** 40

8 a True **b** True
c False **d** True

9 Hassan is incorrect. Numerator should be:
 $2.5 \times 0.2 = 0.5$, not 5.

Denominator should be: $5 \times 0.1 = 0.5$, not 50.
 Answer = 1.

10 a 20 **b** 30
c 500 **d** 0.2

11 a i 1.1 **ii** 2.2 **iii** 3.3
iv 4.4 **v** 5.5 **vi** 6.6

b i larger **ii** smaller

c i 80 **ii** 40

iii 20 **iv** 16

v 10

d i larger **ii** larger

12 a 158.4 **b** 158.4

c 0.01584 **d** 352

e 0.352 **f** 3.52

13 a Estimate: $6 \times 40 = 240$ Accurate: 271.377

b Estimate: $200 \div 0.4 = 500$ Accurate: 495

c Estimate: $\frac{80 \times 5}{0.2} = \frac{400}{0.2} = 2000$
 Accurate: 2400

14 a 5.4 m^2 **b** 7.2 m^2

c 0.48 m^2 **d** 0.124 m^2

15 4m

16 0.35m

17 a True **b** True
c False, 0.0025 **d** False, 0.3
e True **f** True

Exercise 3.3

1 a \$300 increased by 15%
 $100\% + 15\% = 115\%$ multiplier is 1.15
 $\$300 \times 1.15 = \345

b \$200 increased by 20%
 $100\% + 20\% = 120\%$ multiplier is 1.2
 $\$200 \times 1.2 = \240

c \$400 increased by 32%
 $100\% + 32\% = 132\%$ multiplier is 1.32
 $\$400 \times 1.32 = \528

2 a \$300 decreased by 15%
 $100\% - 15\% = 85\%$ multiplier is 0.85
 $\$300 \times 0.85 = \255

b \$200 decreased by 20%
 $100\% - 20\% = 80\%$ multiplier is 0.8
 $\$200 \times 0.8 = \160

c \$400 decreased by 32%
 $100\% - 32\% = 68\%$ multiplier is 0.68
 $\$400 \times 0.68 = \272

3 **A** and **vi**, **B** and **iii**, **C** and **i**, **D** and **iv**, **E** and **ii**, **F** and **v**

4 a \$800 increased by 10%, then increased by 20%.
 $800 \times 1.1 = 880 \rightarrow 880 \times 1.2 = \1056

b \$800 decreased by 10%, then decreased by 20%.
 $800 \times 0.9 = 720 \rightarrow 720 \times 0.8 = \576

c \$800 increased by 25%, then decreased by 40%.
 $800 \times 1.25 = 1000 \rightarrow 1000 \times 0.6 = \600

d \$800 increased by 5%, then decreased by 15%.
 $800 \times 1.05 = 840 \rightarrow 840 \times 0.85 = \714

5 a i 198 **ii** 198

b =

c i = **ii** =

6 a i 85.8 **ii** 362.5

b i 891 **ii** 48.72

7 a 1.071 **b** \$1.29

8 a i 33.6 **ii** 120

b i 127.5 **ii** 76.95

9 a 0.63 **b** \$529.20

10

End of year:	Calculation:	Amount:
1	4000×1.05	\$4200.00
2	$4000 \times (1.05)^2$	\$4410.00
3	$4000 \times (1.05)^3$	\$4630.50
4	$4000 \times (1.05)^4$	\$4862.03
5	$4000 \times (1.05)^5$	\$5105.13

11 a i 1800×0.88

ii $1800 \times (0.88)^2$

iii $1800 \times (0.88)^3$

b The value of the scooter after 7 years.

c The value of the scooter after 12 years.

d $1800 \times (0.88)^4 = \$1079.45$ and
 $1800 \times (0.88)^5 = \$949.92$

e $1800 \times (0.88)^n$

12 a **A** and **ii**, **B** and **v**, **C** and **i**, **D** and **iv**, **F** and **iii**

b **E** and 0.54

13 a 60% increase then 45% decrease \rightarrow
multiplier = 0.88 $\rightarrow \$600 \times 0.88 = \528

b 15% decrease then 12% increase \rightarrow
multiplier = 0.952 $\rightarrow \$800 \times 0.952 = \761.60

c 45% increase then 24% increase \rightarrow
multiplier = 1.798 $\rightarrow \$400 \times 1.798 = \719.20

14 a 1.1016 **b** \$2400

15 Learner's own answers. For example:

a $1.5 \times 0.4 = 0.6 \rightarrow$ 50% increase and 60% decrease

$1.2 \times 0.5 = 0.6 \rightarrow$ 20% increase and 50% decrease

b $1.25 \times 1.2 = 1.5 \rightarrow$ 25% increase and 20% increase

$2 \times 0.75 = 1.5 \rightarrow$ 100% increase and 25% decrease

16 500 000

Exercise 3.4

1 a 115, 116, 117, 118, 119, 120, 121, 122, 123, 124

b 115

c 124

2 a 65, 66, 67, 68, 69, 70, 71, 72, 73, 74

b 65

c 74

3 a 24.5, 24.6, 24.7, 24.8, 24.9, 25.0, 25.1, 25.2, 25.3, 25.4

b 24.5

c 25.4

4 a 7.5, 7.6, 7.7, 7.8, 7.9, 8.0, 8.1, 8.2, 8.3, 8.4

b 7.5

c 8.4

5 a 2.5 **b** 3.5

6 a 85 **b** 95

- 7 a** $6.5 \leq x < 7.5$
b $27.5 \leq x < 28.5$
c $134.5 \leq x < 135.5$
d $558.5 \leq x < 559.5$
- 8 a** $45 \leq x < 55$ **b** $415 \leq x < 425$
c $3735 \leq x < 3745$ **d** $5205 \leq x < 5215$
- 9 a** $750 \leq x < 850$ **b** $1150 \leq x < 1250$
c $6650 \leq x < 6750$ **d** $9050 \leq x < 9150$
- 10 a** 18.5 m^2
b 19.5 m^2
c $18.5 \text{ m}^2 \leq x < 19.5 \text{ m}^2$
- 11 a i** 55 **ii** 65
b $55 \leq x < 65$
- 12 A, ii and c; B, ii and a; C, i and e; D, iii and b; E, i and f; F, iii and d**
- 13 a i** 495 g
ii 505 g
iii $495 \text{ g} \leq x < 505 \text{ g}$
b i $2 \times 495 \text{ g} = 990 \text{ g}$
ii $2 \times 505 \text{ g} = 1010 \text{ g}$
- 14 a i** 145 cm
ii 155 cm
iii $145 \text{ cm} \leq x < 155 \text{ cm}$
b Carlos has worked out the correct answer as all pieces of wood can vary between 145 cm and 155 cm, so you must multiply the upper and lower bounds by 3.
 Pepe is incorrect as he has multiplied the rounded number by three then worked out ± 5 cm from that answer instead of ± 15 cm from that answer (as there are three pieces of wood).
- 15 a i** 1.15 litres or 1150 mL
ii 1.25 litres or 1250 mL
iii $1.15 \text{ litres} \leq x < 1.25 \text{ litres}$ or $1150 \text{ mL} \leq x < 1250 \text{ mL}$
b i 5.75 litres or 5750 mL
ii 6.25 litres or 6250 mL
iii $5.75 \text{ litres} \leq x < 6.25 \text{ litres}$ or $5750 \text{ mL} \leq x < 6250 \text{ mL}$

Exercise 4.1

- 1 a** $2x - 6 = 10$
 $2x = 10 + 6$
 $2x = 16$
 $x = \frac{16}{2}$
 $x = 8$
- b** $4(3x + 2) = 32$
 $12x + 8 = 32$
 $12x = 32 - 8$
 $12x = 24$
 $x = \frac{24}{12}$
 $x = 2$
- c** $\frac{y}{2} - 3 = 1$
 $\frac{y}{2} = 1 + 3$
 $\frac{y}{2} = 4$
 $y = 4 \times 2$
 $y = 8$
- d** $5y + 3 = 9 + 2y$
 $5y - 2y = 9 - 3$
 $3y = 6$
 $y = \frac{6}{3}$
 $y = 2$
- 2 a** $5 - 2x = 9$
 $-2x = 9 - 5$
 $-2x = 4$
 $x = \frac{4}{-2}$
 $x = -2$
- b** $6(3 - x) = 3x$
 $18 - 6x = 3x$
 $18 = 3x + 6x$
 $18 = 9x$
 $\frac{18}{9} = x$
 $x = 2$
- c** $\frac{3y}{4} + 1 = 7$
 $\frac{3y}{4} = 7 - 1$
 $\frac{3y}{4} = 6$
 $3y = 6 \times 4$
 $3y = 24$
 $y = \frac{24}{3}$
 $y = 8$
- d** $3(y + 5) = 2(20 - y)$
 $3y + 15 = 40 - 2y$
 $3y + 2y = 40 - 15$
 $5y = 25$
 $y = \frac{25}{5}$
 $y = 5$
- 3 a** $\frac{30}{x} = 5$
 $30 = 5x$
 $\frac{30}{5} = x$
 $x = 6$
- b** $\frac{63}{y+1} = 9$
 $63 = 9(y+1)$
 $\frac{63}{9} = y+1$
 $7 = y+1$
 $7 - 1 = y$
 $y = 6$
- 4 a** $g = 12$
c $p = 7$
e $y = 5$
g $x = -3$
- b** $g = -10$
d $g = 7$
f $y = 12$
h $x = -2$

5 a $5x + 15 = 10x - 20 \rightarrow x = 7$

b $x + 3 = 2x - 4 \rightarrow x = 7$

c Learner's own answers.

6 a $8x - 32 + 20 - 4x = 0 \rightarrow 4x - 12 = 0 \rightarrow x = 3$

b $2(x - 4) + 5 - x = 0 \rightarrow 2x - 8 + 5 - x = 0 \rightarrow x - 3 = 0 \rightarrow x = 3$

c Learner's own answers.

7 a $5(23 + 4) = 5 \times 27 = 135$ and $2(30 - 23) = 2 \times 7 = 14$, $135 \neq 14$

b Line 1: he added 5 and 4 instead of multiplying 5 and 4.
Line 2: he subtracted $2x$ instead of adding $2x$ and added 9 instead of subtracting 9.

c $x = 5\frac{5}{7}$,

$$5\left(5\frac{5}{7} + 4\right) = 5 \times 9\frac{5}{7} = 45 + \frac{25}{7} = 45 + 3\frac{4}{7} = 48\frac{4}{7}$$

$$\text{and } 2\left(30 - 5\frac{5}{7}\right) = 2 \times 24\frac{2}{7} = 48\frac{4}{7}$$

8 a $a = 21$

b $b = \frac{1}{4}$

c $c = 2$

d $d = 4\frac{3}{5}$

Learner's checks.

9 a $n + 2(n + 3) = 90 \rightarrow 3n + 6 = 90$

b $n = 28$

c 28 and 62

10 a $5(x - 8) = 2(x + 10)$

b 20

11 a B and E

b A $x = 6480$ B $x = 5$ C $x = \frac{1}{5}$ D $x = \frac{1}{5}$
E $x = 5$

B and E give the correct answer of five grandchildren.

12 a $x + 50$ and $2x + 80$

b $2x + 80 = 144$

c $x = 32$

13 a $s + 2s + 2s + 5 = 100 \rightarrow 5s + 5 = 100$

b $s = 19$

c 43 cm

14 a $y + 3y + y - 2 + 4(y - 2) = 116$

b $y = 14$

c 48

15 a i $3(a - 2) = a$ ii 3 cm

b i $3(a - 2) + 3(a - 2) + a + a = 44$ or $2a + 6(a - 2) = 44$ or $a + 3(a - 2) = 22$ or $4a - 6 = 22$

ii 7 cm and 15 cm

16 a $\frac{420}{9 - x} = 60$

b $x = 2$

Exercise 4.2

1 ① $2x - 1 = x + 5$
 $2x - x = 5 + 1$
 $x = 6$

② $y = 2x - 1$
 $= 2 \times 6 - 1$
 $= 12 - 1$
 $= 11$

③ Check values are correct. $y = x + 5$
 $= 6 + 5$
 $= 11$

④ $x = 6$ and $y = 11$

2 ① $6x + 3 = 2x - 9$
 $6x - 2x = -9 - 3$
 $4x = -12$
 $x = \frac{-12}{4} = -3$

② $y = 6x + 3$
 $= 6 \times -3 + 3$
 $= -18 + 3$
 $= -15$

③ $y = 2x - 9$
 $= 2 \times -3 - 9$
 $= -6 - 9$
 $= -15$

④ $x = -3$ and $y = -15$

3 a

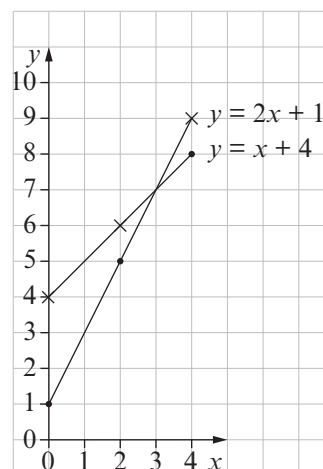
$y = 2x + 1$

x	0	2	4
y	1	5	9

$y = x + 4$

x	0	2	4
y	4	6	8

b



c (3, 7); $x = 3$, $y = 7$

d ① $2x+1=x+4$
 $2x-x=4-1$
 $x=3$

② $y=2x+1$
 $=2 \times 3+1$
 $=6+1$
 $=7$

③ $y=x+4$
 $=3+4$
 $=7$

④ $x=3$ and $y=7$

e Learner's own answer.

4 a $x+y=10$ and $x-y=4$

① $x+y=10$
 $+ \quad x-y=4$
 $\hline 2x+0y=14$
 $2x=14, x=\frac{14}{2}=7$

② $7+y=10$
 $y=10-7$
 $=3$

③ $7-3=4$

④ $x=7$ and $y=3$

b $x+5y=28$ and $x+3y=18$

① $x+5y=28$
 $- \quad x+3y=18$
 $\hline 0x+2y=10$
 $2y=10, y=\frac{10}{2}=5$

② $x+5 \times 5=28$
 $x=28-25$
 $=3$

③ $3+3 \times 5=18$

④ $x=3$ and $y=5$

c $3x+2y=34$ and $x-2y=6$

① $3x+2y=34$
 $+ \quad x-2y=6$
 $\hline 4x+0y=40$
 $4x=40, x=\frac{40}{4}=10$

② $3 \times 10+2y=34$
 $2y=34-30$
 $2y=4, y=\frac{4}{2}=2$

③ $10-2 \times 2=6$

④ $x=10$ and $y=2$

5 $x=6, y=18$

6 $x=2, y=5$

7 $x=6, y=-3$

8 a i, ii $x=2, y=5$

b Learner's own check.

c Learner's own answers.

9 a $x=18, y=2$

b $x=9, y=3$

c $x=9, y=6$

d $x=12, y=14$

10 a $x=10, y=20$

b $x=3, y=24$

c $x=14, y=-9$

d $x=-2, y=4$

11 a $2x+3y=9, 2x+y=5$

b cost of a cake, $x=\$1.50$ and the cost of a coffee, $y=\$2$

12 a $x+y=37.74, x-y=9.24$

b $\$23.49$ and $\$14.25$

13 $x=13, y=8$, so $2x+3y=50$

14 $a=9, b=3, c=4, d=10, e=5, f=11$

a $\text{mean} = \frac{9+3+4+10+5+11}{6} = \frac{42}{6} = 7$

b $\text{range} = 11-3=8$

Exercise 4.3

1 a $x > 2$

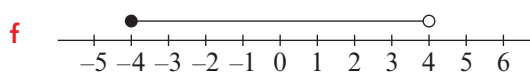
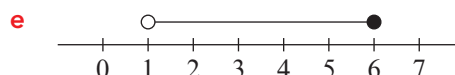
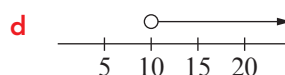
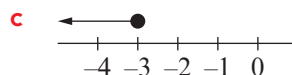
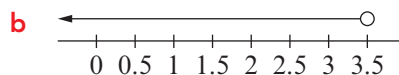
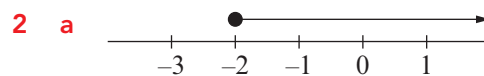
b $x \geq -6$

c $x < 0$

d $x \leq 10$

e $-8 \leq x < 0$

f $-3 < x \leq 3$



3 a 9

b -6

c -3, -2, -1, 0, 1, 2

4 a Could be true.

b Could be true.

c Must be true.

d Cannot be true.

5 a $6x > 18$

$$x > \frac{18}{6}$$

$$x > 3$$

b $2x - 3 < 19$

$$2x < 19 + 3$$

$$2x < 22$$

$$x < \frac{22}{2}$$

$$x < 11$$

c $5x + 1 \leq -9$

$$5x \leq -9 - 1$$

$$5x \leq -10$$

$$x \leq \frac{-10}{5}$$

$$x \leq -2$$

d $3(x - 4) \geq 9$

$$3x - 12 \geq 9$$

$$3x \geq 9 + 12$$

$$3x \geq 21$$

$$x \geq \frac{21}{3}$$

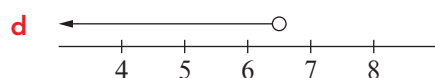
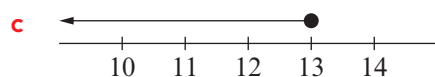
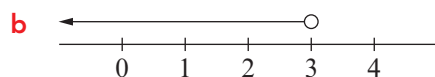
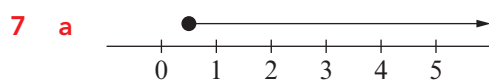
$$x \geq 7$$

6 a $x \geq 0.5$

b $x < 3$

c $x \leq 13$

d $x < 6.5$



8 a $3(y - 4) + 7y \geq 8y - 5$

$$3y - 12 + 7y \geq 8y - 5$$

$$10y - 8y \geq -5 + 12$$

$$2y \geq 7$$

$$y \geq 3.5$$

b i $y = 3$ $3(3 - 4) + 7 \times 3 \geq 8 \times 3 - 5;$
 $3 \times -1 + 21 \geq 24 - 5;$
 $18 \geq 19$ false

ii $y = 3.5$ $3(3.5 - 4) + 7 \times 3.5 \geq 8 \times 3.5 - 5;$
 $3 \times -0.5 + 24.5 \geq 28 - 5;$
 $23 \geq 23$ true

iii $y = 4$ $3(4 - 4) + 7 \times 4 \geq 8 \times 4 - 5;$
 $3 \times 0 + 28 \geq 32 - 5;$
 $28 \geq 27$ true

9 a $x \leq 10$

b $x > 4$

c $x \geq 2$

d $x < 20$

Learner's own checks.

10 a $5x - 14 > 2x + 1$

b $x > 5$

c Learner's own checks.

11 a $3x > 4x + 12$

$$3x - 4x > 12$$

$$-x > 12$$

$$\frac{-x}{-1} < \frac{12}{-1}$$

$$x < -12$$

b $3x - 3 < 5x - 17$

$$3x - 5x < -17 + 3$$

$$-2x < -14$$

$$\frac{-2x}{-2} > \frac{-14}{-2}$$

$$x > 7$$

c $6 - 5x \leq -12$

$$-5x \leq -12 - 6$$

$$-5x \leq -18$$

$$\frac{-5x}{-5} \geq \frac{-18}{-5}$$

$$x \geq 3\frac{3}{5}$$

12 a $x + 2x + x + 30 < 360$ or $4x + 30 < 360$

b $x < 82.5^\circ$

c No, x cannot be 90° because it has to be less than 82.5° .

13 a $A + A + 5 + 2(A + 5) < 100 \rightarrow 4A + 15 < 100$

b $A < 21.25$

c No, because $A < 21.25$, so $2(A + 5) < 52.5$.

14 a $x + 2x + 3(x - 10) < 360 \rightarrow 6x - 30 < 360$

b $x < 65$

c Yes, $2x = 3(x - 10) \rightarrow x = 30$ and this is in the solution set.

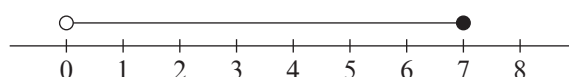
15 a $2z + 9 > 13$

b $3(z - 4) > -6$

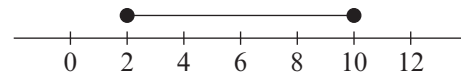
c $4 + 2z > 8$

d $5(3z - 2) > 20$

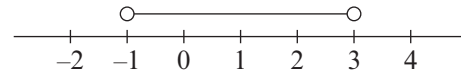
16 a $0 < x \leq 7$



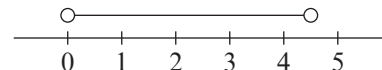
b $2 \leq y \leq 10$



c $-1 < n < 3$



d $0 < m < 4.5$



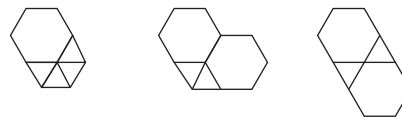
Exercise 5.1

- 1 $a = 80, b = 80, c = 55, d = 125$
- 2 **B and C**
- 3 $B = 48, C = 66, A = 180 - (48 + 66) = 66$
so A and C are equal.
- 4 $a = 100, b = 105, c = 25$
- 5 $a = 49, b = 49, c = 48$
- 6 $x = 30$
- 7 **a, b** Learner's own sketch showing the exterior angles $135^\circ, 120^\circ, 105^\circ$
- 8 $x = 95, y = 39, z = 124$
- 9 $x = 50, y = 30, z = 80$
- 10 Angles of the quadrilateral are $118^\circ, 127^\circ, 75^\circ$;
 $a = 360 - 320 = 40^\circ$
- 11 **a** Angles B and D are not equal.
b Using the exterior angle property,
 $A = 122 - 59 = 63$ and $E = 122 - 63 = 59$.
The third angle is $180 - 122 = 58$, so both triangles have angles of the same size.

Exercise 5.2

- 1 **a** 360° **b** 1080° **c** 1800°
- 2 **a** Learner's own answer; divide pentagon into three triangles.
b 60°
c All the angles are 108° . The fifth angle is also 108 degrees. It is a regular polygon if all the sides are the same length but this may not be the case.
- 3 **a** 1260° **b** 140°
- 4 **a** 7 sides
b The sum must be a multiple of 180.
- 5 One of the angles marked is not inside the hexagon. The angle there is $360 - 90 = 270^\circ$.
- 6 84
- 7 **a** 900° **b** 50°
- 8 $1800 \div 180 = 10$ so that is 12 sides. However, 180 is not a factor of 2000.
- 9 **a** Angles are $135^\circ + 135^\circ + 90^\circ = 360^\circ$
b i $2 \times 120^\circ + 2 \times 60^\circ = 360^\circ$ OR
 $120^\circ + 4 \times 60^\circ = 360^\circ$

ii There are three ways:



- 10 **a** 1440°
b Third angle $= 360 - 108 - 108 = 144^\circ$
- 11 30°
- 12 36°
- 13 It is correct. Substitute values of n . To show it algebraically requires factorising.

Exercise 5.3

- 1 $a = 123; b = 109$
- 2 **a** 90° **b** 120°
- 3 Two exterior angles are 74° and two are 106° .
- 4 60
- 5 72°
- 6 **a** 6 **b** 8 **c** 9 **d** 10
- 7 20, 30 and 40 are factors of 360. 50 is not a factor of 360.
- 8 **a** 10° **b** 36
- 9 12
- 10 36
- 11 12 sides; the interior angle is 150° , the exterior angle is $30^\circ, 360 \div 30 = 12$.
- 12 55
- 13 142°

Exercise 5.4

All questions except questions 7, 9 and 10 have the answer included for self-assessment.

- 1–6 Learner's own diagrams and checks.
- 7 Learner's own pattern. Assess by looking.
- 8 Learner's own diagrams and checks.
- 9 Learner's own pattern. Assess by looking.
- 10 **a** Learner's own diagram.
b 10 cm

Exercise 5.5

- 1 $a = 10\text{ cm}$; $b = 13\text{ cm}$; $c = 34\text{ cm}$
- 2 $a = 8.6\text{ cm}$; $b = 14.4\text{ cm}$; $c = 16.7\text{ cm}$
- 3 $a = 12\text{ cm}$; $b = 7.5\text{ cm}$; $c = 14\text{ cm}$
- 4 $a = 35.3\text{ cm}$; $b = 17.9\text{ cm}$; $c = 16.2\text{ cm}$
- 5 **a** 10.1 cm
b Learner's own diagram.
- 6 **a** **i** 4.2 cm **ii** 7.1 cm
 iii 11.3 cm **iv** 14.1 cm
b Learner's own checks. Check with answers in part **a** and try other side lengths.
- 7 3.7 m OR 3.71 m
- 8 14.7 m OR 14.72 m
- 9 **a** 17.3 cm **b** 173 cm²
- 10 **a** 12 cm **b** 15 cm
- 11 The calculator answer is 36.37... so 36.3 cm or 36.4 cm are acceptable answers.
- 12 **a** 24 cm
b 720 cm²

Exercise 6.1

There are alternative answers to many questions in this unit.

- 1 **a** Learner's own answer. For example: Gender, other interests, availability of equipment.
b Learner's own questions. For example: Do girls spend the same amount of time playing computer games as boys? Do young children play on computer games less than older children? Does playing computer games affect the time spent doing homework?
- c** Learner's own predictions. For example: Girls spend less time playing computer games than boys. Learners who play sports spend less time playing computer games than learners who don't play sports.
- d** Learner's own answer. For example: Use random numbers or names from a hat or a number of learners from different year groups.

e Learner's own answer and explanation.

- 2 **a** Learner's own answer. For example: Time of day, size of car, reason for travel, day of the week.
b Learner's own questions. For example: Do larger cars have more passengers? Are there more passengers in cars early in the morning? Are cars likely to have more passengers at the weekend?
- c** Learner's own predictions. For example: During the rush hour cars are more likely to have only one passenger. Cars on Sundays will have more passengers than cars on Mondays.
- d** Learner's own answer. For example: Observing cars at different times of day or different days of the week.
- e** Learner's own answer and explanation.
- 3 **a** Learner's own questions. For example: Are young people faster using a keyboard than older people? Is there a difference between the speed of young people and old people writing on paper? Is there a difference between boys' speed and girls' speed?
b Learner's own predictions. For example: Girls can type more quickly than boys. Older people can write more quickly on paper than younger people.
c, d, e Learner's own answers. These will depend on the predictions in part **b**.

Exercise 6.2

- 1 **a** 34 **b** 26
- 2 **a** Teacher might not choose at random.
b Learner's own answer. For example: Using random numbers or names from a hat or particular positions in the register.
- 3 **a** People might be more likely to phone if they have a complaint.
b Learner's own answer.