Summary

Check out

1 Rational: $-7, 0.264, \sqrt[3]{125}, 10\,000, \sqrt{4}, \frac{9}{17}, 6\frac{5}{11}, 0.\dot{8}$

Irrational: $\pi, \sqrt{11}, \sqrt[3]{4}$

2 **a** 4.5 **b** 2.5 **c** ± 8.9 **d** 3.6

3 **a** 7^{-2} or $\frac{1}{49}$ or $\frac{1}{7^2}$ **b** 8^8 **c** 3^{-8} or $\frac{1}{3^8}$ **d** 9

Chapter 2

Check in

1 **a** 4 **b** -5 **c** 3 **d** -1 **e** -7

2 **a** -15 **b** 12 **c** -2 **d** 5 **e** 1

3 **a** 15 **b** 13 **c** 11 **d** 21

4 **a** 9^9 **b** 8^8 **c** 5 **d** 3^8

5 **a** Perimeter = $6x + 8$, area = $12x$

b Perimeter = $12 + 4y$, area = $12y$

6 **a** $3(3m + 2)$ **b** $5(3t - 1)$ **c** $13(2 - y)$ **d** $6(4x + 3y)$

Exercise 2A

1 **a** a^5 **b** q^8 **c** r^{10} **d** s^{15} **e** p^8

f j^{19} **g** a^{m+n} **h** p^{a+b} **i** m^{a+b+c}

j x^{a+m+c}

2 **a** q **b** b^3 **c** y^4 **d** $4p^4$ **e** $3x^4$

f $2y^5$ **g** $5n^3$ **h** $\frac{10}{x^2}$

3 **a** $8a^7$ **b** $6c^9$ **c** $6p$ **d** $2q^4$

4 **a** x^6 **b** x^6 **c** x^9 **d** $16x^8$ **e** x^{-8}

f $81x^8$

5 a^{mn}

6 **a** x^3 **b** p^9 **c** y^{-4} **d** q^3

7 **a** $\frac{1}{p^5}$ **b** $\frac{1}{x^3}$ **c** $\frac{1}{q^9}$ **d** y^0 **e** $\frac{1}{k^6}$

8 Students' own examples. For example:

a $3x^{10} \times 4x^6 = 12x^{16}$ **b** $\left(2m^3\right)^4 = 16m^{12}$

c $36y^8 \div 12y^6 = 3y^2$ **d** $3 \times x^0 = 3$

e $2x^{-3} = \frac{2}{x^3}$

9 They are all wrong.

a $(3p)^3 = 27p^9$ **b** $8m^8 \div 2m^2 = 4m^6$

c $4t^4 \times 4t^4 = 16t^8$ **d** $8y^0 = 8$

10 **a** lm^2 **b** $\frac{x^5 z}{y}$

11 **a** $\frac{p^2}{q^3}$ **b** $\frac{x^3}{yz}$ **c** $k^3 m^2$

12 **a** $2p^6 q^3$ **b** p **c** $3p^3$ **d** $\frac{2pq^5}{3}$

13 $x^2 \times x^3$

14 $\dfrac{p^{30}}{\left(p^2 \times p^8\right)^2} = p^{10}$ $\dfrac{\left(p^5 \times p^3\right)^2}{\left(p \times p^3\right)^2} = p^{12}$ $\dfrac{\left(p^4 \times p^2\right)^3}{p^5} = p^{13}$

15 **a** p^6 **b** x **c** A^6 **d** m^{10} **e** x^5

f y **g** $4T$ **h** h^{15} **i** $2g^3$

Exercise 2B

1 **a** $8x$ **b** $10a$ **c** $12b$ **d** $-3y$ **e** $9a$

f $3b$ **g** $-8p$ **h** $17ab$ **i** $9a^2$ **j** $7b^2$

k $11x^2$ **l** $2y^3$

2 **a** $4ab^2 + 5ba^2$

b p^2 (the 1 is not needed but not actually incorrect)

c $6x^2$

3 **a** $2xy - 3z$ **b** $2ab + 6pq$ **c** $7a^2 - 2b^2$ **d** $3a^3 + 4a$

4 **a** $2p + 6q$ **b** $3z - z^3$ **c** $7a^2 - 2b^2$ **d** $8pq - 3p^2$

5 **a** $-21y$ **b** $30p$ **c** $-12pq$ **d** $15y^2$

e $6a^3$ **f** $40x^3$

6 **a** $3a$ **b** 2 **c** 2.5 **d** $4p$ **e** 3

f $4p$ **g** $\frac{5}{x}$ **h** $\frac{1}{2y}$ **i** a **j** a

k $\frac{7b^3}{3a^2}$ **l** $\frac{4x}{y}$

7 **a** $22xy$ **b** $17p^2 q + 7lm$ **c** $pqr + 6abx + mny$

d $4pq - 13ab$ **e** $4x^2 y^2 + 9xy$

8 **a** $4mn$ **b** $-3l^2 m^2$ **c** $-16pqr$ **d** $-15m$

e $8p^3 q^4$ **f** $\frac{7ab^2}{2}$ **g** $\frac{2n^2}{3l^2}$

Exercise 2C

1 **a** $\frac{7}{8}$ **b** $\frac{11}{12}$ **c** $\frac{1}{2}$ **d** $\frac{25}{84}$

2 **a** $\frac{8a}{15}$ **b** $\frac{19a}{45}$ **c** $\frac{11a}{3}$ **d** $\frac{11a}{12}$

e $\frac{-11a}{21}$ **f** $\frac{5a}{7}$

3 **a** $\frac{(4x-y)}{6}$ **b** $\frac{(9y+11x)}{33}$ **c** $\frac{(5y+4x+5z)}{10}$

d $\frac{\left(x+2y^2\right)}{4}$ **e** $\frac{\left(6x+10y^2-y\right)}{4}$ **f** $\frac{\left(7x^2+18y\right)}{63}$

4 **a** $\frac{1}{2b}$ **b** $\frac{15}{8y}$ **c** $\frac{(12+r)}{2pq}$ **d** $\frac{7x}{5}$

e $\frac{5p}{8}$ **f** $\frac{(3x+2)}{x}$ **g** $\frac{(5y-4)}{y}$

5 **a** $\frac{\left(p^2+6q^2\right)}{3pq}$ **b** $\frac{(15+4l)}{3m}$ **c** $\frac{(5x+12z)}{4x}$ **d** $\frac{(r+3pq)}{pqr}$

e $\frac{\left(xy^2+az^2\right)}{zy}$ **f** $\frac{(4a^2 b+5bc^2)}{20ac}$

6 $\frac{(48p+51q)}{(p+q)}$

7 $\frac{(10y+14x)}{xy}$

8 **a** $\$\frac{1.45}{b}$ **b** $\$\frac{2.35}{a}$ **c** $\$\frac{(1.45a+2.35b)}{ab}$

9 **a** $\frac{(9x+11)}{20}$ **b** $\frac{(-3x-9)}{35}$ **c** $\frac{(7x+11)}{(x+1)(x+2)}$

d $\frac{(8x+4)}{(x+3)(x-1)}$ **e** $\frac{2x}{\left(x^2-1\right)}$ **f** $\frac{(2x-22)}{(x+1)(x-3)}$

Investigation

Gap from 1 is $1 - \frac{y}{x}$ or $\frac{x}{y} - 1$

Write with a single denominator $\frac{x-y}{x}$ and $\frac{x-y}{y}$

The numerators are now the same, $x - y$, so you just need to compare the denominators.

Since $x > y$, the fraction with the denominator of x will be smaller, so $\frac{y}{x}$ will be closer to 1.

CamScanner

Exercise 2D

1 a $\dfrac{5(6x+3)}{10} = \dfrac{6x+3}{2}$

b $\dfrac{4(3y-4)}{40} = \dfrac{3y-4}{10}$

c $\dfrac{7}{49p-77} = \dfrac{7}{7(7p-11)} = \dfrac{1}{7p-11}$

d $\dfrac{8(2-9y)}{12} = \dfrac{2(2-9y)}{3} = \dfrac{4-18y}{3}$

e $\dfrac{4(4-18y)}{12} = \dfrac{4-18y}{3}$

f Choose a factor outside of the brackets that is also a factor of the denominator, rather than the highest factor.

2 a $\dfrac{9x+1}{3}$ b $6x+8y$ c $\dfrac{2}{6-y}$ d $\dfrac{5x+3y-z}{2}$

e $\dfrac{6p-9}{4}$

3 These are equivalent to $2x+3$: $\dfrac{2x+15+8x}{5}$, $\dfrac{1}{4}(8x+12)$, $\dfrac{2x+3}{1}$, $\dfrac{x+1.5}{0.5}$

These are not equivalent to $2x+3$: $\dfrac{2x+9}{3}$, $\dfrac{1}{2x+3}$, $\dfrac{20x-(-80x+150)}{50}$, $\dfrac{4x+12}{2}$

4 It is not fully simplified. Divide through by 5 to give $\dfrac{5p+2}{4}$

5 a $\dfrac{x+4}{2}$ b $\dfrac{2}{2m-5}$

6 She can also take m out as a common factor to give the answer $\dfrac{4m+3}{3}$

7 a $\dfrac{6x+5}{16}$ b $\dfrac{5x-6}{8}$

8 a $\dfrac{3}{4}$ b 4 c $\dfrac{3y}{2}$ d $2x$

9 Both fractions simplify to $\dfrac{5}{8}$

Exercise 2E

1 a $x^2+7x+12$ b x^2+6x+5

2 a $x^2+11x+24$ b $x^2+8x+12$

c $x^2+9x+14$ d x^2+3x+2

3 a $x^2+5x-14$ b x^2+x-56

c $x^2-4x-21$ d x^2-x-6

4 a $x^2-10x+21$ b $x^2-16x+63$

c x^2-4x+4 d x^2-2x+1

5 a x^2+x-42 b $x^2-11x+28$

c $x^2-15x+44$ d $x^2-7x-30$

6 Aisha is correct

7 a $x^2+10x+25$ b $x^2+8x+16$ c x^2-2x+1

d $x^2-14x+49$ e $p^2+18p+81$ f $t^2+8t+16$

8 a $x^2+3x-28$ b $x^2-12x+32$ c $\dfrac{(x^2+6x+8)}{2}$

10 a x^2-25 b x^2-64 c x^2-49 d $4-x^2$

11 Students' own answers

12 $ac+bc+ad+bd$

Exercise 2F

1 a x^2-4 b x^2-81 c x^2-121 d $36-x^2$

2 a x^2+4x+4 b $x^2+10x+25$

c x^2-6x+9 d $x^2-24x+144$

3 a x^2-100 b x^2-144

c $x^2-22x+121$ d $x^2+26x+169$

4 a $(x+10)^2$ b $(x-8)^2$ c $(x-6)(x+6)$

d $(x-13)(x+13)$ e $(x-y)(x+y)$

5 $(x+1)(x-1) = x^2-1$, so $49 \times 51 = 50^2-1 = 2500-1 = 2499$

6 $(x+1)^2 = x^2+2x+1$ so:

a $91 = 90^2 + 2 \times 90 + 1 = 8100+180+1 = 8281$

b $401^2 = 400^2 + 2 \times 400 + 1 = 160\,000 + 800 + 1 = 160\,801$

Exercise 2G

1 a -130 b 2 c 82 d 24

e 0.05 f -16

2 a 21.5 b -2.1 c 0.2 d 0.3

e -1.5 f 0.01053

3 a 5.04 b 1331.1 c 18 d -3.2

e 2.5 f -26 g $50\,220$

4 $6xy$ and $48x^2-y^2-y$ have the same value

5 a $324\,000$ b $18\,018$ c 1000

6 a 285 b 362.5

7 0.1571

8 cylinder

9 isosceles

Investigation

Perpendicular sides are 3 and 4 so $\dfrac{1}{2}bh = \dfrac{1}{2}(3 \times 4) = 6$

Using Heron's formula, the perimeter is $3+4+5 = 12$, half of this is 6 so $s = 6$

$A = \sqrt{6(6-3)(6-4)(6-5)} \sqrt{6(3)(2)(1)} = \sqrt{36} = 6$

Exercise 2H

1 a x^2+2x-3 b x^2-64

c $x^2+10x+25$ d $5x+22$

2 $n^2+9n+14$

3 $2w^2+7w$

4 $3 \times 13 = 39$ and $2 \times 9 + 7 \times 3 = 39$

5 $11 \times 11 = 121$ and $5^2 + 36 = 61$

6 $2n^2 + 12n + 18$

7 Both are equal to $2ab + xy - by$. He has found the correct area.

8 As n is even, then $n+1$ will be odd, and so will $n+3$. Their product is: $(n+1)(n+3) = n^2 + 4n + 3$
As n is even, n^2 and $4n$ will also be even. Adding an odd number (here, 3) to an even number always results in an odd number.

9 $\sqrt{x^2+x^2} = \sqrt{2x^2}$ or $\sqrt{2}x$

10 length is $x+8$, $n = 5$

Exercise 2I

1 a $r \rightarrow$ square $\rightarrow \times \pi h \rightarrow V$

b $h \rightarrow \times 2 \rightarrow +r \rightarrow \times \pi r \rightarrow S$

c $a \rightarrow \times t \rightarrow \div 2 \rightarrow +u \rightarrow \times t \rightarrow s$

2 a $r = \sqrt{\dfrac{V}{h\pi}}$ b $h = \dfrac{S - \pi r^2}{2\pi r}$ c $a = \dfrac{2(s-ut)}{t^2}$

3 a $l \rightarrow \div g \rightarrow$ square root $\rightarrow \times \pi \rightarrow \times 2 \rightarrow T$

b 0.898

4 a $l \leftarrow \times g \leftarrow$ square $\leftarrow \div \pi \leftarrow \div 2 \leftarrow T$

b 2

5 a $y = mx \div c$ b $x = cy \div m$

6 a i $r \to$ square $\to \times \pi h \to \div 3 \to V$
  ii $r \leftarrow$ square root $\leftarrow \div \pi h \leftarrow \times 3 \leftarrow V$
 b 6.74 cm

7 a $A = 14x + 28$ **b** $x = \dfrac{A-28}{14}$ or $\dfrac{A}{14} - 2$
 c $x = 2.5$ **d** 9

8 a 314.2 cm³   **b** $R \to$ squared $\to -r^2 \to \times \pi h \to V$
 c $R = \sqrt{\dfrac{V}{\pi h} + r^2}$

9 a i $x \to -s \to \times r \to +t \to y$
  ii $x \to \times n \to +l \to \times m \to y$
 b i $x = s + (y - t) \div r$ **ii** $x = \left(\dfrac{y}{m} - l\right) \div n$

Exercise 2J

1 a $m = \dfrac{Pt}{(v-u)}$ **b** $r = \sqrt{\dfrac{V}{\pi h}}$ **c** $u = \sqrt{v^2 - 2as}$
 d $x = a + \sqrt{r^2 - y^2}$ **e** $g = \dfrac{4\pi^2 l}{T^2}$

2 a $\alpha = \dfrac{P - P_0}{P_0 t}$ **b** $t = \dfrac{P - P_0}{P_0 \alpha}$

3 a $r = \sqrt{\dfrac{S}{4\pi}}$ **b** $r = \dfrac{V}{3\pi h}$
 c $r = \dfrac{2A}{h} - R$ **d** $r = \sqrt{\left(R^2 - \dfrac{V}{\pi h}\right)}$

4 Both are correct. $\dfrac{P-2w}{2} = l$ is the same as $\dfrac{P}{2} - \dfrac{2w}{2} = l$ which
 is $\dfrac{P}{2} - w = l$

5 a $t = \dfrac{2s}{(u+v)}$ **b** $t = \dfrac{(v-u)}{f}$
 c $t = \dfrac{PV}{Rm}$ **d** $t = \dfrac{(T - k\beta)}{k\alpha}$

6 a $k = d(P - mv)$ **b** $m = \dfrac{(Pd - k)}{dv}$
 c $v = \dfrac{(Pd - k)}{dm}$ **d** $d = \dfrac{k}{P - mV}$

7 a $m = {}^-2, c = 9$ **b** $m = \dfrac{1}{5}, c = {}^-2$
 c $m = \dfrac{2}{5}, c = 3$ **d** $m = 2, c = 0$
 e $m = {}^-2, c = 2$

Consolidation

Exercise 2

1 a x^5 **b** y^8 **c** $2x^7$ **d** $3x^9$
 e x^9 **f** y^{11}

2 a x **b** 1   **c** x^4 **d** y^5
 e x^5 **f** y^2

3 a 1   **b** 5   **c** $4m^6$ **d** $16x^2y^6$
 e $\dfrac{x}{2v^2}$ **f** $\dfrac{y^3 z^2}{x}$

4 a y^{10} **b** a^4 **c** x^{-2} **d** m^8
 e p^{-3} **f** $21x^9$ **g** $4m^{-2}$ **h** q^{-8}
 i p^2 **j** R^{10}

5 a $x^2 + 8x + 12$ **b** $x^2 - 25$
 c $x^2 - 3x - 38$ **d** $x^2 + 6x - 16$
 e $x^2 - 7x + 12$ **f** $x^2 - 11x + 10$
 g $x^2 + 10x + 25$ **h** $x^2 - 18x + 81$

6 a i $A = x^2 - 2x - 15$ **ii** $A = x^2 - 8x + 12$
 b i $P = 4x - 4$ **ii** $P = 4x - 16$
 c i $A = 65; P = 36$ **ii** $A = 32; P = 24$

7 a $\dfrac{d}{4} + \dfrac{d}{6} = \dfrac{3d + 2d}{12} = \dfrac{5d}{12}$ **b** $\dfrac{3x}{5} + \dfrac{x}{4} = \dfrac{12x + 5x}{20} = \dfrac{17x}{20}$
 c $\dfrac{2m}{3} - \dfrac{m}{10} = \dfrac{20m - 3m}{30} = \dfrac{17m}{30}$
 d $\dfrac{y}{3} + \dfrac{2y}{5} + \dfrac{y}{4} = \dfrac{20y + 24y + 15y}{60} = \dfrac{59y}{60}$
 e $\dfrac{3}{m} + \dfrac{1}{2m} = \dfrac{6+1}{2m} = \dfrac{7}{2m}$ **f** $1 - \dfrac{1}{x} = \dfrac{x-1}{x}$
 g $\dfrac{3}{4b} + \dfrac{2}{3c} = \dfrac{9c + 8b}{12bc}$
 h $\dfrac{2}{x+1} + \dfrac{1}{x+3} = \dfrac{2(x+3) + (x+1)}{(x+1)(x+3)} = \dfrac{2x + 6 + x + 1}{(x+1)(x+3)} = \dfrac{3x + 7}{(x+1)(x+3)}$

8 a $v = \dfrac{3b - p}{2}$ **b** $h = y - 4T$ **c** $m = \dfrac{3(x - y)}{2}$
 d $r = \dfrac{Y + t}{2} - P$ **e** $n = \dfrac{ab}{3(j + y)}$ **f** $s = \dfrac{hy - d}{2}$

9 a $h = 20\left(F - \dfrac{R}{2}\right)$ **b** $h = 3\left(y^2 - \dfrac{x}{2}\right)$
 c $h = \dfrac{A}{2\pi r^2}$ **d** $h = \dfrac{xy}{(x + y)}$

10 a $r = \sqrt[3]{\dfrac{3V}{4\pi}}$ **b** 3.63 cm

11 a 48   **b** 20.1   **c** -4   **d** 9
 e -4.38   **f** -12.8

Summary

Check out

1 a b^8 **b** $3c^2$ **c** $\dfrac{3a}{2}$ **d** $\dfrac{5a^3 b^2}{c^3}$ **e** $9x^6$
2 a $x = \dfrac{(y - c)}{m}$ **b** $x = \sqrt{y^2 - c^2}$
 c $x = y(p - c) - c$
3 a $x^2 + 6x + 5$ **b** $x^2 + x - 12$ **c** $x^2 - 4x - 12$
 d $x^2 - 11x + 24$ **e** $x^2 + 10x + 25$
4 a $\dfrac{11e}{15}$ **b** $\dfrac{5y}{12}$ **c** $\dfrac{11}{2x}$ **d** $\dfrac{(2p + d)}{8p}$
5 581.25

Chapter 3

Check In

1 a 36°   **b** 215°
2 a 2   **b** 4   **c** 5   **d** 1
3