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** $(2m^3)^4 = 16m^{12}$

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** $\frac{x^5z}{y}$

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

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

13 $x^2 \times x^3$ matches $\frac{x^{10}}{x^3} \times \frac{x^2}{x \times x}$

$\frac{x^4}{x^2 \times x} \times x^2$ matches $x^{11} \times x^2 \div x^{10}$

$x^4 \times x^2 \times x$ matches $x^7 \div x^2$

$x^5 \div x^8$ matches $x^4 \div \frac{(x^4)^2}{x}$

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

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** $17p^2q + 7lm$ **c** $pqr + 6abx + mny$

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

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

e $8p^3q^4$ **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** $\frac{(4a^2b+5bc^2)}{20ac}$

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.

Exercise 2D

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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** $\frac{(x^2+6x+8)}{2}$

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