e $\frac{1}{6}$ recurring **f** $\frac{7}{10}$ terminating

8 **a** recurring **b** terminating

c recurring **d** terminating

9 **a**, **b**

Number of days off work due to illness					
Abi	$\frac{8}{30}=\frac{4}{15}$	Bim	$\frac{5}{30}=\frac{1}{6}$	Caz	$\frac{3}{30}=\frac{1}{10}$
Dave	$\frac{6}{30}=\frac{1}{5}$	Enid	$\frac{2}{30}=\frac{1}{15}$	Fin	$\frac{9}{30}=\frac{3}{10}$

Learner's own decisions on how to group the students.

For example: **A** and **F** are not unit fractions; **B**, **C**, **D** and **E** are unit fractions.

OR

A, **B** and **E** are recurring decimals; **C**, **D** and **F** are terminating decimals.

10 **a** For example:

i $\frac{1}{6}+\frac{2}{3}=\frac{5}{6}$ **ii** $\frac{3}{5}+\frac{2}{9}=\frac{37}{45}$

iii $\frac{1}{6}+\frac{1}{3}=\frac{1}{2}$ **iv** $\frac{2}{5}+\frac{1}{4}=\frac{13}{20}$

b **i** $\frac{5}{18}+\frac{2}{3}=\frac{17}{18}$ **ii** $\frac{3}{5}+\frac{2}{9}=\frac{37}{45}$

iii $\frac{1}{6}+\frac{1}{3}=\frac{1}{2}$ **iv** $\frac{2}{5}+\frac{1}{4}=\frac{13}{20}$

c No. Learner's own examples. For example: $\frac{1}{2}+\frac{1}{4}=\frac{3}{4}$ (terminating), $\frac{2}{5}+\frac{3}{8}=\frac{31}{40}$ (terminating), $\frac{3}{10}+\frac{4}{25}=\frac{23}{50}$ (terminating).

Exercise 8.2

1 **a** $2\frac{1}{8}+\left(1\frac{1}{2}-\frac{1}{4}\right)$ Brackets: $1\frac{1}{2}-\frac{1}{4}=1\frac{2}{4}-\frac{1}{4}=1\frac{1}{4}$

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

b $3+\frac{2}{3}\times\frac{4}{5}$ Multiplication: $\frac{2}{3}\times\frac{4}{5}=\frac{2\times4}{3\times5}=\frac{8}{15}$

Addition: $3+\frac{8}{15}=3\frac{8}{15}$

c $2^2\div\frac{3}{5}-1\frac{5}{6}$ Indices: $2^2=4$

Division: $4\div\frac{3}{5}=4\times\frac{5}{3}=\frac{20}{3}$

Subtraction: $\frac{20}{3}-1\frac{5}{6}=\frac{40}{6}-\frac{11}{6}=\frac{29}{6}=4\frac{5}{6}$

2 **a** $4\frac{3}{4}$ **b** $2\frac{2}{5}$

c $2\frac{3}{4}$ **d** 5

3 **A** and **ii**, **B** and **iii**, **C** and **i**

4 **a–d i** Learner's own estimates.

a **ii** $6\frac{1}{4}$ **b** **ii** $11\frac{7}{18}$

c **ii** $40\frac{5}{8}$ **d** **ii** $15\frac{13}{14}$

5 **a** $25\frac{49}{50}-\left(4\frac{2}{5}+12\frac{7}{25}\right)$ or equivalent.

b Learner's own answer and explanation. For example: He cannot be correct because if you round both sides up and add them to 6 you get $6+5+13=24$. This is nearly 2 m less than the perimeter, so the third side must be at least 2 m more than 6 m.

c $9\frac{3}{10}$ m. Learner's own answer and explanation.

6 $56\frac{7}{10}$ kg

7 Division: $\frac{2}{3}\div\frac{3}{7}=\frac{2}{3}\times\frac{7}{3}=\frac{14}{9}$

Multiplication: $6\frac{1}{2}\times7=\frac{13}{2}\times7=\frac{91}{2}$

Addition: $\frac{14}{9}+\frac{91}{2}=\frac{28}{18}+\frac{819}{18}=47\frac{1}{18}$

8 $16\frac{29}{36}$ m^2

9 **a** $15\frac{3}{4}$ **b** $35\frac{7}{16}$ **c** $910\frac{4}{5}$

10 **a** $\left(1\frac{5}{6}\right)^2+1\frac{5}{6}\times3\frac{1}{3}$ or equivalent.

b $9\frac{17}{36}$ m^2

11 **a** $8\frac{5}{9}$ cm^2 **b** 12 cm

Exercise 8.3

1 **a** $\frac{2}{3}\times12=\frac{2}{3}\times3\times4=2\times4=8$

b $\frac{3}{5}\times20=\frac{3}{5}\times5\times4=3\times4=12$

c $\frac{5}{6}\times18=\frac{5}{6}\times6\times3=5\times3=15$

d $\frac{4}{9}\times27=\frac{4}{9}\times9\times3=4\times3=12$

e $\frac{3}{4}\times32=\frac{3}{4}\times4\times8=3\times8=24$

f $\frac{5}{8}\times48=\frac{5}{8}\times8\times6=5\times6=30$

g $\frac{4}{7}\times35=\frac{4}{7}\times7\times5=4\times5=20$

2 **a** 6 **b** 18 **c** 28

3 **a** $\frac{1}{8}\times20=\frac{1}{4\times2}\times4\times5=\frac{1\times5}{2}=\frac{5}{2}=2\frac{1}{2}$

b $\frac{3}{10}\times 25=\frac{3}{2\times 5}\times 5\times 5=\frac{3\times 5}{2}=\frac{15}{2}=7\frac{1}{2}$

c $\frac{3}{4}\times 14=\frac{3}{2\times 2}\times 2\times 7=\frac{3\times 7}{2}=\frac{21}{2}=10\frac{1}{2}$

d $\frac{5}{9}\times 24=\frac{5}{3\times 3}\times 3\times 8=\frac{5\times 8}{3}=\frac{40}{3}=13\frac{1}{3}$

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

5 **a** 9 **b** 12
c 15 **d** 33
e 30 **f** $6\frac{3}{4}$
g $9\frac{1}{3}$ **h** $3\frac{1}{3}$
i $13\frac{1}{5}$ **j** $11\frac{1}{5}$

6 **a** $\frac{18}{35}$ **b** $\frac{7}{15}$
c $\frac{35}{48}$ **d** $\frac{19}{24}$
e $\frac{21}{40}$ **f** $\frac{9}{13}$
g $\frac{1}{9}$ **h** $\frac{1}{5}$
i $\frac{7}{11}$ **j** $\frac{1}{9}$

7 **a** $\frac{1}{16}$ **b** $\frac{1}{15}$

8 Sarah is incorrect. 21 cm is the smallest whole number value for d so that the circumference is greater than 64 cm.

Learner's own working. For example:

When $d=22$ cm, $C=\frac{22}{7}\times 22=\frac{484}{7}=69\frac{1}{7}$ cm, $69\frac{1}{7}>64$

When $d=21$ cm, $C=\frac{22}{7}\times 21=22\times 3=66$ cm, $66>64$

When $d=20$ cm, $C=\frac{22}{7}\times 20=\frac{440}{7}=62\frac{6}{7}$ cm, $62\frac{6}{7}<64$

9 **a–f i** Learner's own estimates.

a ii $3\frac{3}{20}$ **b ii** $5\frac{1}{4}$
c ii $4\frac{9}{14}$ **d ii** $11\frac{2}{3}$
e ii $2\frac{16}{25}$ **f ii** $22\frac{1}{2}$

10 **a** $1\frac{11}{25}$ m^2 **b** $4\frac{1}{6}$ m^2
c $5\frac{1}{5}$ m^2 **d** $1\frac{43}{56}$ m^2

11 24 m^3

12 **a** Learner's own examples of two proper fractions that when multiplied do not cancel.

e.g. $\frac{1}{3}\times\frac{2}{5}=\frac{2}{15}$, $\frac{2}{7}\times\frac{3}{11}=\frac{6}{77}$

b Learner's own answer and explanation. For example: When the four numbers in the fractions are all different and are all prime numbers or 1, then you will not be able to cancel. When one of the numerators and denominators are the same, then you will be able to cancel. When one of the numerators and denominators are even, then you will be able to cancel. When one of the numerators and denominators are a multiple of each other, then you will be able to cancel.

13 $\left(\frac{2}{3}\right)^2+2\frac{1}{3}\times\frac{4}{5}=2\frac{14}{45}$

Exercise 8.4

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

2 **a** $12\div\frac{2}{3}=12\times\frac{3}{2}=6\times 2\times\frac{3}{2}=6\times 3=18$

b $18\div\frac{3}{4}=18\times\frac{4}{3}=6\times 3\times\frac{4}{3}=6\times 4=24$

c $20\div\frac{4}{7}=20\times\frac{7}{4}=5\times 4\times\frac{7}{4}=5\times 7=35$

d $30\div\frac{2}{3}=30\times\frac{3}{2}=15\times 2\times\frac{3}{2}=15\times 3=45$

e $24\div\frac{4}{5}=24\times\frac{5}{4}=6\times 4\times\frac{5}{4}=6\times 5=30$

3 **a**
$15\div\frac{6}{7}=15\times\frac{7}{6}=5\times 3\times\frac{7}{3\times 2}=\frac{5\times 7}{2}=\frac{35}{2}=17\frac{1}{2}$

b
$12\div\frac{8}{9}=12\times\frac{9}{8}=3\times 4\times\frac{9}{4\times 2}=\frac{3\times 9}{2}=\frac{27}{2}=13\frac{1}{2}$

c
$20\div\frac{6}{5}=20\times\frac{5}{6}=10\times 2\times\frac{5}{2\times 3}=\frac{10\times 5}{3}=\frac{50}{3}=16\frac{2}{3}$

d
$15\div\frac{10}{13}=15\times\frac{13}{10}=3\times 5\times\frac{13}{5\times 2}=\frac{3\times 13}{2}=\frac{39}{2}=19\frac{1}{2}$

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

5 **a** 25 **b** $15\frac{3}{4}$ **c** 88
d $35\frac{1}{5}$ **e** $16\frac{1}{2}$ **f** $20\frac{1}{4}$

6 **a** $\frac{15}{16}$ **b** $4\frac{1}{6}$ **c** $1\frac{19}{26}$

d $2\frac{4}{9}$ **e** $4\frac{1}{5}$ **f** $\frac{10}{11}$

7 **D** 1, **A** $1\frac{1}{14}$, **C** $1\frac{1}{3}$, **B** $1\frac{11}{16}$

8 Estimates are given first, then the accurate answers:

a 1, $\frac{25}{26}$ **b** 4, $3\frac{1}{8}$

c $\frac{3}{5}$, $\frac{3}{5}$ **d** $\frac{4}{3}=1\frac{1}{3}$, $1\frac{5}{21}$

e 5, 4 **f** $\frac{7}{2}=3\frac{1}{2}$, $3\frac{1}{9}$

9 Sofia is incorrect. Learner's own examples. e.g. $\frac{1}{2}\div\frac{1}{4}=2$, $\frac{2}{3}\div\frac{3}{5}=\frac{10}{9}$

10 **a** $\frac{5}{12}$, check $\frac{5}{12}\times\frac{3}{5}=\frac{3}{12}=\frac{1}{4}$

b $4\frac{4}{5}$, check $\frac{24}{5}\times\frac{1}{6}=\frac{4}{5}$

c $\frac{13}{21}$, check $\frac{13}{21}\times\frac{12}{13}=\frac{12}{21}=\frac{4}{7}$

d $1\frac{1}{5}$, check $\frac{6}{5}\times\frac{3}{4}=\frac{18}{20}=\frac{9}{10}$

11 **a** $\frac{7}{20}$ **b** $1\frac{7}{15}$ **c** $1\frac{12}{25}$

12 50 kg

13 $2\frac{3}{4}$ m

14 **a** Learner's own explanation. For example: He rounded $3\frac{1}{4}$ to 3 and he rounded $9\frac{3}{8}$ to 9. So 3 : 9 = 1 : 3.

b Completing the working gives $1:\frac{75}{\cancel{8}_{2}}\times\frac{\cancel{4}^{1}}{13}=1:\frac{75}{26}=1:2\frac{23}{26}$

c Yes, $1:2\frac{23}{26}\approx1:3$

d $1:\frac{2}{3}$

e $1:1\frac{2}{5}$

15 $\frac{4}{7}\div\frac{3}{14}=2\frac{2}{3}$, $1\frac{1}{2}+3\frac{2}{3}=5\frac{1}{6}$, $2\frac{2}{5}\times1\frac{1}{2}=3\frac{3}{5}$, $8\frac{3}{4}-2\frac{5}{6}=5\frac{11}{12}$

Exercise 8.5

1 **a**

$\left(\frac{1}{2}+1.5\right)^2+9 \Rightarrow \left(\frac{1}{2}+1\frac{1}{2}\right)^2=(2)^2=4 \Rightarrow 4+9=13$

b

$\left(2\frac{3}{5}-0.6\right)^3-3 \Rightarrow \left(2\frac{3}{5}-\frac{3}{5}\right)^3=(2)^3=8 \Rightarrow 8-3=5$

c

$5^2-\left(4\frac{1}{4}+0.75\right) \Rightarrow \left(4\frac{1}{4}+\frac{3}{4}\right)=5 \Rightarrow 5^2=25$

$\Rightarrow 25-5=20$

2 **a** 80 **b** 81 **c** $4\frac{3}{5}$

3 **a**

$3.5\times1.5\times12 \Rightarrow \frac{7}{2}\times\frac{3}{2}=\frac{21}{4} \Rightarrow \frac{21}{\cancel{4}_{1}}\times\cancel{12}^{3}=21\times3=63$

b

$1.75\times2\frac{1}{2}\times32 \Rightarrow \frac{7}{4}\times\frac{5}{2}=\frac{35}{8} \Rightarrow \frac{35}{\cancel{8}_{1}}\times\cancel{32}^{4}$

$=35\times4=140$

c

$4.7\times35 \Rightarrow 4\frac{7}{10}\times35=\frac{47}{10}\times35 \Rightarrow \frac{47}{\cancel{10}_{2}}\times\cancel{35}^{7}$

$=\frac{329}{2}=164\frac{1}{2}$

4 **a** 45 **b** 234 **c** $49\frac{1}{2}$

5 175 cm³

6 **a**

$0.44\times5^2 \Rightarrow 0.44=\frac{44}{100}$, $5^2=25 \Rightarrow \frac{44}{\cancel{100}_{4}}\times\cancel{25}^{1}=11$

b

$0.9\times6\frac{2}{3} \Rightarrow 0.9=\frac{9}{10}$, $6\frac{2}{3}=\frac{20}{3} \Rightarrow \frac{\cancel{9}^{3}}{\cancel{10}_{1}}\times\frac{\cancel{20}^{2}}{\cancel{3}_{1}}=6$

c

$2.4\times\left(3^3-7\right) \Rightarrow 2.4=\frac{24}{10}$, $3^3-7=20 \Rightarrow \frac{24}{\cancel{10}_{1}}\times\cancel{20}^{2}$

$=48$

7 **a** 1 **b** 12 **c** 57

8 $\frac{4}{5}$ m²

9 **a** $38\frac{1}{2}$ cm² **b** $19\frac{5}{8}$ m²

10 $\frac{1}{5}$ m

11 $8\frac{3}{4}$

12 Terms are 12, 15, 18. *n*th term rule is $3n+9$, so 50th term = 159.

13 **a** $V = 154\,\text{cm}^3$

b $3V = 3\times154$, $\pi h = \frac{22}{7}\times12 = \frac{22\times12}{7}$

$\frac{3V}{\pi h} = \frac{3\times154}{\frac{22\times12}{7}} = \frac{{}^{1}\cancel{3}\times\cancel{154}^{7}\times7}{{}_{1}\cancel{22}\times\cancel{12}_{4}} = \frac{49}{4}$ and

$r = \sqrt{\frac{49}{4}} = \frac{7}{2} = 3.5$

c $r = \sqrt{\frac{3\times27}{\frac{22}{\cancel{7}_{1}}\times\cancel{154}^{22}}} = \sqrt{\frac{81}{22^2}} = \sqrt{\frac{9^2}{22^2}} = \frac{9}{22}$

Check:

$V = \frac{1}{3}\pi r^2 h = \frac{1}{\cancel{3}_{1}}\times\frac{\cancel{22}^{1}}{\cancel{7}_{1}}\times\frac{\cancel{9}^{3}}{\cancel{22}_{1}}\times\frac{9}{\cancel{22}_{1}}\times\cancel{154}^{7} = 3\times9 = 27$

Exercise 9.1

1 **a** 5, 7, 9, 11, 13

b 0, 3, 6, 9, 12

c 11, 9, 7, 5, 3

d 2, 2.5, 3, 3.5, 4

e 210, 190, 170, 150, 130

2 **a** 4, 5, 7, 10, 14

b 5, 7, 11, 17, 25

c 20, 17, 13, 8, 2

3 **a** non-linear **b** linear

c linear **d** non-linear

4 **a** linear **b** non-linear

c linear **d** linear

e non-linear **f** linear

5 **a** 9, 5, 1, −3, …

b 12, 17, 22, 27, …

c 3, 4, 6, 9, …

d 10, 9, 7, 4, …

e 64, 40, 28, 22, …

f 8, 10, 14, 22, …

6 **A** and **iv**, **B** and **ii**, **C** and **i**, **D** and **iii**

7 **a** 5, 6, 17, …

b −1, 2, 5, …

c 4, 1, 4, …

d −2, 0, 4, …

8 **a** $3, 4\frac{1}{3}, 5\frac{2}{3}, 7, 8\frac{1}{3}, 9\frac{2}{3}, 11$

b $10, 9\frac{1}{5}, 8\frac{2}{5}, 7\frac{3}{5}, 6\frac{4}{5}, 6, 5\frac{1}{5}$

c −6, −5.6, −5.2, −4.8, −4.4, −4, −3.6

d 7.5, 6.25, 5, 3.75, 2.5, 1.25, 0

9 **a** **B**

b The 6th term, which is 2390. (Sequence is 3, 10, 38, 150, 598, 2390, …)

10 **a** 7, 8, 11, 16, …

b 15, 19, 26, 36, …

c 17, 15, 11, 5, …

d 32, 24, 12, −4, …

11 **a** **A** 343; **B** 64; **C** 179

b 64, 179, 343 or **B**, **C**, **A**

12 Sofia is incorrect. Learner's own explanation. For example:

If ✱ = 9, then the sequence is −2, 1, 10, 1009, …

If ✱ = 8, then the sequence is −2, 0, 8, 520, …

If ✱ = 7, then the sequence is −2, −1, 6, 223, …

If ✱ = 6, then the sequence is −2, −2, −2, −2, …

If ✱ = 5, then the sequence is −2, −3, −22, −10 643, …

So, as long as ✱ is greater than 6, there will be positive numbers in the sequence.

13 Timo's method is incorrect. Learner's own explanation. For example: He has reversed the order of the operations, but he hasn't used inverse operations to reverse the actual operations. Correct solution is: 4th term = 72 + 8 = 80, 80 ÷ 2 = 40, 3rd term = 40 + 8 = 48, 48 ÷ 2 = 24.

14 16

15 Two of the terms in the sequence are negative. Learner's own working. For example: Sequence is −4, 2, −10, 86, …

16 First term = −10. Learner's own working. For example: 4th term = 512, 3rd term = 0, reverse the function so rule is cube root and subtract ?.

$\sqrt[3]{512} - ? = 0$

$8 - ? = 0$

$? = 8$

The reverse function is cube root and subtract 8.

2nd term = $\sqrt[3]{0} - 8 = -8$, 1st term = $\sqrt[3]{-8} - 8 = -10$

Exercise 9.2

1 **a** 1st term $= 3 \times 1 = 3$ 2nd term $= 3 \times 2 = 6$
3rd term $= 3 \times 3 = 9$ 4th term $= 3 \times 4 = 12$

b 1st term $= \frac{1}{4} \times 1 = \frac{1}{4}$ 2nd term $= \frac{1}{4} \times 2 = \frac{2}{4} = \frac{1}{2}$
3rd term $= \frac{1}{4} \times 3 = \frac{3}{4}$ 4th term $= \frac{1}{4} \times 4 = \frac{4}{4} = 1$

c 1st term $= 1^2 = 1$ 2nd term $= 2^2 = 4$
3rd term $= 3^2 = 9$ 4th term $= 4^2 = 16$

d 1st term $= 1^3 = 1$ 2nd term $= 2^3 = 8$
3rd term $= 3^3 = 27$ 4th term $= 4^3 = 64$

2 **a** 1st term $= 6 \times 1 + 1 = 7$
2nd term $= 6 \times 2 + 1 = 13$
3rd term $= 6 \times 3 + 1 = 19$
10th term $= 6 \times 10 + 1 = 61$

b 1st term $= 1^2 - 1 = 0$ 2nd term $= 2^2 - 1 = 3$
3rd term $= 3^2 - 1 = 8$ 10th term $= 10^2 - 1 = 99$

c 1st term $= \frac{1}{2} \times 1 = \frac{1}{2}$ 2nd term $= \frac{1}{2} \times 2 = \frac{2}{2} = 1$
3rd term $= \frac{1}{2} \times 3 = \frac{3}{2} = 1\frac{1}{2}$
10th term $= \frac{1}{2} \times 10 = \frac{10}{2} = 5$

d 1st term $= \frac{1}{2}$ 2nd term $= \frac{2}{2} = 1$
3rd term $= \frac{3}{2} = 1\frac{1}{2}$ 10th term $= \frac{10}{2} = 5$

3 **a** They are the same.

b **i** The sequence $\frac{1}{2}n$ is the same as $\frac{n}{2}$.

ii The sequence $\frac{1}{3}n$ is the same as $\frac{n}{3}$.

iii The sequence $\frac{1}{5}n$ is the same as $\frac{n}{5}$.

iv The sequence $\frac{3}{4}n$ is the same as $\frac{3n}{4}$.

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

5 **a** 15, 23, 31, …, 87 **b** −1, 6, 13, …, 62
c $-3\frac{1}{2}, -3, -2\frac{1}{2}$, …, 1 **d** $\frac{1}{10}, \frac{2}{10}, \frac{3}{10}$, …, 1
e 21, 24, 29, …, 120

6 **A** and **iv**, **B** and **iii**, **C** and **i**, **D** and **ii**

7 **a** Learner's own answers.

b **B** has the smaller value.
A 11th term $= 121 - 33 = 88$,
B 120th term $= \frac{2}{3} \times 120 + 7 = 87$.

c Learner's own answers.

8 **a** linear **b** quadratic
c neither **d** quadratic
e neither **f** linear

9 **a** n^2 **b** $n^2 + 20$
c $n^2 - 2$ **d** $n^2 + 7$

10 Learner's own explanations. For example:
For the sequence $n^2 - 10$, the first term will be negative, so 7 cannot be the first term.

11 **a** $\frac{n}{13}$ **b** $\frac{n}{9}$ **c** $\frac{n}{12}$

12 **a** **A** $\frac{3}{5}$, **B** $\frac{5}{8}$, **C** $\frac{4}{7}$ **b** **C** $\frac{4}{7}$, **A** $\frac{3}{5}$, **B** $\frac{5}{8}$

13 **a** No. $n^2 + 34 = 292$, $n^2 = 258$, $n = \sqrt{258} = 16.06\ldots$, which is not a whole number.

b Yes. $\sqrt[3]{5832} = 18$, which is a whole number. 5832 is the 18th term in the sequence.

14 **a** $\frac{1}{3}n + 8\frac{1}{3}$ **b** $12.8 - 0.3n$
c $-2\frac{3}{4} - \frac{1}{2}n$ **d** $3.5 - 3.5n$

15 **a** 2, 7, 14, … **b** 119

16 **a** 9, 17, 27, … 153
b 1, 10, 25, …, 298
c 9, 12, 19, …, 180

Exercise 9.3

1 **a** 16 and 25 **b** 64 and 125

2 **a** **i**

x	2	4	5
y	4	16	25

ii

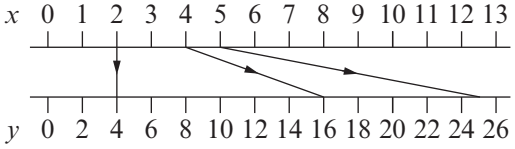
x	2	4	5
y	8	64	125

b They are the same.

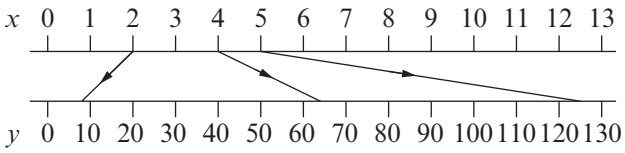
c **i** $y = x^2$

ii $y = x^3$

d **i**



ii



3 **a** **i**

x	3	6	8
y	10	37	65

ii

x	1	3	10
y	−1	25	998

b **i** $y = x^2 + 1$ **ii** $y = x^3 - 2$

4 **a** **i**

x	−2	1	3
y	16	4	36

ii

x	−1	3	4
y	9	81	144

iii

x	−1	2	4
y	0	27	125

b **i** $y = 4x^2$

ii $y = (3x)^2$

iii $y = (x + 1)^3$

5 **a** **i**

x	−2	0	12
y	36	16	64

ii

x	−3	2	$\frac{1}{2}$
y	14	9	$5\frac{1}{4}$

iii

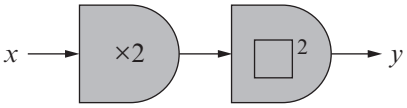
x	−3	$-\frac{1}{2}$	$\frac{1}{2}$
y	$-27\frac{1}{2}$	$-\frac{5}{8}$	$-\frac{3}{8}$

b **i** $y = (x - 4)^2$

ii $y = x^2 + 5$

iii $y = x^3 - \frac{1}{2}$

6 **a**



b

x	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	2
y	$\frac{1}{16}$	$\frac{1}{4}$	1	16

7 **a** **i**

x	2	−4	−6	−10
y	2	8	18	50

ii

x	5	−3	−15	−7
y	64	0	144	16

b **i** $y = \frac{x^2}{2}$

ii $y = (x + 3)^2$

8 Sofia is correct. Learner's own explanation. For example: When you square the positive and negative of the same number you get the same answer, e.g. $2^2 = (-2)^2 = 4$ and $5^2 = (-5)^2 = 25$.

Zara is incorrect. Learner's own explanation. For example: When you add 1 to the positive and negative of the same number you get different answers, so when you square these answers, your final answers will be different, e.g. $(2 + 1)^2 = 3^2 = 9$ and $(-2 + 1)^2 = (-1)^2 = 1$.

9 **a** **i** $y = x^4$

ii $x = \pm\sqrt[4]{y}$

iii Learner's own check.

b **i** $y = x^5$

ii $x = \sqrt[5]{y}$

iii Learner's own check.

c **i** $y = (3x)^2$

ii $x = \pm\frac{\sqrt{y}}{3}$

iii Learner's own check.

d **i** $y = x^3 - 10$

ii $x = \sqrt[3]{y + 10}$

iii Learner's own check.

e **i** $y = \left(\frac{x}{4}\right)^2$

ii $x = \pm 4\sqrt{y}$

iii Learner's own check.

f **i** $y = \frac{x^3}{2}$

ii $x = \sqrt[3]{2y}$

iii Learner's own check.

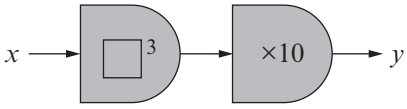
10 **a**, **b** Learner's own answers for grouping the functions: For example:

- One step functions: **B**, **F**, **G**, **L**
  Two step functions: **A**, **C**, **D**, **E**, **H**, **I**, **J**, **K**
- Contains a power: **A**, **C**, **D**, **F**, **H**, **J**
  Contains a root: **B**, **E**, **I**, **K**
  Contains no powers or roots: **G**, **L**
- Contains the number 4: **A**, **D**, **E**, **L**
  Contains the number 9: **G**, **H**, **I**, **K**
  Contains the number 2: **C**, **J**
  Contains no numbers: **B**, **F**
- Contains fractions: **C**, **D**, **E**, **I**
  Contains no fractions: **A**, **B**, **F**, **G**, **H**, **J**, **K**, **L**

11 Sofia and Zara are both correct. The table of values works for both equations.

This is because
$x = \pm\sqrt{4y} = \pm\sqrt{4} \times \sqrt{y} = \pm 2 \times \sqrt{y} = \pm 2\sqrt{y}$

12



$y = 10x^3$

x	$\frac{1}{2}$	$\frac{1}{4}$	-3
y	$1\frac{1}{4}$	$\frac{5}{32}$	-270

Learner's own explanation. For example:
Start by working out the missing number in the function machine using the first pair of values in the table.
$\left(\frac{1}{2}\right)^3 \times ? = 1\frac{1}{4}$, $\frac{1}{8} \times ? = \frac{5}{4}$, $? = \frac{5}{4} \times 8 = 10$, so the missing number in the function machine is 10.

13 Marcus is incorrect. Learner's own explanations. For example:

His conjecture is correct for the first function $y = (x - 5)^4$. When you work out $x - 5$, if the answer is positive or negative, once you have raised it to the power of 4, the answer is always positive. For example, $3^4 = (-3)^4 = 81$.

His conjecture is incorrect for the second function $y = 5 - x^5$. If x^5 is greater than 5, the y-value will be negative. For example: when $x = 2$, $y = 5 - 2^5 = 5 - 32 = -27$.

Exercise 10.1

1 **a** $20 + 15 \times 4 = \$80$ **b** \$170
c $y = 15w + 20$

2 **a** 20 kg **b** $2x + 4y = 22$

3 **a** $a + b = 36$ **b** 23
c $b = 3a$

4 **a** 24
b **i** $4s + 6l = 40$ **ii** 2

5 **a** 84 minutes **b** $t = 2g - 20$
c 36 minutes

6 **a** 85 **b** $5p + 6h = 100$
c 15 (with two pentagons)

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

8 $y = 10 + x$ because all the other functions are equivalent.

9 **a** $r + b = 18$ **b** $r + 4b = 27$
c 15 red and 3 blue

Exercise 10.2

1 **a**

x	-1	0	1	2	3	4
y	7	12	17	22	27	32

b at (0, 12)
c $5 \times 5 + 12 = 37$, but $5 \times 10 + 12 = 62$

2 **a**

x	-10	0	10	20	30	40
y	8	10	12	14	16	18

b at (0, 10)
c 11.4

3 **a**

x	0	5	10	15	20	25
y	20	15	10	5	0	-5

b at (0, 20) and (20, 0)

4 **a**

x	0	1	2	3	4	5	6
y	10	8	6	4	2	0	-2

b Learner's own graph; A straight line through (0, 10) and (5, 0).
c 3.5

5 **a**

x	0	3	6	9	12	15
y	4	3	2	1	0	-1

b Learner's own graph; A straight line through (0, 4) and (12, 0).

c at (4.5, 2.5)

6 a

x	0	6	2	5
y	9	0	6	1.5

b Learner's own graph; A straight line through (0, 9) and (6, 0).

c at (0, 9) and (6, 0)

7 a

x	−3	−2	−1	0	1	2	3
y	6	1	−2	−3	−2	1	6

b Learner's own graph; A parabola with the bottom at (0, −3).

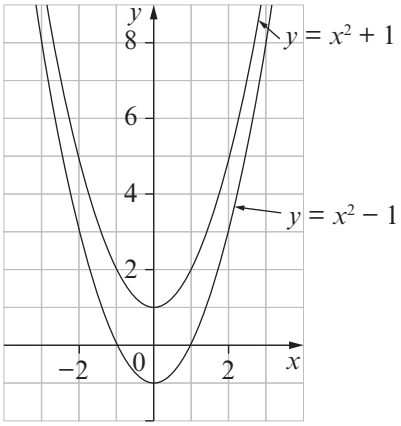
c $5^2 - 3 = 22$

d Yes; $(-9)^2 - 3 = 78$

8 a

x	−3	−2	−1	0	1	2	3
x^2+1	10	5	2	1	2	5	10

b and c



d It is on $y = x^2 - 1$.

9 a

x	0	12	4	8
y	9	0	6	3

b Learner's own graph; A straight line through (0, 9) and (12, 0).

c Learner's own graph; A straight line through (0, 6) and (8, 0).

d Learner's own graph; A straight line through (0, 3) and (4, 0).

10 a $6 \times 5 + 5 \times 6 = 60$

b at (0, 12) and (10, 0)

c Learner's own graph; A straight line through (0, 12) and (10, 0).

11 a Learner's own graph; A straight line through (0, 7) and (14, 0).

b Learner's own graph; A straight line through (0, 12) and (4, 0).

c (2, 6)

12 a **A** is $y = x^2$; **B** is $y = x^2 - 4$

b **i** 49 **ii** 45

c 5 and −5

Exercise 10.3

1 a gradient 10 and y-intercept 20

b gradient −20 and y-intercept 10

c gradient 0.5 and y-intercept −2.5

2 a gradient $\frac{1}{3}$ and y-intercept $\frac{10}{3}$

b gradient 0 and y-intercept 12

c gradient −30 and y-intercept −45

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

4 a $y = 15 - x$

b gradient −1 and y-intercept 15

c (15, 0)

5 a $y = 4 - \frac{1}{3}x$

b gradient $-\frac{1}{3}$ and y-intercept 4

c

x	0	12	6	3
y	4	0	2	3

d Learner's own graph; A straight line through (0, 4) and (12, 0).

e Learner's own checks.

6 a $4 \times 2.5 = 10$ and $20 - 10 = 10$

b $y = \frac{1}{4}x - 2\frac{1}{2}$

c gradient $\frac{1}{4}$ and y-intercept $-2\frac{1}{2}$

7 a **C** $-\frac{3}{5}$ **b** **C** 2

8 **A** and **iv**, **B** and **ii**, **C** and **iii**, **D** and **i**

9 a gradient −0.2 and y-intercept 2

b gradient −2.5 and y-intercept 5

c gradient −1 and y-intercept 0.4

10 a $4 \times 0 - 2 \times (-6) + 8 = 0 + 12 + 8 = 20$

b $4 \times 5 - 2 \times 4 + 8 = 20 - 8 + 8 = 20$

c $y = 0.5x + 3$

d gradient 0.5 and y-intercept 3

Exercise 10.4

1 **a** 400 m

b gradient = 8; the speed is 8 m/s

c $y = 8t$

d 560 m

2 **a** 15 dollars

b 6 dollars/metre

c $d = 6x$

d 51 dollars

e 5 metres

3 **a** **i** 14 dinars **ii** 7 dinars

b 0.35 **c** $y = 0.35x$

d 32.55 dinars **e** 2000 dollars

4 **a**

Time (hours)	0	5	10
Temperature (°C)	20	17	14

b −0.6; the temperature decreases at a rate of 0.6 °C/hour

c $y = 20 - 0.6t$

d 12.8 °C

5 **a** **i** 15 000

ii 23 000

iii 27 000

b 400/year or 0.4 thousand/year

c $p = 0.4t + 15$

6 **a** Learner's own graph; A line from the origin through (25, 42).

b about 30 dollars

c The gradient is $42 \div 25 = 1.68$, so the equation is $d = 1.68l$.

d 30.24 is the exact value

e 100.8 dollars

f 40 litres

7 He is not correct. Priya's speed is 50 km/h and Mei's is 60 km/h.

8 **a** Learner's own graph; A straight line from (0, 12) through (20, 40).

b 33 litres

c 1.4 litres/second

d $y = 1.4x + 12$

9 **a** Learner's own graph; A line from the origin through (50, 875).

b $y = 17.5x$

c You can exchange 1 Franc for 17.5 Rand.

d 2275 Rand

10 **a** Learner's own graph; A straight line from (0, 300) to (120, 0).

b 75 m

c 2.5 m/s

d $y = 300 - 2.5x$ (learners could use other letters).

Exercise 11.1

1 **a** Flour: 2 parts = 250 g,
1 part = 250 ÷ 2 = 125 g

Butter: 1 part = 125 g

b Total = 250 + 125 = 375 g

2 **a** Peach juice: 3 parts = 450 mL,
1 part = 450 ÷ 3 = 150 mL

Pineapple juice: 4 parts = 4 × 150 = 600 mL

b Total = 450 + 600 = 1050 mL

3 Tina: 5 parts = \$65 → 1 part = 65 ÷ 5 = \$13

Kim: 2 parts = 2 × 13 = \$26

Total they share = 65 + 26 = \$91

4 **a** Benji: 2 parts = \$24, 1 part = 24 ÷ 2 = \$12

Abdul: 1 part = \$12

Caen: 3 parts = 3 × 12 = \$36

b Total = 12 + 24 + 36 = \$72

5 **a** 21 **b** 35

6 **a** 180 g **b** 480 g

7 **a** 6, 15, 24 **b** 45

8 **a** Instead of using \$40 = 5 parts (for travel) he has used \$40 = 4 parts (for food).

He has also added up the total number of parts incorrectly. The total is 16 not 15.

b 5 parts = \$40, so 1 part = 40 ÷ 5 = \$8

Total number of parts = 4 + 7 + 5 = 16

Total spent = 16 × 8 = \$128

9 650 mL

10 **a** $135

b Zosia gets $60, Abie gets $75

11 12 : 16 → divide both numbers by 4 → 3 : 4

9 : 12 → divide both numbers by 3 → 3 : 4

12 550 mL vanilla ice cream, 2200 mL grape juice, 2750 mL ginger ale. Learner's own method.
For example:
Grape juice: 2250 ÷ 4 = 562.5 mL per part,
Ginger ale: 2750 ÷ 5 = 550 mL per part.

Use 550 mL per part as smallest amount.

Ice cream: 1 × 550 mL = 550 mL,
Grape juice: 4 × 550 mL = 2200 mL,
Ginger ale: 5 × 550 mL = 2750 mL

13 0.03 and 0.025 or 0.036 and 0.03

14 22.5 cm

15 **a** 90°, 35° and 55° or 90°, 70° and 20°

b Two solutions. Learner's own explanation. For example: The 20° difference could be between the right angle and one of the other angles, or it could be between the two other angles (not the right angle).

c 35° : 55° : 90° → 7 : 11 : 18 or
20° : 70° : 90° → 2 : 7 : 9

16 **a**

Activity	Child : staff ratio	Number of children	Number of staff
Horse-riding	4 : 1	22	22 ÷ 4 = 5.5 so 6
Sailing	5 : 1	17	17 ÷ 5 = 3.4 so 4
Rock-climbing	8 : 1	30	30 ÷ 8 = 3.75 so 4
Canoeing	10 : 1	26	26 ÷ 10 = 2.6 so 3

Total number of staff = 6 + 4 + 4 + 3 = 17

b Learner's own answer. For example: Move two children from horse riding to rock climbing and move two children from sailing to canoeing. New table is:

Activity	Child : staff ratio	Number of children	Number of staff
Horse-riding	4 : 1	20	20 ÷ 4 = 5 so 5
Sailing	5 : 1	15	15 ÷ 5 = 3 so 3
Rock-climbing	8 : 1	32	32 ÷ 8 = 4 so 4
Canoeing	10 : 1	28	28 ÷ 10 = 2.8 so 3

Total number of staff = 5 + 3 + 4 + 3 = 15

Exercise 11.2

1 **a** **i** 80 **ii** 120 **iii** 160

b direct proportion

2 **a** **i** $4.40 **ii** $6.60

iii $8.80

b direct proportion

3 **a** less time **b** more time

c **i** ÷2 ↷ 2 people = 6 days ↷ 1 person = 12 days ↷ ×2

ii ×2 ↷ 2 people = 6 days ↷ 4 people = 3 days ↷ ÷2

d inverse proportion

4 **a** less than 60 seconds

b more than 60 seconds

c **i** ×2 ↷ normal speed = 60 seconds ↷ 2 × speed = 30 seconds ↷ ÷2

ii ÷2 ↷ normal speed = 60 seconds ↷ $\frac{1}{2}$ speed = 120 seconds ↷ ×2

d inverse proportion

5 **a** ÷2 ↷ 4 people = 7 hours ↷ 2 people = 14 hours ↷ ×2

b ×2 ↷ 4 people = 7 hours ↷ 8 people = 3.5 hours ↷ ÷2

c ×7 ↷ 4 people = 7 hours ↷ 28 people = 1 hour ↷ ÷7

6 **a** 100 g

b 225 g

c 400 mL

7 **a** **i** 3 hours

ii 12 hours

iii 4 hours

b 60 km/h

8

Number of students	5	2	3	4	6	7	8
Cost per student ($)	240	600	400	300	200	171.43	150

9 1 hour 20 minutes

10 4 days

11 Zara is incorrect. It will take the same amount of time as 20 minutes is the time the journey takes. It doesn't matter how many people are on the train.

12 $A = 14$, $B = 15$, $C = 49$, $D = 7.5$

13 **a** 169 cm **b** 165 cm

14 **a** 2 houses

b 12 people

c 15 days

d

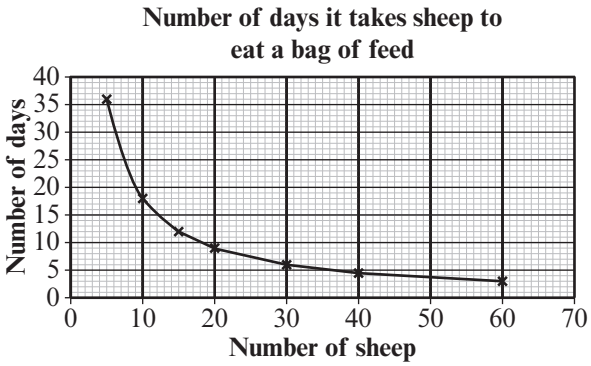
People	Days	Houses
6	20	4
1	120	4
1	30	1
6	60	12
4	60	8

15 **a**

Number of sheep (x)	5	10	15	20	30	40	60
Number of days (y)	36	18	12	9	6	4.5	3
$x \times y$	180	180	180	180	180	180	180

b $x \times y = 180$, yes

c **i** and **iii**



ii No, the points do not form a straight line.

iv Answer between 25 and 26 days (accurate answer is 25.7 to 1 d.p.)

Exercise 12.1

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

c $\frac{1}{4}$ **d** $\frac{5}{12}$

e $\frac{7}{12}$

2 **a** 0.35 **b** 0.2

3 **a** 85% **b** 35% **c** 20%

4 **a** 0.34 **b** 0.7 **c** 0.52

5 **a** **i** 0.45 **ii** 0.65

b 0.85

6 $\frac{5}{12}$

7 **a** 0.4 **b** 0.9

8 **a** 0.01 **b** 0.98

c 0.5 **d** 0.95

e 0.89 **f** 0.81

9 **a** T is 3, 6, 9 or 12 and F is 5 or 10 and these have no common element.

b **i** $\frac{19}{36}$ **ii** $\frac{2}{3}$ **iii** $\frac{17}{36}$

10 **a** **i** $\frac{13}{25}$ **ii** $\frac{12}{25}$ **iii** $\frac{22}{25}$

b 15 is a multiple of both 3 and 5, so the events are not mutually exclusive. Adding the probabilities will not give the correct answer.