

Rayner GCSE Textbook ANSWERS

1 Number 1

page 1 Exercise 1 1

- | | | |
|-------------|-----------|-----------|
| 1 20 | 2 400 | 3 80 |
| 4 6 | 5 6000 | 6 20 000 |
| 7 5 000 000 | 8 800 000 | 9 200 |
| 10 70 | 11 10 | 12 800 |
| 13 a 720 | b 5206 | c 16 430 |
| d 500 000 | e 300 090 | f 8500 |
| 14 a 8753 | b 3578 | |
| 15 a 75 423 | b 23 574 | |
| 16 a 257 | b 3221 | c 704 |
| 17 a 1392 | b 26 611 | c 257 900 |
| 18 a 0 | b 52 000 | |

page 2 Exercise 2 1

- | | | |
|--|----------------------|---------------------------|
| 1 True | 2 False | 3 True |
| 4 True | 5 True | 6 False |
| 7 True | 8 True | 9 $50 + 7 + \frac{2}{10}$ |
| 10 a 235.1 | b 67.23 | |
| c 98.32 | d 3.167 | |
| 11 0.2, 0.31, 0.41 | 12 0.58, 0.702, 0.75 | |
| 13 0.41, 0.43, 0.432 | 14 0.6, 0.609, 0.61 | |
| 15 0.04, 0.15, 0.2, 0.35 | | |
| 16 0.18, 0.81, 1.18, 1.8 | | |
| 17 0.061, 0.07, 0.1, 0.7 | | |
| 18 0.009, 0.025, 0.03, 0.2 | | |
| 19 0.01, 0.05, 0.1, 0.11, 0.2, 0.205, 0.25 | | |
| CARWASH | | |
| 20 a 32.51 | b 0.853 | c 1.16 |
| 21 a 5.69 | b 0.552 | c 1.30 |
| 22 a £3.50 | b £0.15 | c £0.03 |
| d £0.10 | e £12.60 | f £0.08 |
| 23 a True | b False | c True |
| d True | | |

page 4 Exercise 3 1

- | | | |
|------------------------------|----------|---------|
| 1 3497 | 2 2435 | 3 785 |
| 4 91745 | 5 212 | 6 41 |
| 7 859 | 8 208 | 9 270 |
| 10 5000 | 11 365 | 12 856 |
| 13 2528 | 14 64568 | 15 85 |
| 16 324 | 17 639 | 18 325 |
| 19 52 r 1 or $52\frac{1}{7}$ | 20 52 | 21 2018 |
| 22 4569 | 23 7 | 24 1080 |
| 25 1492 | 26 524 | 27 5800 |
| 28 188 | 29 1641 | 30 365 |
| 31 254 | 32 21200 | |

page 4 Exercise 4 1

- 1 a
$$\begin{array}{r} 285 \\ + 514 \\ \hline 799 \end{array}$$
- b
$$\begin{array}{r} 637 \\ + 252 \\ \hline 889 \end{array}$$
- c
$$\begin{array}{r} 635 \\ + 344 \\ \hline 979 \end{array}$$
- 2 a
$$\begin{array}{r} 356 \\ + 526 \\ \hline 882 \end{array}$$
- b
$$\begin{array}{r} 224 \\ + 537 \\ \hline 761 \end{array}$$
- c
$$\begin{array}{r} 388 \\ + 425 \\ \hline 813 \end{array}$$
- 3 a
$$\begin{array}{r} 48 \\ \times 3 \\ \hline 144 \end{array}$$
- b
$$\begin{array}{r} 33 \\ \times 7 \\ \hline 231 \end{array}$$
- c
$$\begin{array}{r} 321 \\ \times 5 \\ \hline 1605 \end{array}$$

4 a $\boxed{1} \boxed{5} \boxed{0} \div 3 = 50$

b $\boxed{1} \boxed{5} \times 4 = 60$

c $9 \times \boxed{9} = 81$

d $\boxed{1} \boxed{1} \boxed{5} \boxed{2} \div 6 = 192$

5 a
$$\begin{array}{r} 4 \boxed{4} 5 \\ + 28 \boxed{5} \\ \hline \boxed{7} 30 \end{array}$$

b
$$\begin{array}{r} 4 \boxed{2} 7 \\ + \boxed{1} 7 \boxed{7} \\ \hline 604 \end{array}$$

c
$$\begin{array}{r} \boxed{5} 3 \boxed{5} \\ + 2 \boxed{6} 4 \\ \hline 799 \end{array}$$

6 a $\boxed{3} \boxed{5} \times 7 = 245$

b $\boxed{5} \boxed{8} \times 10 = 580$

c $32 \div \boxed{4} = 8$

d $\boxed{9} \boxed{5} \boxed{0} \div 5 = 190$

page 5 Exercise 5 1

- | | | |
|-------------|----------|---------|
| 1 10.14 | 2 20.94 | 3 26.71 |
| 4 216.95 | 5 9.6 | 6 23.1 |
| 7 9.14 | 8 17.32 | 9 0.062 |
| 10 1.11 | 11 4.36 | 12 2.41 |
| 13 1.36 | 14 6.23 | 15 2.46 |
| 16 8.4 | 17 2.8 | 18 10.3 |
| 19 0.18 | 20 4.01 | 21 6.66 |
| 22 41.11 | 23 3.6 | 24 6.44 |
| 25 105.2 cm | 26 £8.96 | |

page 6 Exercise 6 1

- | | | |
|----------|---------|----------|
| 1 0.06 | 2 0.15 | 3 0.12 |
| 4 0.006 | 5 1.8 | 6 3.5 |
| 7 1.8 | 8 0.8 | 9 0.36 |
| 10 0.014 | 11 1.26 | 12 2.35 |
| 13 8.52 | 14 3.12 | 15 0.126 |
| 16 127.2 | 17 0.17 | 18 0.327 |
| 19 0.126 | 20 0.34 | 21 0.055 |
| 22 0.52 | 23 1.3 | 24 0.001 |

page 6 Exercise 7 1

- | | | |
|---------|---------|--------|
| 1 2.1 | 2 3.1 | 3 4.36 |
| 4 4 | 5 4 | 6 2.5 |
| 7 16 | 8 200 | 9 70 |
| 10 0.92 | 11 30.5 | 12 6.2 |

13 12.5

16 56

19 0.3

22 3.04

25 0.14

28 0.15

31 1.75

14 122

17 60

20 0.7

23 5.62

26 3.75

29 1.22

32 18.8

15 212

18 1500

21 0.5

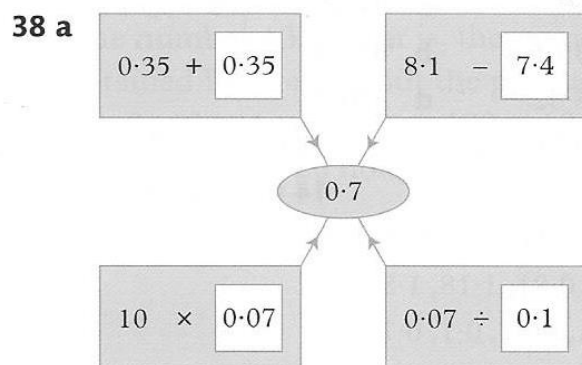
24 0.78

27 0.075

30 163.8

page 7 Exercise 8 1

- | | | |
|-----------|------------|-----------|
| 1 7.91 | 2 22.22 | 3 7.372 |
| 4 0.066 | 5 466.2 | 6 1.22 |
| 7 1.67 | 8 1.61 | 9 16.63 |
| 10 24.1 | 11 26.7 | 12 3.86 |
| 13 0.001 | 14 1.56 | 15 0.0288 |
| 16 2.176 | 17 0.02 | 18 0.0001 |
| 19 355 | 20 20 | 21 £12.80 |
| 22 34 000 | 23 18 | 24 0.569 |
| 25 2.335 | 26 1620 | 27 8.8 |
| 28 1200 | 29 0.00175 | 30 13.2 |
| 31 200 | 32 0.804 | 33 0.08 |
| 34 0.077 | 35 0.0009 | 36 0.01 |
| 37 a 20 | b 184 | c 0.63 |
| d 540 | e 3 | |



- 39 a True b True c True
 d False e False f True
 g True h False i True
 j True
- 40 a > b > c <
 d < e > f >

page 9 Exercise 9 1

- | | | |
|--------|---------|---------|
| 1 805 | 2 459 | 3 650 |
| 4 1333 | 5 2745 | 6 1248 |
| 7 4522 | 8 30368 | 9 28224 |

- 10 8568 11 46800 12 66281
13 57602 14 89516 15 97525

page 10 **Exercise 10** 1

- 1 32 2 25 3 18 4 13
5 35 6 $22 \text{ r } 2 \text{ or } 22\frac{1}{13}$
7 $23 \text{ r } 24 \text{ or } 23\frac{12}{17}$ 8 $18 \text{ r } 10 \text{ or } 18\frac{10}{41}$
9 $27 \text{ r } 18 \text{ or } 27\frac{3}{4}$ 10 $13 \text{ r } 31 \text{ or } 13\frac{31}{52}$
11 $35 \text{ r } 6 \text{ or } 35\frac{2}{9}$ 12 $25 \text{ r } 28 \text{ or } 25\frac{28}{31}$
13 $64 \text{ r } 37 \text{ or } 64\frac{37}{64}$ 14 $151 \text{ r } 17 \text{ or } 151\frac{17}{18}$
15 $2961 \text{ r } 15 \text{ or } 2961\frac{15}{19}$

page 10 **Exercise 11** 1

- 1 £47.04 2 46 3 7592
4 15 with 20p change 5 8
6 £14 million 7 £85 8 £80.64
9 £21 600 10 54
11 a 6.72 b 2.795 c 3.976
12 a 4.9 b 3.5 c 2.0
13 a

End of year	1	2	3	4	5
No. of gerbils	40	120	360	1080	3240

- b 608

page 13 **Exercise 12** 1

- 1 a 1, 2, 3, 6 b 1, 3, 5, 15
c 1, 2, 3, 6, 9, 18 d 1, 3, 7, 21
e 1, 2, 4, 5, 8, 10, 20, 40
2 2, 3, 5, 7, 11, 13, 17, 19
3 Multiple answers. Two examples are $2 + 3 = 5$ and $2 + 5 = 7$
4 3, 11, 19, 23, 29, 31, 37, 47, 59, 61, 67, 73
5 a $2 \times 2 \times 2 \times 3 \times 5 \times 5$
b $3 \times 3 \times 7 \times 11$
c $2 \times 2 \times 2 \times 2 \times 2 \times 7 \times 11$
d $2 \times 3 \times 3 \times 3 \times 5 \times 13$
e $2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 5$
f $2 \times 2 \times 5 \times 7 \times 7 \times 23$

6

	Prime number	Multiple of 3	Factor of 16
Number greater than 5	7	9	8
Odd number	5	3	1
Even number	2	6	4

- 7 a 7 b 50 c 1 d 5

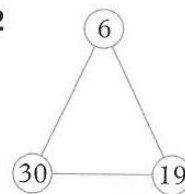
- 8 a 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225

- 9 1, 8, 27, 64, 125

- 10 a 25 b 27 c 125

- 11 13

- 12



- 13 $13 + 15 + 17 + 19 = 64 = 4^3$

$$21 + 23 + 25 + 27 + 29 = 125 = 5^3$$

$$31 + 33 + 35 + 37 + 39 + 41 = 216 = 6^3$$

- 14 No, because for example $2 + 3$ is an odd number.

- 15 a No b Yes c No

- d Yes e Yes

- 16 8

- 17 2, 5, 7, 43, 61, 89

- 18 $7 = 3 + 2^2$ $9 = 5 + 2^2$ $11 = 7 + 2^2$
 $13 = 5 + 2^3$ $15 = 7 + 2^3$ $17 = 13 + 2^2$
 $19 = 11 + 2^3$ $21 = 13 + 2^3$ $23 = 19 + 2^2$
 $25 = 17 + 2^3$ $27 = 23 + 2^2$

- 19 Yes it is.

- 20 No, for example when $n = 4$ and $a = 2$,
 $a^n - a = 2^4 - 2 = 16 - 2 = 14$

page 15 **Exercise 13** 1

- 1 a 2, 4, 6, 8, 10, 12 b 5, 10, 15, 20, 25, 30 c 10
2 a 4, 8, 12, 16 b 12, 24, 36, 48 c 12
3 a 18 b 24 c 70
d 12 e 10 f 63
4 12 5 6

6 a 6 b 11 c 9
d 6 e 12 f 10

7 a 6 b 40
c Multiple answers e.g. 22, 33
d 5 and 2 or 10 and 1

8 15

9 21

10 a $2^4 \times 7 \times 3^2$ $2^3 \times 3 \times 5 \times 7$

b 168 c 7

11 a $2^3 \times 3^2 \times 5^2 \times 11$
 $2 \times 3^2 \times 5 \times 11 \times 13$

b 990 c 22

page 17 Exercise 14 1

1 i ii A = +15, B = $\times 2$,
C = -22, D = $\div 4$

a $\xrightarrow{7}$ A $\xrightarrow{22}$ B $\xrightarrow{44}$ C $\xrightarrow{22}$ D $\xrightarrow{5.5}$

b $\xrightarrow{10}$ A $\xrightarrow{25}$ B $\xrightarrow{50}$ C $\xrightarrow{28}$ D $\xrightarrow{7}$

c $\xrightarrow{16}$ A $\xrightarrow{31}$ B $\xrightarrow{62}$ C $\xrightarrow{40}$ D $\xrightarrow{20}$

d $\xrightarrow{\frac{1}{2}}$ A $\xrightarrow{15\frac{1}{2}}$ B $\xrightarrow{31}$ C $\xrightarrow{9}$ D $\xrightarrow{2\frac{1}{4}}$

2 i ii A = square, B = $\times 3$,
C = -10, D = $\div 2$

a $\xrightarrow{4}$ A $\xrightarrow{16}$ B $\xrightarrow{48}$ C $\xrightarrow{38}$ D $\xrightarrow{19}$

b $\xrightarrow{5}$ A $\xrightarrow{25}$ B $\xrightarrow{75}$ C $\xrightarrow{65}$ D $\xrightarrow{32\frac{1}{2}}$

c $\xrightarrow{6}$ A $\xrightarrow{36}$ B $\xrightarrow{108}$ C $\xrightarrow{98}$ D $\xrightarrow{49}$

d $\xrightarrow{8}$ A $\xrightarrow{64}$ B $\xrightarrow{192}$ C $\xrightarrow{182}$ D $\xrightarrow{91}$

3 A = $\times 4$, B = square root,
C = -10, D = $\times (-2)$

4 A = reciprocal, B = +1,
C = square, D = $\div 3$

5 A = +3, B = cube,
C = $\div (-2)$, D = +100

page 18 Exercise 15 1

1 a 4 b 6 c 6 d 15

e 21 f 20 g 18 h 30

2 a $\frac{3}{4}$ b $\frac{1}{4}$ c $\frac{2}{5}$ d $\frac{1}{4}$

e $\frac{3}{5}$ f $\frac{8}{9}$ g $\frac{4}{5}$ h $\frac{1}{3}$

i $\frac{3}{5}$ j $\frac{7}{8}$

3 a $\frac{2}{4}$ b $\frac{5}{9}$ c $\frac{2}{97}$

4 $\frac{3}{12} = \frac{1}{4}$, $\frac{6}{15} = \frac{2}{5}$, $\frac{10}{45} = \frac{2}{9}$, $\frac{5}{6} = \frac{30}{36}$, $\frac{3}{7} = \frac{12}{28}$

5 a $\frac{2}{3} = \frac{8}{12}$, $\frac{1}{2} = \frac{6}{12}$, $\frac{1}{4} = \frac{3}{12}$ b $\frac{1}{4}$, $\frac{1}{2}$, $\frac{2}{3}$

6 a $\frac{5}{6} = \frac{10}{12}$, $\frac{2}{3} = \frac{8}{12}$, $\frac{1}{4} = \frac{3}{12}$ b $\frac{1}{4}$, $\frac{2}{3}$, $\frac{5}{6}$

7 $\frac{1}{2}$, $\frac{3}{5}$, $\frac{7}{10}$ 8 $\frac{7}{12}$, $\frac{3}{4}$, $\frac{5}{6}$ 9 $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$

10 $\frac{2}{15}$, $\frac{1}{3}$, $\frac{7}{15}$

11 a $\frac{2}{3}$ b $\frac{2}{5}$ c $\frac{5}{8}$ d $\frac{3}{4}$

12 a $\frac{7}{4} = 1\frac{3}{4}$

b i $2\frac{2}{3}$ ii $2\frac{2}{5}$ iii $2\frac{1}{4}$

iv $1\frac{1}{6}$ v $7\frac{1}{2}$

13 a $\frac{7}{5}$ b $\frac{5}{2}$ c $\frac{15}{4}$

d $\frac{13}{3}$ e $\frac{15}{7}$

page 20 Exercise 16 1

1 a $\frac{3}{8}$ b $\frac{9}{10}$ c $\frac{11}{15}$

2 a $\frac{5}{6}$ b $\frac{5}{12}$ c $\frac{7}{12}$

d $\frac{9}{20}$ e $1\frac{11}{20}$ f $1\frac{1}{2}$

g $1\frac{7}{12}$ h $3\frac{7}{12}$

3 a $\frac{1}{6}$ b $\frac{5}{12}$ c $\frac{7}{15}$

d $\frac{1}{10}$ e $1\frac{1}{12}$ f $\frac{1}{6}$

4	+	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{3}$
	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{5}{6}$
	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{11}{14}$
	$\frac{1}{5}$	$\frac{9}{20}$	$\frac{23}{40}$	$\frac{8}{15}$

- 5 a $\frac{1}{9}$ b $\frac{1}{5}$ c $\frac{5}{8}$
 d $\frac{9}{100}$ e 7 f 14
 g £22 h £20

- 6 a $\frac{8}{15}$ b $\frac{5}{42}$ c $\frac{15}{26}$
 d $1\frac{1}{6}$ e $\frac{5}{8}$ f $9\frac{1}{6}$
 g $\frac{4}{15}$ h $\frac{3}{14}$

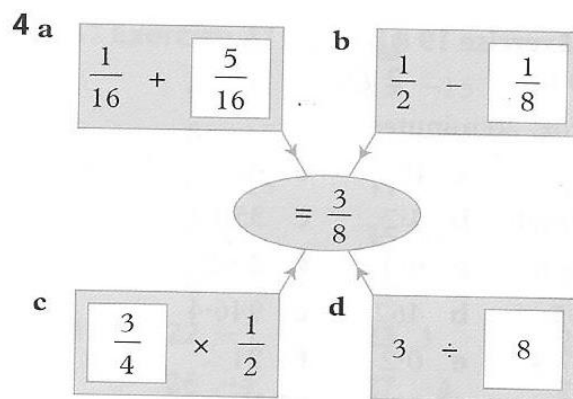
7 Kate $\frac{5}{8}$ Liam $\frac{3}{8}$

- 8 a $\frac{4}{15}$ b $\frac{2}{5}$ c $\frac{1}{2}$
 d $\frac{3}{4}$ e $1\frac{1}{2}$ f $1\frac{1}{4}$
 9 $\frac{1}{4}$ 10 $\frac{3}{7}$ 11 $\frac{2}{5}, \frac{3}{5}$

12 $\frac{2}{5}$

page 22 **Exercise 17** 1

- 1 a $\frac{4}{1} \times \frac{3}{2} = 6$ b $\frac{2}{3} \times \frac{5}{3} = 1\frac{1}{9}$
 2 a $\frac{8}{9}$ b 6 c $\frac{4}{5}$
 d $\frac{3}{16}$ e $5\frac{1}{3}$ f 16
 g 1 h 70
 3 a $\frac{5}{12}$ b $4\frac{1}{2}$ c $1\frac{2}{3}$
 d $\frac{5}{16}$ e $1\frac{7}{8}$ f $2\frac{5}{8}$
 g $1\frac{9}{26}$ h 8



5 123 cm

- 6 a $1\frac{1}{3}$ b $\frac{1}{3}$ c $\frac{5}{12}$ d $1\frac{2}{3}$
 e $\frac{7}{10}$ f $\frac{1}{10}$ g $\frac{3}{25}$ h $4\frac{2}{3}$

7 $\frac{1}{5}$

- 8 a $\frac{9}{16}$ b $\frac{7}{20}$ c $1\frac{1}{5}$ d $1\frac{1}{6}$
 e $\frac{1}{10}$ f $\frac{7}{15}$ g $\frac{20}{23}$ h $1\frac{3}{5}$

9 5

10 $n = 3$

11 $1\frac{16}{17}$

12 9

13 a $a = 1, b = 2$

b $a = 1, b = 5$

c $a = 1, b = 13$ or $a = 5, b = 7$

14

$\times$	$\frac{2}{5}$	$\frac{3}{4}$	$\frac{2}{3}$
$\frac{1}{3}$	$\frac{2}{15}$	$\frac{1}{4}$	$\frac{2}{9}$
$\frac{1}{2}$	$\frac{1}{5}$	$\frac{1}{8}$	$\frac{1}{3}$
$\frac{1}{4}$	$\frac{1}{10}$	$\frac{3}{16}$	$\frac{1}{6}$

15 144 ml

16 a line 3 = $\frac{15}{16}$; line 4 = $\frac{31}{32}$ b $1 - \frac{1}{2^{n+1}}$

page 25 **Exercise 18** 1

- 1 C 2 A 3 C 4 C 5 A
 6 B 7 C 8 A 9 A 10 C
 11 C 12 B 13 C 14 B 15 A
 16 C 17 A 18 C 19 B 20 C
 21 B 22 A 23 B 24 B 25 A

page 25 **Exercise 19** 1

1 £8000 2 £6

3 Approx. 20 minutes

4 C 5 B 6 A 7 A

8 a 89.89 b 4.2 c 358.4

d 58.8 e 0.3 f 2.62

9 a 4.5 b 462 c 946.4

d 77.8 e 0.2 f 21

10 £5200 11 20 12 Yes, it is

13 Yes

14 Cost

$200 \times £2 \div 40 = £10$ so he is not correct.

15 50

page 28 **Exercise 20** 1

1 a 5600 b 600 c 28 200

d 100 e 11 400 f 200

2 a 18 b 225 c 4

3 a 0.7 b 8.81 c 0.726

d 1.18 e 0.9 f 8.22

g 0.075 h 11.726 i 20.2

j 6.67 k 0.3 l 0.0725

4 a 2.7 b 189 c 3

d 0.36 e 1.7 f 0.0416

g 0.04 h 800 i 9300

j 8.1k 6.10 l 8

page 30 **Exercise 21** 1

1 a 2:7 b 3:5 c 1:3

2 a 3:2 b 3:5 c 1:4

d 5:2 e 3:4 f 8:5

g 3:2:4 h 3:2:5

3 a 1:6 b 1:50 c 1:1.6

d 1:0.75

4 a 2.4:1 b 2.5:1 c 0.8:1

5 £15:£25 6 £36:£84

7 £70:£28 8 £2.10:£6.30

9 15 kg : 75 kg : 90 kg

10 46 mins : 69 mins : 69 mins

11 £39 12 $5:3$

13 a 10 apples b $\frac{2}{5}$

14 a 18

b $\frac{3}{7}$

15 a $\frac{5}{8}$

b 3:5

16 £200

17 3:7

18 $\frac{1}{7}x$

19 6

20 £120

21 300g

22 625

page 31 **Exercise 22** 1

1 12.3 km 2 4.71 km

3 50 cm 4 64 cm

5 5.25 cm

6 40 m $\times$ 30 m, 12 cm², 1200 m²

7 1 m², 6 m²

8 0.32 km² (or 320 000 m²)

9 a i 14 m ii 6 m iii 4 m

b 8 m c 14 m d 2 cm

e 12 m f 42 m²

10 Belfast, Douglas, Carlisle, Liverpool, Caernarvon, Dublin, Belfast; 772 km

11 a 1 cm = 1 km or 1 : 100 000 b 5 km

c 4 km²

page 34 **Exercise 23** 1

1 £1.10 2 6 hours

3 6 days 4 $2\frac{1}{2}$ litres

5 60 km 6 119 g

7 260 mins 8 $2\frac{1}{4}$ weeks

9 6 men

10 a 12 pens b 2100

page 34 **Exercise 24** 1

1 a 5 SF b 8 SF c 12 SF

d 6.2 SF e £4 f £3.40

g £2.60 h £4.60

i $k = 2.5$, 8500 SF

j £10.5 million SF

2 $\frac{6.15}{5}$, 9.8 euros

3 a $\frac{15.5}{7}$ b 26.6 lbs

4 18333, 6417, £16.37 5 Hardware shop

6 3.5 litres

7 a Bank B

b Bank A

8 6.4 litres red, 9.6 litres white **9** 16.7 litres

10 a 7 : 3 **b** 3 litres

11 a 0.5 litres **b** $\frac{1}{11}$

page 36 **Exercise 25 1**

- | | | |
|---------------|---------------|---------------|
| 1 -4 | 2 -12 | 3 -11 |
| 4 -3 | 5 -5 | 6 4 |
| 7 -5 | 8 -8 | 9 19 |
| 10 -17 | 11 -4 | 12 -5 |
| 13 -11 | 14 6 | 15 -4 |
| 16 6 | 17 0 | 18 -18 |
| 19 -3 | 20 -11 | 21 -12 |
| 22 4 | 23 4 | 24 0 |
| 25 -8 | 26 -3 | 27 3 |
| 28 -12 | 29 18 | 30 -5 |
| 31 -66 | 32 98 | |

page 37 **Exercise 26 1**

- | | | |
|--------------|---------------|--------------|
| 1 -8 | 2 -7 | 3 1 |
| 4 1 | 5 9 | 6 11 |
| 7 -8 | 8 42 | 9 4 |
| 10 15 | 11 -7 | 12 -9 |
| 13 -1 | 14 -7 | 15 0 |
| 16 11 | 17 -14 | 18 0 |
| 19 17 | 20 3 | 21 -1 |
| 22 -3 | 23 12 | 24 -9 |
| 25 3 | 26 0 | 27 8 |
| 28 2 | | |

29 a

+	-5	1	6	-2
3	-2	4	9	1
-2	-7	-1	4	-4
6	1	7	12	4
-10	-15	-9	-4	-12

b

+	-3	2	-4	7
5	2	7	1	12
-2	-5	0	-6	5
10	7	12	6	17
-6	-9	-4	-10	1

page 37 **Exercise 27 1**

- | | | | |
|---------------|---------------|----------------|---------------|
| 1 -6 | 2 -4 | 3 -15 | 4 9 |
| 5 -8 | 6 -15 | 7 -24 | 8 6 |
| 9 12 | 10 -18 | 11 -21 | 12 25 |
| 13 -60 | 14 21 | 15 48 | 16 -16 |
| 17 -42 | 18 20 | 19 -42 | 20 -66 |
| 21 -4 | 22 -3 | 23 3 | 24 -5 |
| 25 4 | 26 -4 | 27 -4 | 28 -1 |
| 29 -2 | 30 4 | 31 -16 | 32 -2 |
| 33 -4 | 34 5 | 35 -10 | 36 11 |
| 37 16 | 38 -2 | 39 -4 | 40 -5 |
| 41 64 | 42 -27 | 43 -600 | 44 40 |
| 45 2 | 46 36 | 47 -2 | 48 -8 |

49 a

×	4	-3	0	-2
-5	-20	15	0	10
2	8	-6	0	-4
10	40	-30	0	-20
-1	-4	3	0	2

b

×	-2	5	-1	-6
3	-6	15	-3	-18
-3	6	-15	3	18
7	-14	35	-7	-42
2	-4	10	-2	-12

Test 1

- | | | | |
|--------------|---------------|---------------|--------------|
| 1 -16 | 2 64 | 3 -15 | 4 -2 |
| 5 15 | 6 18 | 7 3 | 8 -6 |
| 9 11 | 10 -48 | 11 -7 | 12 9 |
| 13 6 | 14 -18 | 15 -10 | 16 8 |
| 17 -6 | 18 -30 | 19 4 | 20 -1 |

Test 2

- | | | | |
|--------------|--------------|--------------|---------------|
| 1 -16 | 2 6 | 3 -13 | 4 42 |
| 5 -4 | 6 -4 | 7 -12 | 8 -20 |
| 9 6 | 10 0 | 11 36 | 12 -10 |
| 13 -7 | 14 10 | 15 6 | 16 -18 |
| 17 -9 | 18 15 | 19 1 | 20 0 |

Test 3

- 1 100 2 -20 3 -8 4 -7
 5 -4 6 10 7 9 8 -10
 9 7 10 35 11 -20 12 -6
 13 -10 14 -7 15 -19 16 -1
 17 -5 18 -13 19 0 20 8

Test 4

- 1 5 2 2 3 -20 4 4
 5 $-\frac{1}{2}$ 6 -5 7 1 8 2
 9 6 10 12 11 0 12 -8
 13 1 14 -1000 15 -1

page 39 Exercise 28 1

- 1 6 2 17
 3 $6^2 + 7^2 + 42^2 = 43^2$, $10^2 + 11^2 + 110^2 = 111^2$

- 4 400 5 200 g 6 128 cm^2

- 7 $\frac{1}{66}$ 8 5

9 a
$$\begin{array}{r} 5 \overline{) 4} \\ 9 \times \\ \hline 4 \overline{) 8} 6 \end{array}$$

b
$$\begin{array}{r} \overline{) 5} 7 \\ \overline{) 8} \times \\ \hline 4 \overline{) 5} 6 \end{array}$$

c
$$\begin{array}{r} 5 \overline{) 2} \\ \overline{) 2} \times \\ \hline 1 \overline{) 0} 4 \end{array}$$

- 10 a $\frac{1}{3}$ b $a = 2, b = 8$ or vice versa

page 40 Exercise 29 1

$\times$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{1}{5}$
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{3}{8}$	$\frac{1}{10}$
$\frac{1}{4}$	$\frac{1}{6}$	$\frac{3}{16}$	$\frac{1}{20}$
$\frac{2}{5}$	$\frac{4}{15}$	$\frac{3}{10}$	$\frac{2}{25}$

- 2 a $66667^2 = 4444488889$
 b 44444448888889 c 66666667

- 3 a $a = 100, b = 1$ is one solution.

- b $a = 100, b = 2$ is one solution.

- 4 $47 \rightarrow \text{prime}$, $26 \rightarrow 2 \times 13$,
 $40 \rightarrow 2 \times 2 \times 2 \times 5$,
 $25 \rightarrow 5 \times 5$, $63 \rightarrow 3 \times 3 \times 7$, $71 \rightarrow \text{prime}$

- 5 $5 \times 7 \times 13 \times 13 \times 71$ 6 1

- 7 36, 49, 64

- 8 a $x = 1$ b $x = 15$

- 9 50

- 10 (e) 106

page 41 Exercise 30 1

- 1 £7055 2 10

- 3 $11^2 = 121$, $111^2 = 12321$, $1111^2 = 1234321$

Predict $11111^2 = 123454321$

and $111111^2 = 12345654321$

- 4 $\begin{array}{cc} (1) & (3) \\ | & | \\ (48) & (33) \end{array}$ is one answer.

- 5 a 66666 b 82 c 455551

6

¹ 8	² 1		³ 9
	⁴ 3	⁵ 7	1
⁶ 2	5	5	
7		⁷ 6	8

- 7 500 8 5 and 28; 32

- 9 $(1 + 2) \times 3 + (4 \times 5) + 6 + (7 \times 8) + 9$
 is a possible answer.

page 42 Exercise 31 1

- 1 a 4 b 5

2 a

3	-4	1
-2	0	2
-1	4	-3

- 3 $x = 57^\circ$ or 54° 4 216 cm^3

- 5 a $\frac{1}{994}, \frac{1}{949}, \frac{1}{499}$ b $\frac{91}{94}$

6 a £6576

b i 8

7 8

ii 99

page 43 **Exercise 32** 1

1

0.5	-	0.01	→	0.49
+		×		
3.5	×	10	→	35
↓		↓		
4	÷	0.1	→	40

2

5.2	-	1.8	→	3.4
-		÷		
4.2	×	5	→	21
↓		↓		
1	+	0.36	→	1.36

3

0.7	×	30	→	21
×		-		
10	-	-19	→	29
↓		↓		
7	-	49	→	-42

4

-12	×	-6	→	72
÷		+		
4	+	7	→	11
↓		↓		
-3	+	1	→	-2

5

-8	÷	4	→	-2
×		÷		
-2	+	8	→	6
↓		↓		
16	-	$\frac{1}{2}$	→	$15\frac{1}{2}$

6

27	+	-7	→	20
×		÷		
$\frac{1}{3}$	÷	$\frac{1}{3}$	→	1
↓		↓		
9	+	-21	→	-12

page 43 **Test yourself**

1 a 7 hrs 10 mins

b £378

c 80 sandwiches

2 a 6

b $2^4 \times 3 \times 5$

3 Blackcurrant: 7 g/100 ml; Fizzy orange: 8.5 g/100 ml. Kelly drinks more sugar.

4 a $6\frac{5}{12}$

b i $\frac{1}{3}$

ii It converts to 0.3.

5 No. Car cost is approx £24 fuel.

6 100

7 £3500

8 a -3

b -12

c -3

d 16

e -2

f -4

9 a 4510

b $+\frac{1}{3}, -\frac{1}{3}$

10 a i $2^5 \times 3$ ii 12

b $5\frac{1}{6}$

2 **Number 2**

page 47 **Exercise 1** 1

1 a 0.25

b 0.4

c 0.375

d 0.416

e 0.16

f 0.285714

2 a $\frac{1}{5}$

b $\frac{9}{20}$

c $\frac{9}{25}$

d $\frac{1}{8}$

e $1\frac{1}{20}$

f $\frac{7}{1000}$

3 a 25%

b 10%

c 72%

d 7.5%

e 2%

f $33\frac{1}{3}\%$

4 $\frac{1}{4}$

5 0.58

6 1.42

7 0.65

8 0.32

9 0.07

10 0.69

11 40%

12

	Fraction	Decimal	Percentage
a	$\frac{3}{4}$	0.75	75%
b	$\frac{1}{5}$	0.2	20%
c	$\frac{16}{25}$	0.64	64%
d	$\frac{1}{1000}$	0.001	0.1%
e	$\frac{1}{50}$	0.02	2%
f	$\frac{1}{3}$	0.3	$33\frac{1}{3}\%$

13 0.07, 0.7, 0.77, 0.7

14 $\frac{2}{3}, \frac{5}{7}, \frac{11}{15}, \frac{3}{4}$

15 A 0.04

B -0.42

C $\frac{5}{12}$

D -0.42

E $\frac{7}{15}$

16 45%, $\frac{1}{2}$, 0.6

17 4%, $\frac{6}{16}$, 0.38

18 11%, 0.111, $\frac{1}{9}$

19 0.3, 32%, $\frac{1}{3}$

20 No

21 95.3% (1 dp)

22 a 58.9% (1 dp)

b 55.0% (1 dp)

23 Prices will still rise but at a slower rate, so Pete is not correct.

$$24 \ r = \frac{4}{9}$$

$$25 \ a \ \frac{2}{9} \quad b \ \frac{7}{9} \quad c \ \frac{29}{99} \quad d \ \frac{541}{999}$$

page 49 **Exercise 2** 1

- | | | |
|------------|----------|----------|
| 1 £12 | 2 £8 | 3 £10 |
| 4 £3 | 5 £2.40 | 6 £24 |
| 7 £45 | 8 £72 | 9 £244 |
| 10 £9.60 | 11 \$42 | 12 \$88 |
| 13 8 kg | 14 12 kg | 15 272 g |
| 16 45 m | 17 40 km | 18 \$710 |
| 19 4.94 kg | 20 60 g | 21 £204 |

page 49 **Exercise 3** 1

- | | | |
|-----------|-----------|----------|
| 1 £0.28 | 2 £1.16 | 3 £1.22 |
| 4 £2.90 | 5 £3.57 | 6 £0.45 |
| 7 £0.93 | 8 £37.03 | 9 £16.97 |
| 10 £0.38 | 11 £0.79 | 12 £1.60 |
| 13 £13.40 | 14 £50 | 15 £2.94 |
| 16 £11.06 | 17 £1.23 | 18 £4.40 |
| 19 £11.25 | 20 £22.71 | 21 £9.19 |

page 50 **Exercise 4** 1

- | | | |
|-----------|-----------|-----------|
| 1 £63 | 2 £736 | 3 £77.55 |
| 4 £104 | 5 £1960 | 6 £792 |
| 7 £132 | 8 £45.75 | 9 £110.30 |
| 10 £42 | 11 £12.03 | 12 £9.49 |
| 13 £7.35 | 14 £7.01 | 15 £12.34 |
| 16 £16.92 | 17 £31.87 | 18 £9.02 |
| 19 £8.88 | 20 £14.14 | |

page 50 **Exercise 5** 1

- | | | |
|--------------|----------|------------------|
| 1 a £15 | b 900 kg | c \$2.80 |
| d 125 people | | |
| 2 £32 | | |
| 3 a 88 500 | b 77 880 | c $\frac{1}{30}$ |
| 4 52.8 kg | | |
| 5 a 0.53 | b 0.03 | c 0.085 |
| d 1.22 | | |
| 6 a £1.02 | b £21.58 | c £2.22 |
| d £0.53 | | |

$$7 \text{ £}253.86 \quad 8 \text{ £}26182 \quad 9 \text{ £}8425.60$$

$$10 \text{ £}74.59 \quad 11 \text{ £}6825$$

$$12 \text{ Tablet £}201.40 \text{ House £}166 \text{ 500 Boat £}2700$$

$$\text{Tree £}199.50 \text{ Phone £}55.25$$

$$13 \ 325 \quad 14 \text{ £}6.30$$

$$15 \ a \ 256 \text{ g} \quad b \ 72 \text{ p} \quad c \ 14 \text{ cm}$$

$$d \ 30 \text{ minutes} \quad e \ 14.4 \text{ seconds}$$

$$16 \ a \ 1.08 \times P \times 0.9$$

$$b \ 15\% \text{ increase, } 6\% \text{ increase}$$

$$c \ 1.25 \times Q \times 0.95$$

page 53 **Exercise 6** 1

- | | | |
|----------|----------------------|--------|
| 1 8% | 2 10% | 3 25% |
| 4 2% | 5 4% | 6 2.5% |
| 7 20% | 8 50% | 9 15% |
| 10 80% | 11 25% | 12 20% |
| 13 12.5% | 14 $33\frac{1}{3}\%$ | 15 80% |
| 16 5% | 17 6% | 18 20% |
| 19 5% | 20 2.5% | |

page 53 **Exercise 7** 1

- | | |
|--------------------|-----------------|
| 1 a 25% profit | b 25% profit |
| c 10% loss | d 20% profit |
| e 30% profit | f 7.5% profit |
| 2 28% | 3 44.4% (1 dp) |
| 4 46.9% | 5 12% |
| 6 $5\frac{1}{3}\%$ | 7 44% |
| 8 27.05% | |
| 9 20% | 10 14.3% (1 dp) |
| 11 21% | |
| 12 a 25 000 | b 76.3% (1 dp) |

page 55 **Exercise 8** 1

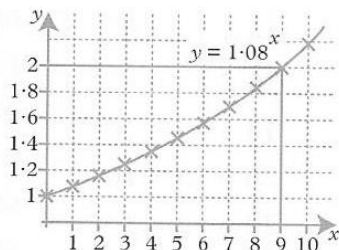
- | | |
|-----------------|-----------|
| 1 £6200 | 2 £25 500 |
| 3 a £50 | b £200 |
| c £54 | |
| d £150 | e £2400 |
| 4 210 000 | 5 85 kg |
| 6 8 cm × 10 cm | 7 200 |
| 8 £62.67 | 9 400 kg |
| 10 350 g | |
| 11 29 000 | 12 500 cm |
| 13 £500 | |
| 14 £480 000 000 | |

page 56 **Exercise 9** ②

- 1 a £2200 b £2420 c £2662
 2 a £5600 b £7024.64
 3 £13 108 (to nearest £)
 4 a £36 465.19 b £38 288.45
 5 a £85 500 b £81 225
 6 a £18 350 b £730
 c £1079 500
 7 £4913 8 No 9 8 years
 10 11 years 11 13 years
 12 £20,000 at 12% produces more

13 a

x	1	2	3	4	5	6	7	8	9	10
y	1.08	1.17	1.26	1.36	1.47	1.59	1.71	1.85	2.00	2.16



- b $x = 9$ c 9 years

page 58 **Exercise 10** ①

- 1 a £6.10 b £6.40 c £4.70
 d £116 e £129.30 f £0.04
 2 a 2.5h b 4.25h c 3.75h
 d 0.1h e 0.2h f 0.25h
 g 0.283h h 1.13h i 2.56h
 3 a 24.75h b 22.75h c 2.9h
 d 2.75h e 2.5h f 1.75h

page 59 **Exercise 11** ①

- 1 22 2 3 3 5
 4 12 5 0 6 3
 7 9 8 12 9 18
 10 70 11 4 12 70
 13 6 14 250 15 97
 16 2 17 $\frac{1}{2}$ 18 11
 19 8 20 $10\frac{1}{2}$

page 59 **Exercise 12** ①

- 1 4.2 2 15.9 3 0.6
 4 5.3 5 4.0 6 12.7
 7 0.5 8 5.6 9 14.0
 10 2.1 11 14.1 12 1.2
 13 9.9 14 9.1 15 9.5
 16 0.6 17 23.0 18 11.4
 19 7.4 20 5.5 21 11.5
 22 11.7 23 10.9 24 1.9
 25 13.0 26 4.9 27 18.8
 28 3.4 29 2.4 30 2.9

page 61 **Exercise 13** ①

- 1 3.041 2 1460 3 0.03083
 4 47.98 5 130.6 6 0.4771
 7 0.3658 8 37.54 9 8.000
 10 0.6537 11 0.03716 12 34.31
 13 0.7195 14 3.598 15 0.2445
 16 2.043 17 0.3798 18 0.7683

page 62 **Exercise 14** ①

- 1 10.18 2 -0.061 11 3 1.858
 4 0.8264 5 2.717 6 4.840
 7 10.87 8 7.425 9 13.49
 10 0.7392 11 1135 12 13.33
 13 5.836 14 86.39 15 10.23
 16 5540 17 14.76 18 8.502
 19 57.19 20 19.90 21 6.578
 22 9.097 23 0.08280 24 1855
 25 2.367 26 1.416 27 7.261
 28 3.151 29 149.9 30 74 020
 31 8.482 32 75.21 33 1.226
 34 6767 35 5.964 36 15.45
 37 25.42 38 2.724 39 4.366
 40 0.2194 41 0.0004659 42 0.3934
 43 -0.7526 44 2.454 45 40000
 46 3.003 47 0.006562 48 0.1330

page 63 **Exercise 15** 1

- | | | | |
|----------------------|-------------------|-------------------|---------------------|
| 1 $\frac{11}{15}$ | 2 $1\frac{1}{6}$ | 3 $\frac{16}{21}$ | 4 $\frac{23}{30}$ |
| 5 $\frac{5}{6}$ | 6 $\frac{13}{16}$ | 7 $\frac{5}{28}$ | 8 $\frac{19}{30}$ |
| 9 $\frac{19}{20}$ | 10 $\frac{1}{6}$ | 11 $\frac{2}{9}$ | 12 $\frac{3}{44}$ |
| 13 $2\frac{5}{6}$ | 14 $2\frac{1}{6}$ | 15 $5\frac{1}{8}$ | 16 $3\frac{11}{12}$ |
| 17 $4\frac{7}{8}$ | 18 6 | 19 $8\frac{3}{4}$ | 20 4 |
| 21 a $3\frac{9}{20}$ | b $3\frac{1}{6}$ | c $\frac{11}{14}$ | d $\frac{23}{40}$ |
| e $\frac{6}{7}$ | f $\frac{7}{18}$ | | |

page 64 **Exercise 16** 1

- 1 a 509 cm^2 b 507 cm^2

page 64 **Exercise 17** 1

- | | |
|-------------------------------------|-------------------------------------|
| 1 4×10^3 | 2 5×10^2 |
| 3 7×10^4 | 4 6×10 |
| 5 2.4×10^3 | 6 3.8×10^2 |
| 7 4.6×10^4 | 8 4.6×10 |
| 9 9×10^5 | 10 2.56×10^3 |
| 11 7×10^{-3} | 12 4×10^{-4} |
| 13 3.5×10^{-3} | 14 4.21×10^{-1} |
| 15 5.5×10^{-5} | 16 1×10^{-2} |
| 17 5.64×10^5 | 18 1.9×10^7 |
| 19 $1.67 \times 10^{-24} \text{ g}$ | 20 2.17×10^8 |
| 21 $5.1 \times 10^8 \text{ km}^2$ | 22 $2.5 \times 10^{-10} \text{ cm}$ |
| 23 6.023×10^{23} | 24 $3 \times 10^{10} \text{ cm/s}$ |
| 25 $\pounds 3.6 \times 10^6$ | 26 c, a, b |
| 27 13 | 28 16 |
| 29 a 8×10^{11} | b 5×10^{13} |
| c 4.5×10^7 | d 6.4×10^2 |
| e 5.5×10^{-4} | f 4×10^9 |
| g 3×10^4 | h 4×10^{12} |
| 30 a 23000 | b 0.03 |
| c 560 | d 800000 |
| e 0.0022 | f 900000000 |
| g 0.6 | h 7000 |
| i 3140000 | |

- | | |
|--|-------------------------|
| 31 a 6.5×10^5 | b 2.7×10^3 |
| c 3.54×10^6 | d 2.8×10^{-2} |
| e 7×10^{-3} | f 7.07×10^{22} |
| 32 a 6×10^3 | b 1.1×10^{-1} |
| c 4.5×10^8 | d 8.5×10^{-6} |
| e 6×10^{12} (if an English billion) | |
| f 5×10^{-1} | |

page 66 **Exercise 18** 1

- | | |
|---|------------------------------------|
| 1 1.5×10^9 | 2 3×10^8 |
| 3 2.8×10^{-2} | 4 7×10^{-9} |
| 5 2×10^6 | 6 4×10^{-6} |
| 7 9×10^{-2} | 8 6.6×10^{-8} |
| 9 3.5×10^{-7} | 10 1×10^{-16} |
| 11 8×10^9 | 12 7.4×10^{-7} |
| 13 4.9×10^{11} | 14 4.4×10^{12} |
| 15 1.5×10^3 | 16 2×10^{17} |
| 17 1.68×10^{13} | 18 4.25×10^{11} |
| 19 9.9×10^7 | 20 6.25×10^{-16} |
| 21 7.2×10^7 | 22 6.82×10^{-7} |
| 23 1.2×10^{-5} | 24 5×10^{-4} |
| 25 $1.1 \times 10^{10} \text{ days}$ | 26 $1.3 \times 10^{-4} \text{ m}$ |
| 27 a Europe $6.50 \times 10^{-2} \text{ people/m}^2$,
Asia $6.80 \times 10^{-2} \text{ people/m}^2$ | |
| b Asia | |
| 28 5.57×10^9 | 29 $2.4528 \times 10^7 \text{ km}$ |
| 30 3000 secs or 50 mins | |
| 31 L = 6×10^2 | 32 $2.7 \times 10^9 \text{ kg}$ |
| 33 a $9.5 \times 10^{12} \text{ km}$ (1 dp) | |
| b $1.44 \times 10^8 \text{ km}$ | |
| 34 a 6×10^{101} | b 20.5 seconds |
| c $6.34 \times 10^{91} \text{ years}$ | |

page 69 **Exercise 19** 1

- | | | |
|--------|------|------|
| 1 a 12 | b 1 | c 19 |
| d 12 | e 4 | f 6 |
| g 16 | h 24 | |
| 2 a 8 | b 12 | c 30 |
| d -1 | e 1 | f 4 |
| g 25 | h 5 | |

- 3 a 3 b 7
d 27 e 2
g $\frac{1}{2}$ h 2

4

¹ 2	4		² 1	³ 9
3		⁴ 1	2	0
	⁵ 4	1	5	
⁶ 2	0			⁷ 2
2	4		⁸ 4	5

- c -2
f -2

7 -2

10 22

13 1

16 $-6\frac{1}{2}$

19 4

22 22

25 -7

28 -30

31 -7

34 $-\frac{5}{36}$

8 -81

11 14

14 $\sqrt{5}$

17 54

20 312

23 14

26 1

29 -5

32 $-\frac{3}{13}$

9 4

12 5

15 4

18 25

21 45

24 -36

27 901

30 $7\frac{1}{2}$

33 $1\frac{1}{3}$

page 70 **Exercise 20** 1

- | | | |
|--------|--------|-------|
| 1 7 | 2 13 | 3 13 |
| 4 22 | 5 1 | 6 -1 |
| 7 18 | 8 -4 | 9 -3 |
| 10 37 | 11 0 | 12 -4 |
| 13 -7 | 14 -2 | 15 -3 |
| 16 -8 | 17 -30 | 18 16 |
| 19 -10 | 20 0 | 21 7 |
| 22 -6 | 23 -2 | 24 -7 |
| 25 -5 | 26 3 | 27 4 |
| 28 -8 | 29 -2 | 30 2 |
| 31 0 | 32 4 | 33 -4 |
| 34 -3 | 35 -9 | 36 4 |

page 70 **Exercise 21** 1

- | | | |
|--------|--------|--------|
| 1 9 | 2 27 | 3 4 |
| 4 16 | 5 36 | 6 18 |
| 7 1 | 8 6 | 9 2 |
| 10 8 | 11 -7 | 12 15 |
| 13 -23 | 14 3 | 15 32 |
| 16 36 | 17 144 | 18 -8 |
| 19 -7 | 20 13 | 21 5 |
| 22 -16 | 23 84 | 24 17 |
| 25 6 | 26 0 | 27 -25 |
| 28 -5 | | |

page 71 **Exercise 22** 1

- | | | |
|-------|-------|--------|
| 1 -20 | 2 16 | 3 -42 |
| 4 -4 | 5 -90 | 6 -160 |

page 72 **Exercise 23** 1 2

- 1 21 2 a 54 cm^2 b 63 m^2
3 $T = 1.62$ (2 dp) 4 $A = 395.9$ (1 dp)
5 650 6 63.8
7 $E = 9 \times 10^{12}$ 8 10.5 9 800
10 a 1245 km/h (4 sf) b 4.8°C (1 dp)
c 1008 km/h
11 a $A = ab + ac - a^2$ b 30
12 a $S = r - p + q$ b $S = 4.1$

page 73 **Exercise 24** 1

- | | | |
|-------------------------|-----------------------|-----------------------|
| 1 0.85 m | 2 2400 m | 3 63 cm |
| 4 0.25 m | 5 0.7 cm | 6 20 mm |
| 7 1200 m | 8 2 m^2 | 9 580 m |
| 10 0.815 m | 11 0.65 km | |
| 12 125000 cm^2 | 13 5000 g | 14 4200 g |
| 15 6400 g | 16 3000 g | 17 800 g |
| 18 0.4 kg | 19 2000 kg | 20 0.25 kg |
| 21 500 kg | 22 620 kg | 23 0.007 t |
| 24 1.5 kg | 25 0.8 l | 26 2000 ml |
| 27 4500 ml | 28 6000 ml | 29 3000 cm^3 |
| 30 2000 l | 31 5500 l | |
| 32 500000 cm^3 | 33 0.001 m^3 | |
| 34 a km | b ml or l | c g |
| d mm | e t or kg | f m^2 |

page 74 **Exercise 25** ①

- 1 180 cm 2 45 l 3 10 kg
 4 8.8 pounds 5 5 miles 6 0.5 kg
 7 20 miles 8 135 cm 9 30 kg
 10 17.5 pints 11 25 miles
 12 1750 pints 13 6.6 pounds
 14 $\frac{5}{16}$ miles (or 0.3125 miles)
 15 200 gallons 16 5000 miles
 17 50 mph 18 The market
 19 A one pound coin has a mass of about 10 g.
 20 The width of the class room is about 7 m.
 21 A can of lemonade contains about 500 ml.
 22 The distance from London to Birmingham is about 100 miles.
 23 The thickness of a one pound coin is about 3 mm.
 24 a 3 kg b 15 l c 3 pounds

page 76 **Exercise 26** ①

- 1 a $2\frac{1}{2}$ hours b 3 hours $7\frac{1}{2}$ mins
 c 75 seconds d 4 hours
 2 45 m/s
 3 a 75 km/h b 14 mph c 50 m/s
 4 a 120 km b 30 miles
 c 4500 m d 50 400 m
 5 a 3 hours $7\frac{1}{2}$ minutes
 b 76.8 km/h
 6 a 4 hours 27 mins b 23.6 km/h (1 dp)
 7 a 6.67 m/s (2 dp) b 6.33 m/s
 c 123.19 secs (2 dp)
 8 1230.8 km/h (1 dp) 9 3 hours
 10 100 seconds 11 1.5 minutes
 12 600 m 13 53.3 secs (1 dp)
 14 5 cm/sec 15 1 minute
 16 120 mph

page 78 **Exercise 27** ②

- 1 10 g/cm^3 2 240 g 3 35 m^3
 4 0.6 kg 5 250 people/ km^2

- 6 a 6000 people/ km^2 b 5.58×10^{10}
 7 1000 kg 8 3000 kg/m^3
 9 0.8 g/cm^3
 10 a 20 m/s b 108 km/h
 c 1.2 cm/s d 90 m/s

page 80 **Exercise 28** ③

- 1 195.5 cm 2 36.5 kg
 3 3.25 kg 4 95.55 m
 5 28.65 seconds

6	Measurement	Half unit	Lower bound	Upper bound
a	Temperature in a fridge = 2°C to the nearest degree	0.5°C	1.5°C	2.5°C
b	Mass of an acorn = 2.3 to 1 dp	0.05 g	2.25 g	2.35 g
c	Length of telephone cable = 64 m to nearest m	0.5 m	63.5 m	64.5 m
d	Time taken to run 100 m = 13.6 s to nearest 0.1 s	0.05 s	13.55 s	13.65 s

- 7 B 8 175 g and 185 g 9 2650 m
 10 a No b 1 cm
 11 a $16.5 \leq m < 17.5$ b $255.5 \leq d < 256.5$
 c $2.35 \leq e < 2.45$ d $0.335 \leq m < 0.345$
 e $2.035 \leq v < 2.045$ f $11.95 \leq x < 12.05$
 g $81.35 \leq T < 81.45$ h $0.25 \leq M < 0.35$
 i $0.65 \leq m < 0.75$ j $51\,500 \leq n < 52\,500$
 12 No, as the card could be 11.549 cm long and the envelope only 11.5 cm long.

page 83 **Exercise 29** ③

- 1 a 7.5 cm, 8.5 cm, 10.5 cm b 26.5 cm
 2 46.75 cm^2
 3 a 7 b 5 c 10
 d 4 e 2 f 5
 g 2 h 24

- 4 250 cm 5 47.5 m^2 6 18.0375 m^2
 7 a 13 cm b 11 cm c 3 cm
 d 12.5 cm
 8 a 10.5 b 4.3
 9 a 11 b 1 c 0.6
 10 56 cm^2 11 55.71 (2 dp)
 12 17.20 m/s (2 dp)
 13 3.30 (2 dp) 2.87 (2 dp)

page 85 **Exercise 30** 1

- 1 a €26.60 b \$114.80 c 3400 Rand
 d ¥270 e \$4.10 f €1.20
 2 a £375.94 b £1524.39 c £155.29
 d £676.69 e £49 f £0.47
 3 £3.84
 4 Britain £15 000 France £15 632 USA £15 172
 5 3.25 Swiss francs to the £
 6 20 7 a 256 b 65 536
 8 4.68×10^5 9 a $\frac{3}{19}$ b $\frac{1}{6}$
 10 £10 485.76

page 86 **Exercise 31** 1

- 1 a 1.25 m/min b 2.08 cm/sec (2 dp)
 2 77.5% (1 dp) 3 225 mm
 4 a 35 pints b 5.14 litres (2 dp)
 5 43.5 mm
 6 a

3	-4	1
-2	0	2
-1	4	-3

b 12

- 7 210 kg
 8 a 10.45 b 51 mins
 9 221
 10 a £909 (nearest £)
 b $8400 \div 40 = 210$ gallons
 $200 \times 5 = 1000$ litres
 $1000 \times £1 = £1000$

page 87 **Exercise 32** 2 3

- 1 a 0.0018 km/h b $1.8 \times 10^{-3} \text{ km/h}$
 2 $n = 12$ 3 $£6.36 \times 10^{10}$

- 4 a £9.79 b £32
 c £44.20 d £45
 5 a 323 g b 23
 c 121 p d 29
 6 6 m 7 190 ml
 8 400 9 18:52
 10 a 8.9 m/s (1 dp) b 769.5 mph
 11 $\frac{1}{8}$ 12 37 13 7^{77}

page 88 **Test yourself**

- 1 32%
 2 a £190 800 b £350 000
 3 24 students
 4 1.19 5 £8 400 6 $\frac{34}{99}$
 7 a 1.8×10^{15} b 5×10^{-5}
 8 a 2.122226 697 b 2.12
 9 a 9.476841579 b 9.48
 10 a 1.2 b 500
 11 12.7 g 12 28.5 cm/s
 13 i 200.5 cm ii 201.5 cm
 14 17 15 8.1 secs (2 sf)
 16 a 125 000
 b 2340 people/km (3 sf)

3 Algebra 1

page 91 **Exercise 1** 1

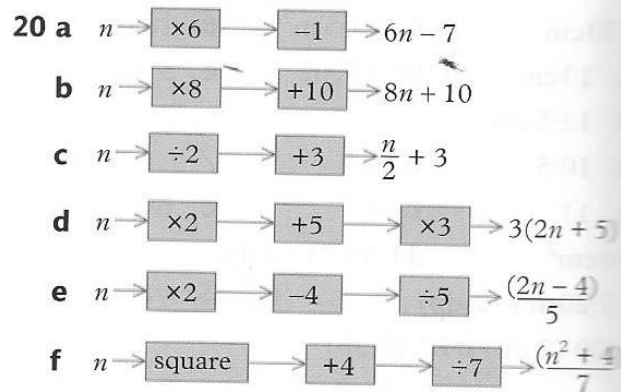
- 1 a $2x - 6$ b $(x + 4)^2$ c $\frac{2(x - 5)}{3}$
 d $7x + n$ e $4h - t$ f $2(x + y)$
 2 a $2a + b$ b $n^2 - n$ c $(x + 2)^2$
 d $(w - x)^2$ e $\frac{(n + p)^3}{a}$ f $[3(t - 1)]^2$
 3 a $8w \text{ kg}$ b $nw \text{ kg}$
 4 $£\frac{n}{3}$ 5 $\frac{x}{n}$ pence 6 $\frac{y}{n} \text{ kg}$
 7 $£\frac{p}{5}$ 8 $y + n + 6$ years old
 9 $£(n + r)w$
 10 a $\frac{x}{t}$ metres b $\frac{xn}{t}$ metres
 11 $\frac{100n}{x}$ 12 $\frac{100n}{x + 1}$ pence

page 92 **Exercise 2** 1

- | | |
|----------------------|----------------------|
| 1 $5x + 8$ | 2 $9x + 5$ |
| 3 $7x + 4$ | 4 $7x + 4$ |
| 5 $7x + 7$ | 6 $8x + 12$ |
| 7 $12x - 6$ | 8 $2x + 5$ |
| 9 $2x - 5$ | 10 $2x - 5$ |
| 11 $13a + 3b - 1$ | 12 $10m + 3n + 8$ |
| 13 $3p - 2q - 8$ | 14 $2s - 7t + 14$ |
| 15 $2a + 1$ | 16 $x + y + 7z$ |
| 17 $5x - 4y + 4z$ | 18 $5k - 4m$ |
| 19 $4a + 5b - 9$ | 20 $a - 4x - 5e$ |
| 21 a $3x^2 + 1$ | b $2a + 5ab$ |
| c $x^3 - 7x + 4x^2$ | d $4a^2 - 7a$ |
| 22 B and D | 23 $x^2 + 3x + 3$ |
| 24 $3x^2 + 6x + 5$ | 25 $2x^2 + 6x - 7$ |
| 26 $3x^2 + x + 12$ | 27 $2x^2 + x + 3$ |
| 28 $2x^2 - x$ | 29 $x^2 - 4x - 2$ |
| 30 $3x^2 - 2x - 2$ | 31 $4y^2 + 5x^2 + x$ |
| 32 $12 + x$ | 33 $2 - 6y + 5y^2$ |
| 34 $3ab - 3b$ | 35 $2cd - 2d^2$ |
| 36 $4ab - 2a^2 + 2a$ | 37 $2x^3 + 5x^2$ |
| 38 $11 + x^2 + x^3$ | 39 $3xy$ |
| 40 $p^2 - q^2$ | |

page 94 **Exercise 3** 1

- | | |
|---|---|
| 1 True | 2 False unless $n = 1\frac{1}{2}$ |
| 3 True | 4 True |
| 5 False unless $n = 0$ or $\pm\sqrt{3}$ | |
| 6 True | 7 False unless $m = n$ |
| 8 True | 9 False unless $n = 0$ or $\pm\sqrt{3}$ |
| 10 False unless $m = 0$ or $\frac{1 \pm \sqrt{5}}{2}$ | |
| 11 False unless $c = 1\frac{1}{2}$ | 12 True |
| 13 True | 14 False unless $n = \pm 2$ |
| 15 True | 16 False unless $n = 0$ |
| 17 True | 18 False unless $n = 0$ or 1 |
| 19 a $n + n, 4n - 2n$ | b $n \times n^2, n \times n \times n$ |
| c $3n \div 3, n^2 \div n$ | d $4 \div n$ |
| e Multiple answers e.g. $2 \times n \times n$ | |



- | | | |
|----------|------------------|------------------|
| 21 3 | 22 1 | 23 n |
| 24 n | 25 $2a + b + c$ | 26 $2n^2$ |
| 27 $2mn$ | 28 n^2 | 29 3 |
| 30 a^3 | 31 n | 32 $3t - 3p + 3$ |
| 33 1 | 34 $4n + 2$ | 35 $2n + 8$ |
| 36 n | 37 $\frac{1}{a}$ | 38 $3ab$ |

page 95 **Exercise 4** 1

- | | | |
|--------------------------------|-------------------|----------------|
| 1 a $6x$ | b $15a$ | c $-10t$ |
| d $1000a$ | e $2x^2$ | f $4x^2$ |
| g $2x^3$ | h $20t^2$ | |
| 2 a $4x + 2$ | b $10x + 15$ | c $a^2 - 3a$ |
| d $2n^2 + 2n$ | e $-4x - 6$ | f $2x^2 + 2xy$ |
| g $-3a + 6$ | h $pq - p^2$ | i $ab + a^2$ |
| j $2b^2 - 2b$ | k $2n^2 + 4n$ | l $6x^2 + 9x$ |
| 3 $A = G, B = D, C = E, F = H$ | | |
| 4 a $6ab$ | b $3x^4$ | c $2xy$ |
| d $10pq$ | e $15xy$ | f $18x^3$ |
| g $24a^4$ | h $2a^2b$ | i $3xy^2$ |
| j $5c^2d$ | k a^2b^2 | l $2x^2y^2$ |
| m $3d^3$ | n $10x^2y$ | o $-6a^2$ |
| p $2a^2b$ | | |
| 5 $6x^2 + 12x \text{ cm}^2$ | | |
| 6 a $7x + 10$ | b $8x + 2$ | c $5a - 3$ |
| d $11a + 17$ | e $8a - 10$ | f $8t + 4$ |
| g $x + 4$ | h $x + 6$ | |
| 7 a $l = 2x - 2$ | b $l = x - 1$ | c $l = x + 2$ |
| d $l = x - 3$ | e $l = x + 3$ | f $l = x + 3$ |
| 8 a $2x^2 + 4x + 6$ | b $2x^2 + 2x + 5$ | |
| c $3a^2 + 6a - 4$ | d $5y^2 + 4y - 3$ | |
| e $5x^2 + 2x$ | f $a^2 + 2a$ | |

page 97 **Exercise 5** **2** **3**

- 1 $x^2 + 4x + 3$ 2 $x^2 + 5x + 6$
 3 $y^2 + 9y + 20$ 4 $x^2 + x - 12$
 5 $x^2 + 3x - 10$ 6 $x^2 - 5x + 6$
 7 $a^2 - 2a - 35$ 8 $z^2 + 7z - 18$
 9 $x^2 - 9$ 10 $k^2 - 121$
 11 $2x^2 - 5x - 3$ 12 $3x^2 - 2x - 8$
 13 $2y^2 - y - 3$ 14 $49y^2 - 1$
 15 $x^2 + 8x + 16$ 16 $x^2 + 4x + 4$
 17 $x^2 - 4x + 4$ 18 $4x^2 + 4x + 1$
 19 $2x^2 + 6x + 5$ 20 $2x^2 + 2x + 13$
 21 $5x^2 + 8x + 5$ 22 $2y^2 - 14y + 25$
 23 $10x - 5$ 24 $-8x + 8$

25 a $4x(x + 5) = 4x^2 + 20x$

b $(2x + 5)^2 = 4x^2 + 20x + 25$ c 25

26 $x^3 + 5x^2 + 6x + x^2 + 5x + 6 = x^3 + 6x^2 + 11x + 6$

27 a $x^3 + 6x^2 + 11x + 6$ b $x^3 + 8x^2 + 19x + 12$

c $x^3 + 5x^2 + 2x - 8$ d $2x^3 + 3x^2 - 18x - 27$

e $2x^3 - x^2 - 32x + 16$ f $9x^3 - x + 18x^2 - 2$

g $x^3 + 3x^2 - 4$ h $2x^3 - x^2 - 4x + 3$

i $x^3 + x^2 - x - 1$ j $x^3 + 3x^2 + 3x + 1$

k $x^3 - 3x^2 + 3x - 1$

28 d Yes. $n = 10, 11, 21, 22$ etc.

page 98 **Exercise 6** **1** **2**

- 1 $x(x + 5)$ 2 $x(x - 6)$
 3 $x(7 - x)$ 4 $y(y + 8)$
 5 $y(2y + 3)$ 6 $2y(3y - 2)$
 7 $3x(x - 7)$ 8 $2a(8 - a)$
 9 $3c(2c - 7)$ 10 $3x(5 - 3x)$
 11 $7y(8 - 3y)$ 12 $x(a + b + 2c)$
 13 $x(x + y + 3z)$ 14 $y(x^2 + y^2 + z^2)$
 15 $ab(3a + 2b)$ 16 $xy(x + y)$
 17 $2a(3a + 2b + c)$ 18 $m(a + 2b + m)$
 19 $2k(x + 3y + 2z)$ 20 $a(x^2 + y + 2b)$
 21 $x(7x + 1)$ 22 $4y(y - 1)$
 23 $p(p - 2)$ 24 $2a(3a + 1)$
 25 $4(1 - 2x^2)$ 26 $5x(1 - 2x^2)$
 27 $\pi(4r + h)$ 28 $\pi r(r + 2)$

29 $\pi r(3r + h)$

31 $xk(x + k)$

33 $bc(a - 3b)$

35 $ab(a^2 + b^2)$

37 $2xy(3y - 2x)$

38 $3ab(b^2 - a^2) = 3ab(b - a)(b + a)$

39 $a^2b(2a + 5b)$

41 $2ab(x + b + a)$

43 a $2x + 8y$

30 $x(3y + 2)$

32 $ab(a^2 + 2b)$

34 $ae(2a - 5e)$

36 $x^2y(x + y)$

40 $ax^2(y - 2z)$

42 $yx(a + x^2 - 2yx)$

b $10a - 2x$

page 99 **Exercise 7** **1** **2**

1

Equation	Expression	Identity	Formula
$7x + 11 = x - 9$	$7y + 10$	$x(x + 1) \equiv x^2 + x$	$V = IR$
$x^2 - 7x = 0$	$x^2 - 3x + 10$	$(x + 1)^2 \equiv x^2 + 2x + 1$	$A = \pi r^2$

2 a $a = 5, b = 1$

b $a = 5, b = 11$

c $a = 1, b = 6, c = 9$

d $a = 2, b = 5, c = 1$

3 a = b $\equiv$ c $\equiv$ d =

page 100 **Exercise 8** **1**

1 3	2 17	3 14	4 16
5 7	6 7	7 3	8 13
9 4	10 0	11 31	12 8
13 10	14 8	15 8	16 3
17 5	18 3	19 2	20 4
21 1	22 0	23 2	24 1
25 $\frac{1}{5}$	26 7	27 200	28 7
29 0	30 $\frac{1}{8}$		

page 101 **Exercise 9** **1**

1 8	2 9	3 7	4 10
5 $\frac{1}{3}$	6 10	7 $1\frac{1}{2}$	8 -1
9 $-1\frac{1}{2}$	10 $\frac{1}{3}$	11 $\frac{99}{100}$	12 0
13 1000	14 $-\frac{1}{1000}$	15 1	16 -7
17 -5	18 $1\frac{1}{6}$	19 1	20 2

- 21 -5 22 -3 23 $-1\frac{1}{2}$ 24 2
 25 1 26 $3\frac{1}{2}$ 27 2 28 -1
 29 $10\frac{2}{3}$ 30 1.1 31 -1 32 2

page 102 **Exercise 10** ①

- 1 35 2 130 3 14 4 $\frac{2}{3}$
 5 $3\frac{1}{3}$ 6 $-2\frac{1}{2}$ 7 3 8 $1\frac{1}{8}$
 9 $\frac{3}{10}$ 10 $-1\frac{1}{4}$ 11 10 12 27
 13 20 14 18 15 28 16 -15
 17 $2\frac{1}{2}$ 18 $1\frac{1}{3}$

page 103 **Exercise 11** ②

- 1 $-1\frac{1}{2}$ 2 2 3 $-\frac{2}{5}$ 4 $-\frac{1}{3}$
 5 $1\frac{2}{3}$ 6 6 7 $-\frac{2}{5}$ 8 $-3\frac{1}{5}$
 9 $\frac{1}{2}$ 10 -4 11 18 12 5
 13 4 14 3 15 $2\frac{3}{4}$ 16 $-\frac{7}{22}$
 17 $\frac{1}{4}$ 18 1 19 4 20 -11

page 103 **Exercise 12** ② ③

- 1 $\frac{1}{3}$ 2 $\frac{1}{5}$ 3 $1\frac{2}{3}$ 4 -3
 5 $\frac{5}{11}$ 6 -2 7 -7 8 $-7\frac{2}{3}$
 9 2 10 3 11 2 12 3
 13 5 14 -4 15 4 16 $\frac{3}{5}$
 17 $1\frac{1}{8}$ 18 -1 19 1 20 1
 21 $1\frac{5}{7}$

page 104 **Exercise 13** ②

- 1 3 2 $\frac{3}{4}$ 3 $4\frac{1}{2}$ 4 $-\frac{3}{10}$
 5 $-\frac{1}{2}$ 6 $17\frac{2}{3}$ 7 $\frac{1}{6}$ 8 5
 9 12 10 $3\frac{1}{3}$ 11 $4\frac{2}{3}$ 12 -9

page 105 **Exercise 14** ②

- 1 $3\frac{1}{3}$ cm 2 12 cm
 3 91, 92, 93 4 21, 22, 23, 24
 5 57, 59, 61 6 506, 508, 510
 7 $12\frac{1}{2}$ 8 $x = 20^\circ$
 9 $27\frac{1}{2}$, $18\frac{1}{2}$ 10 20° , 60° , 100°
 11 5, 15, 8 12 5 cm
 13 Paul $72\frac{2}{3}$ kg, John $64\frac{2}{3}$ kg, David $59\frac{2}{3}$ kg
 14 7
 15 a $(4 + 2x)(3 + 2x) - 12 = 4x^2 + 14x$
 b $14 + 8xm$ c $\frac{3}{4}$

page 107 **Exercise 15** ②

- 1 $x = \frac{27}{5}$ 2 $53\frac{1}{3}$ or $56\frac{2}{3}$ 3 $2\frac{9}{10}$
 4 26, 58 5 2000 m 6 8 km
 7 21 8 23 9 £3600
 10 26 cm

page 108 **Exercise 16** ②

- 1 $\frac{1}{4}$ 2 -3 3 4 4 $-7\frac{2}{3}$
 5 -43 6 11 7 $-\frac{1}{2}$ 8 0
 9 1 10 $-1\frac{2}{3}$ 11 7 12 10
 13 4 14 5

page 109 **Exercise 17** ②

- 1 5 cm $\times$ 15 cm
 2 a 26 cm, 13 cm b 16 cm, 8 cm
 c 32 cm, 16 cm d 9 cm, 4.5 cm
 e 6.5 cm, 3.25 cm
 3 a 19 cm, 18 cm b 6.5 cm, 5.5 cm
 c 8.7 cm, 7.7 cm

page 111 **Exercise 18** ② ③

- 1 a 9.5 cm b 7.6 cm
 2 a 3.4 b 4.6 c 6.7
 3 a 1.7 b 3.0 c 6.1

- 4 a 5.1 b 3.8 c 4.0 d 3.3
 5 8.1 cm 6 3.58 cm
 7 a 3.2 b 2.7 c 3.6 8 2.15
 9 a 3 cm^2 b $x(x+3) - 6$ c $x = 3.8$
 10 a $x - 1$ b $x^2 - x = 1, x = 1.62$
 11 6.3 12 38.5
 13 a $2x\sqrt{1-x^2}$ b 0.71 14 b 1.5

page 114 **Exercise 19** 3

- 1 3.30 2 3.41 3 1.62 4 1.30
 5 4.56 6 2.46 7 1.32 8 6.20
 9 1.47 10 7.74 m 11 5.6 cm

page 116 **Exercise 20** 1

- 1 $w = b + 4$ 2 $w = 2b + 6$ 3 $w = 2b - 12$

- 4 a b $m = 2t + 1$

t	m
1	3
2	5
3	7
4	9

- 5 6 $s = t + 2$

t	m
1	5
2	8
3	11
4	14

$$m = 3t + 2$$

- 7 a $p = 5n - 2$ b $k = 7n + 3$ c $w = 2n + 11$
 8 $m = 8c + 4$
 9 a $y = 3n + 1$ b $h = 4n - 3$ c $k = 3n + 5$
 10 a $t = 2n + 4$ b $e = 3n + 11$ c $e = 1.5t + 5$
 11 a £7800 b $R = 400N + 5000$
 12 $n^2 - n$

page 120 **Exercise 21** 1

- 1 a $10n$ b $5n$ c $n + 2$ d $2n + 1$
 e $30n$ f $6n - 1$ g $3n - 2$
 2 a $10 \rightarrow 20 \rightarrow 23$ $n \rightarrow 2n \rightarrow 2n + 3$
 b $20 \rightarrow 60 \rightarrow 61$ $n \rightarrow 3n \rightarrow 3n + 1$

3 a

n	5n	Term
1	5	6
2	10	11
3	15	16
4	20	21
5	25	26
⋮	⋮	⋮
n	5n	5n + 1

- b i 51
 ii $5n + 1$

- 4 b A $3n - 2$ B $4n + 2$ C $7n - 2$

- 5 a 80 b 76 c $8n$ d $8n - 4$

- 6 a $6n + 2$ b $6n - 1$

- 7 a $10 \rightarrow 10 \times 11 \rightarrow 110$

$$n \rightarrow n(n+1) \rightarrow n^2 + n$$

- b $10 \rightarrow 10^2 + 1 \rightarrow 101$

$$n \rightarrow n^2 + 1 \rightarrow n^2 + 1$$

- 8 $n^2 + 4$

- 9 a 10^2

- b n^2

- 10 a 10×11

- b $n(n+1)$

- 11 a $\frac{10}{11}$

- b $\frac{n}{n+1}$

- 12 a $\frac{5}{10^2}$

- b $\frac{5}{n^2}$

- 13 a 10×12

- b $n(n+2)$

page 123 **Exercise 22** 3

- 1 a 22 b 39 c 73
 d 19 e 106 f 218

- 2 a 35, $n^2 - 1$, 899 b 38, $n^2 + 2$, 902
 c 75, $2n^2 + 3$, 1803 d 107, $3n^2 - 1$, 2699
 e 68, $2n^2 - 4$, 1796 f 110, $3n^2 + 2$, 2702

- 3 $x^2 + x$

- 4 b 120 c 861

- 5 a $n^2 + 2n + 5$, 125 b $n^2 + 4n + 1$, 141

- c $2n^2 + n + 3$, 213 d $2n^2 - 3n + 6$, 176

- e $3n^2 - 2n + 1$, 281 f $n^2 - n - 3$, 87

- g $4n^2 + n - 2$, 408 h $2n^2 + 0.5n - 1$, 204

- 6 a $2n^2 + 2n$, 312 b $n^2 + 3n$, 180

- c $n^2 + n - 1$, 155

- 7 a The first differences give the odd numbers. The second differences have a constant value of 2.
 b The second differences are successive multiples of 6. The third differences have a constant value of 2.
 c The second and third differences are all powers of 2.
 d The differences are double the previous differences. For example, the third differences are double the second differences.
 e The differences follow the pattern of the Fibonacci numbers but with different starting values.

page 126 **Exercise 23** 2

- 1 15, 21, 28
 2 b 64, 225 c $z = 199$
 d Double, take away 1 e $\frac{(n+1)^2}{4}$
 3 a $4^2 - 2^2$ b $8^2 - 7^2$ or $4^2 - 1^2$
 c not 1, 2, 4, 6, 10, 14, 18.
 4 Option 1: £664.30, Option 2: £520.
 5 a 1, 1, 2, 3, 5, 8, 13
 b Add two previous numbers together
 c $F_8 = F_2 + F_1$
 d F_6 e 21, 34
 6 a 6th generation: F, M, F, F, M, F, M, F
 7th generation: F, M, F, F, M, F, M, F, F, M, F, F, M
 b 1, 1, 2, 3, 5, 8, 13. Fibonacci numbers
 c 21, 34

page 128 **Exercise 24** 2

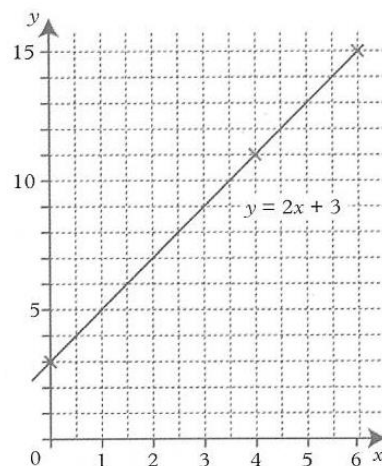
- 1 a yes, 3 b yes, 10 c no
 d yes, -6 e no f no
 2 a 19 b 75 c 52
 d 37 e -23 f -2.5
 3 a 23 b 11 c 11
 d 14 e 10 f 33
 4 £15 £18 £21 £24 10 weeks
 5 172 litres 6 10 weeks

page 130 **Exercise 25** 2 3

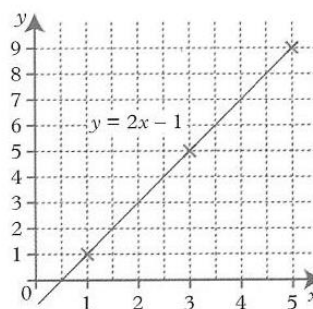
- 1 a yes, 2 b yes, 3 c yes, 5
 d yes, 1.5 e no f yes, $\sqrt{2}$
 2 a 512 b 19 683 c 32 768
 d 768 e $40\sqrt{2}$ f 81
 3 a 6 b 6 c 7
 d 8 e 7 f 6
 4 a $4 + 8 + 16 + 32 + 64$
 b $5 + 5\sqrt{2} + 10 + 10\sqrt{2} + 20$
 c $10 + 10\sqrt{3} + 30 + 30\sqrt{3} + 90$
 d $7 + 7\sqrt{7} + 49 + 49\sqrt{7} + 343$
 5 a 3 b 4 c $\frac{3}{8} + 3 + 24$
 6 £520 £540.80 £562.43 £584.93
 7 2,488
 8 6 weeks No, the times become too long.

page 131 **Exercise 26** 1

X	0	1	2	3	4	5	6
Y	3	5	7	9	11	13	15

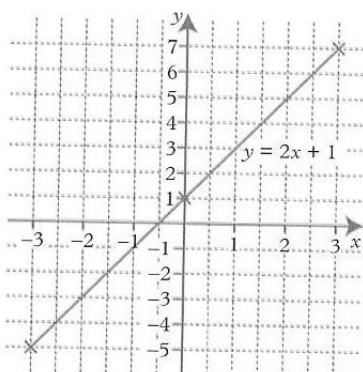


X	0	1	2	3	4	5
Y	-1	1	3	5	7	9



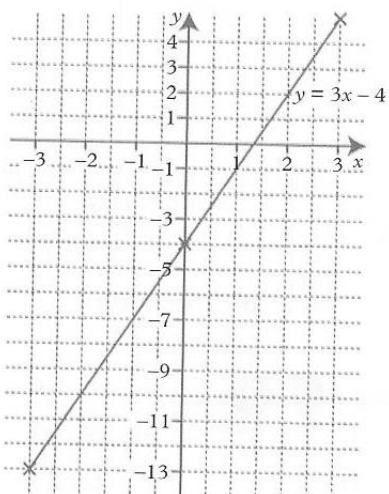
3

X	-3	0	3
Y	-5	1	7



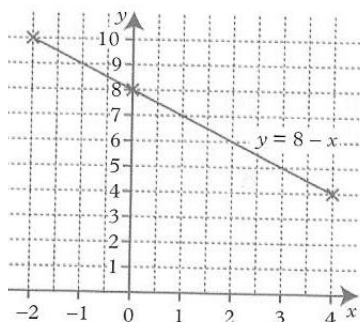
4

X	-3	0	3
Y	-13	-4	5



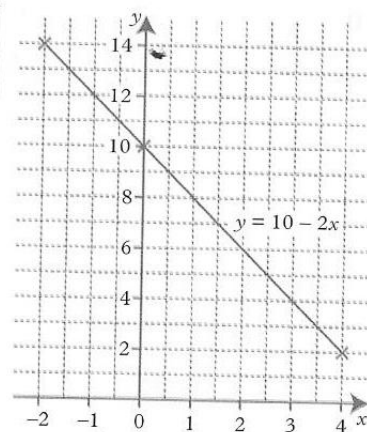
5

X	-2	0	4
Y	10	8	4



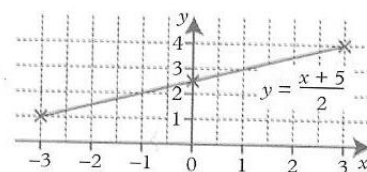
6

X	-2	0	4
Y	14	10	2



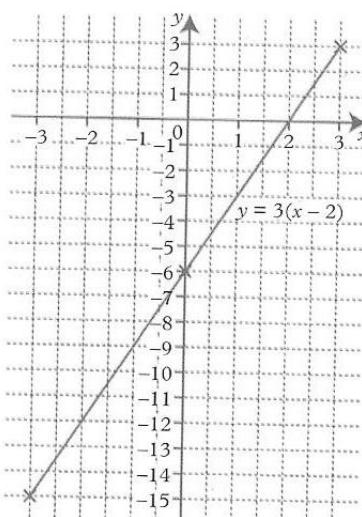
7

X	-3	0	3
Y	1	$2\frac{1}{2}$	4



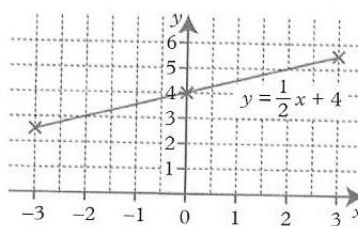
8

X	-3	0	3
Y	-15	-6	3



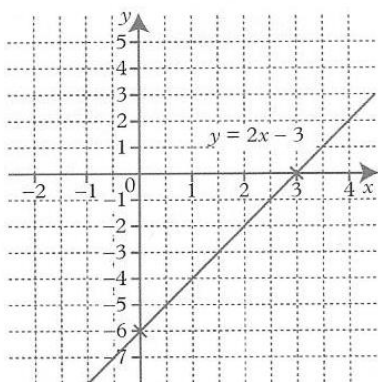
9

X	-3	0	3
Y	$2\frac{1}{2}$	4	$5\frac{1}{2}$



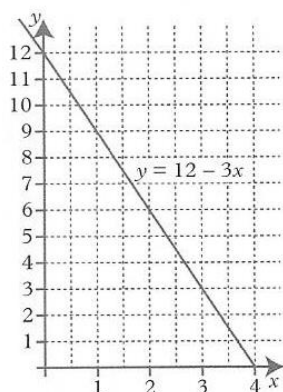
10

x	-2	0	4
y	-7	-3	5



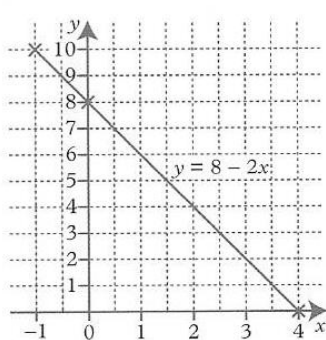
11

x	-2	0	4
y	18	12	0



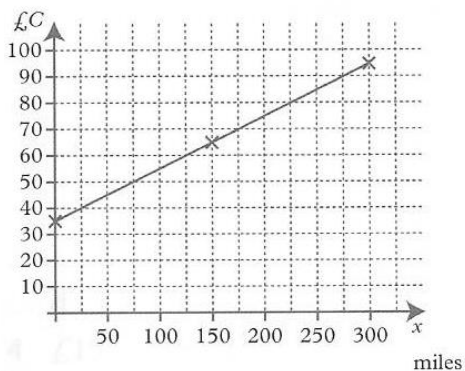
12

x	-1	0	4
y	10	8	0



13

x	0	50	100	150	200	250	300
C	35	45	55	65	75	85	95

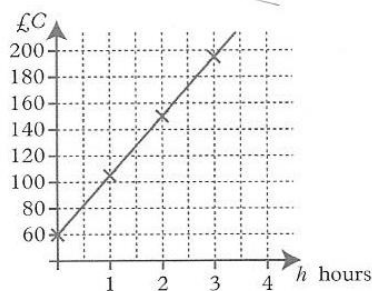


a 180 miles

b $C = \frac{x}{5} + 35$

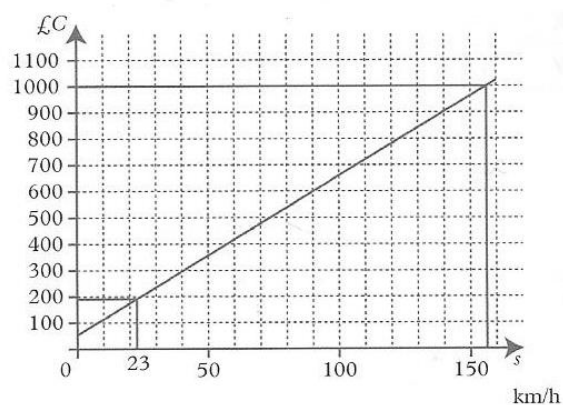
14

h	0	1	2	3
C	60	105	150	195



15

s	0	80	160
C	50	530	1010



a £190

b 158 km/h

page 134 **Exercise 27** **1** **3**

1 a 4, 3 **b** 14, 12 **c** 21, ± 2

2 a 1, 3 **b** 7, 1 **c** 5, ± 2

3 a $\frac{x-4}{5}$ **b** $2(x+3)$

c $\frac{x}{3} - 7$ **d** $\sqrt{x} + 2$

e $\sqrt{(x+2)}$ **f** $\sqrt{\left(\frac{x}{4}\right)} - 1$

4 a 23, 21 **b** 439, 93
c ± 5 **d** 2

5 a $x^2 - 2x + 2$ **b** x^2
c $x^4 + 2x^2 + 2$ **d** $x - 2$
e 1

6 a $z(c) = 50 - c, 24$

b The distance travelled when you get £14 change from a £50 note.

page 136 **Exercise 28** 2

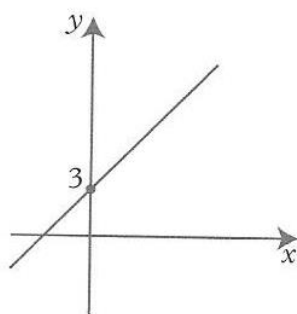
- 1 a (4, 10) b (6, 7)
 c (1, 3) d (1, 3)
 2 a 5 b 13
 c $\sqrt{74}$
 3 A(0, 12) B(6, 0)
 a (3, 6) b $\sqrt{180}$ or $6\sqrt{5}$
 4 (4a, a)

page 137 **Exercise 29** 2 3

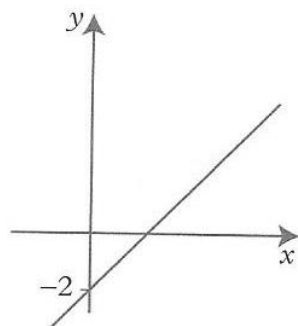
- 1 $\frac{1}{5}, \frac{5}{2}, -\frac{4}{3}$ 2 $\frac{4}{5}, -\frac{1}{6}, -5$
 3 a 3 b $\frac{3}{2}$
 c 4 d 5
 4 $a = 3\frac{1}{2}$
 5 a $\frac{n+4}{2m-3}$ b -4 c $1\frac{1}{2}$
 6 a 1 and -1, $\frac{1}{2}$ and -2, 3 and $-\frac{1}{3}$
 b -1 c -1 d the same
 7 Missing numbers are 5, $-\frac{1}{2}, -\frac{2}{3}, \frac{1}{5}$ and $-\frac{4}{3}$
 8 -1

page 140 **Exercise 30** 2

- 1 a 1 b 3

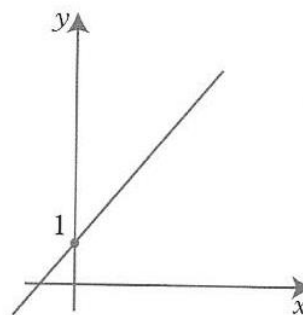


- 2 a 1 b -2



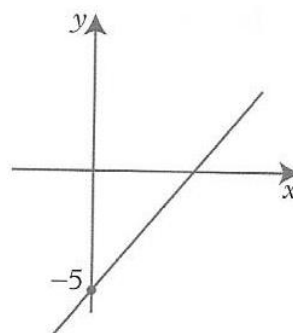
- 3 a 2

- b 1



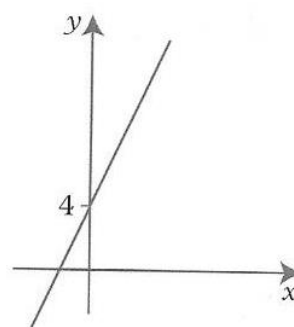
- 4 a 2

- b -5



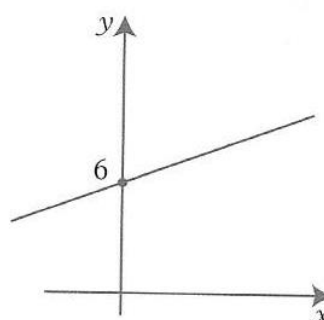
- 5 a 3

- b 4



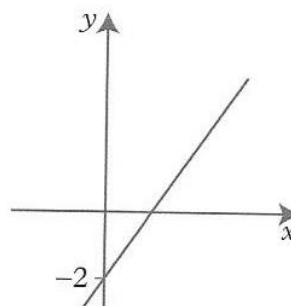
- 6 a $\frac{1}{2}$

- b 6



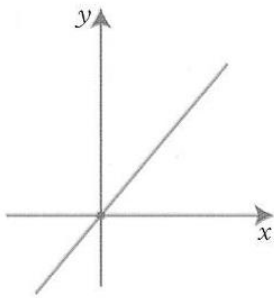
- 7 a 3

- b -2



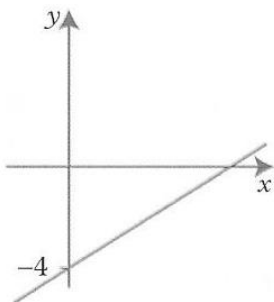
8 a 2

b 0



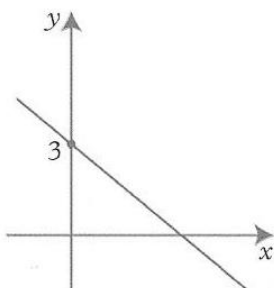
9 a $\frac{1}{4}$

b -4



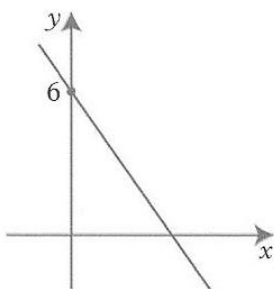
10 a -1

b 3



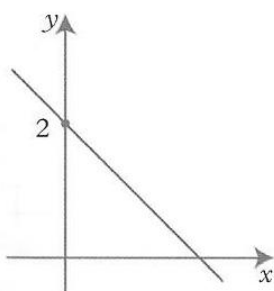
11 a -2

b 6



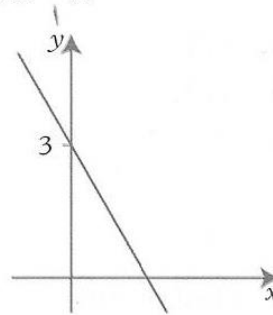
12 a -1

b 2



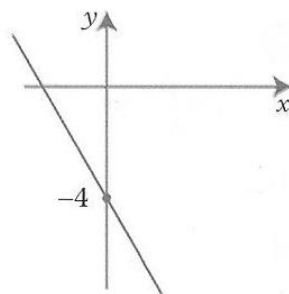
13 a -2

b 3



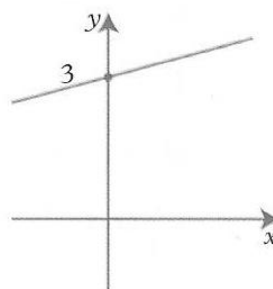
14 a -3

b -4



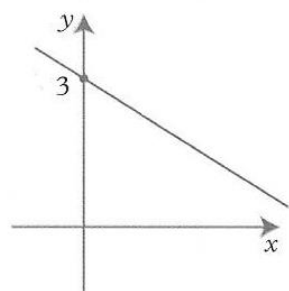
15 a $\frac{1}{2}$

b 3



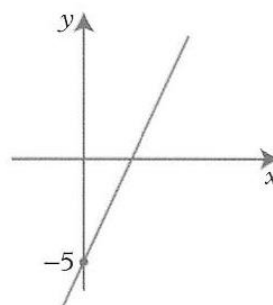
16 a $-\frac{1}{3}$

c 3



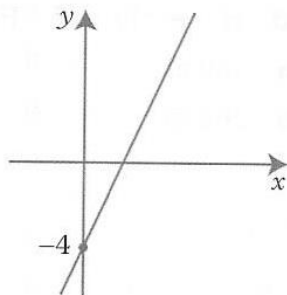
17 a 4

c -5



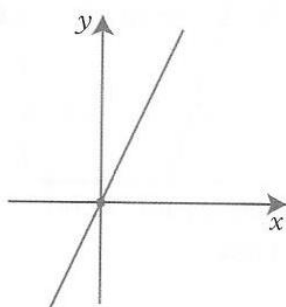
18 a $\frac{3}{2}$

b -4



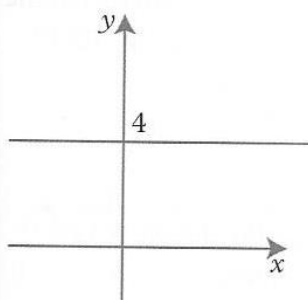
19 a 10

b 0



20 a 0

b 4



21 A: $y = 3x - 4$

22 C: $y = \frac{2}{3}x - 2$

B: $y = x + 2$

D: $y = -2x + 4$

23 a F and G; C and D

b B and H; A and E

c I

24 a A(0, -8); B(4, 0)

b 2

c $y = 2x - 8$

page 141 **Exercise 31** 2

1 $y = 3x + 7$

2 $y = 2x - 9$

3 $y = -x + 5$

4 $y = 2x - 1$

5 $y = 3x + 5$

6 $y = -x + 7$

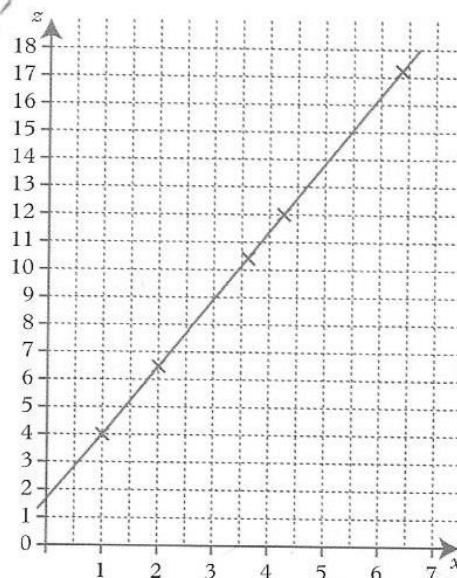
7 $y = \frac{1}{2}x - 3$

8 $y = 2x - 3$

9 $y = 3x - 11$

10 $y = -x + 5$

11

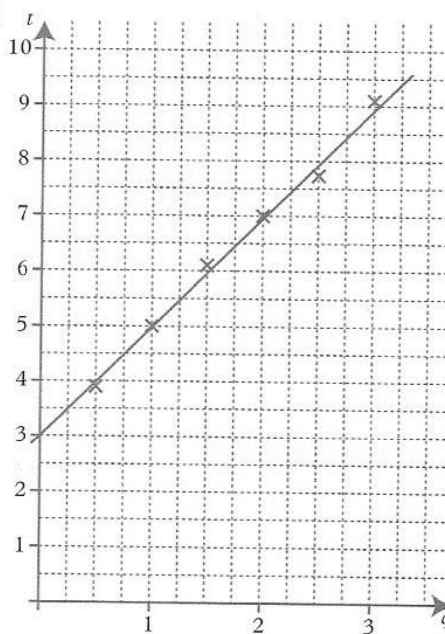


$a = 2.5$

$c = 1.5$

$z = 2.5x + 1.5$

12



gradient = 2

t-intercept = 3

Estimate $m = 2$, $c = 3$

page 144 **Exercise 32** 3

1 a $\frac{3}{2}$, 0, 36 units squared

b 2, -1, 40 units squared

2 a $\frac{5}{2}$, $-\frac{5}{4}$, 28 units squared

b $-\frac{1}{2}$, 0, 29 units squared

3 a 600 units squared, 50

b 675 units squared, 55

c 900 units squared, 75

d 800 units squared, 70

4 a 60 units squared, 15°

5 a 2 b -4

6 a 3 b -5 c 1.5

7 a $-2\frac{1}{2}$ b $-\frac{2}{5}$ c gradient tends to 0

8 a i 4 ii 8

9 22 units squared 10 7.47

11 b 38.5 c less

page 149 **Exercise 33** 3

1 a 8 degrees/min b $3\text{ m}^3/\text{hr}$ c -10 kg/s

2 a 7.5 degrees/min b 0

c -0.5 degrees/min

3 a -5 amps/s b 4.5 amps/s c 0

4 a $3\frac{1}{3}$ degrees/min

b $13\frac{1}{3}$ degrees/min

c 10 degrees/min

d $-8\frac{1}{3}$ degrees/min

5 a 7.5 m/s b 3.5 m/s c 6 m/s

d 5.7 m/s (1dp)

page 153 **Exercise 34** 1 2 3

1 a 40 km b 60 km

c York and Scarborough

d 15 minutes

e i 11.00 ii 13.45

f i 40 km/h ii 60 km/h iii 100 km/h

2 a 45 mins b 09.15

c 60 km/h d 100 km/h

e 57.1 km/h (1 dp)

3 a 09:00 b 64 km/h

c 40 km/h d 70 km

e 80 km/h

4 a $1\frac{1}{2}\text{ m/s}^2$ b 675 m

5 a 600 m b 225 m c -2 m/s^2

6 a 600 m b 387.5 m c 0 m/s^2

7 a 20 m/s b 750 m

8 a 8 s b 496 m c 12.4 m/s

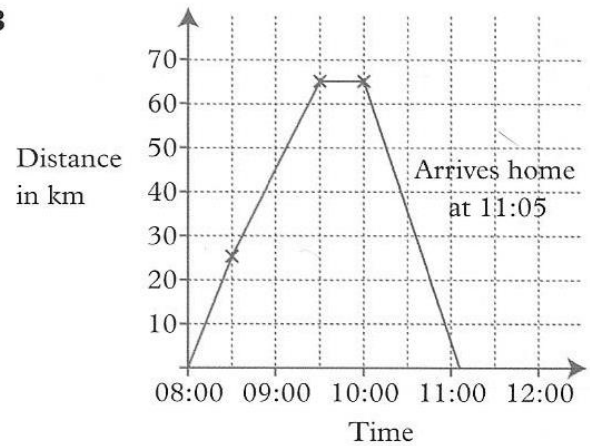
9 a E b C c A d B e D f F

10 a 0.75 m/s^2 b 680 m

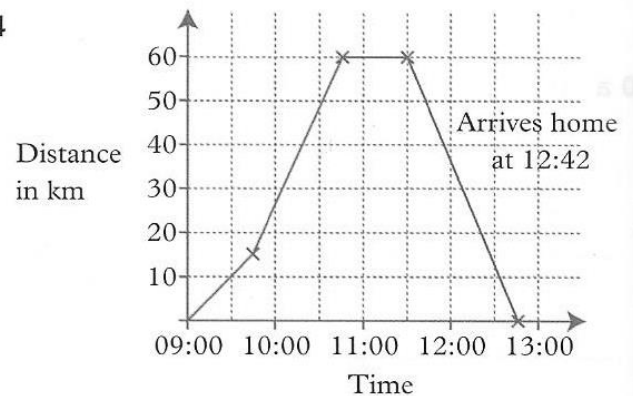
11 a 0.35 m/s^2 b 260 m

12 $1.0 < \text{speed} < 1.1\text{ m/s}$

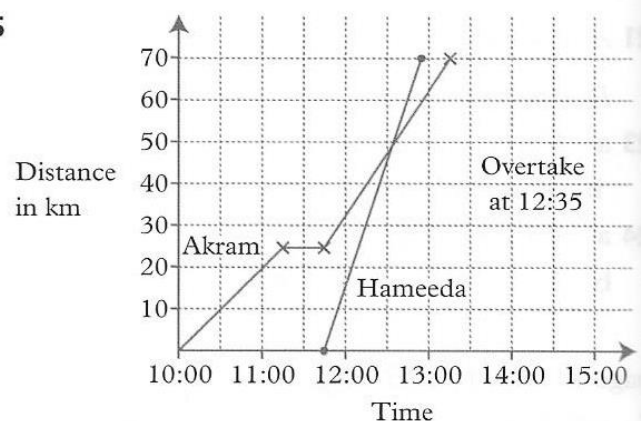
13



14



15



page 157 **Exercise 35** 2

1 a Y b X c V d Z e W

2 a 200 litres/hr b 500 litres/hr

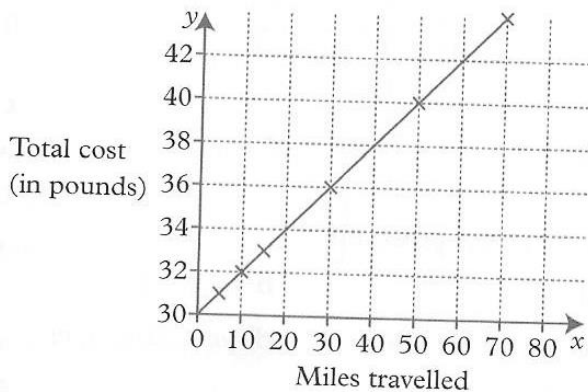
c 1000 litres/hr

3 a about 30 000/hr b about 100 000/hr

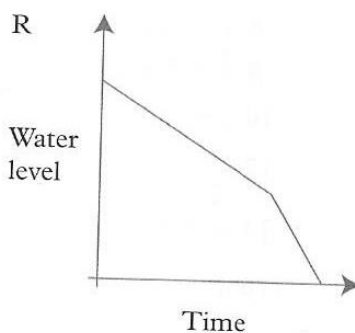
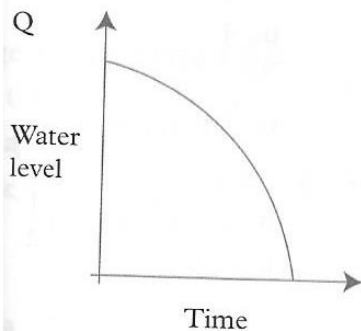
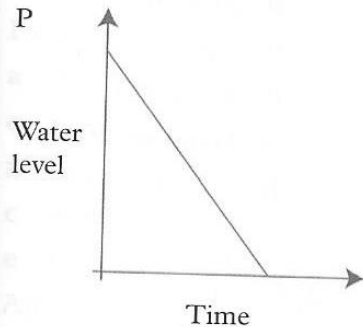
- 4 a 1 hr b 120 g/hr
 5 a 6 amps/sec b 4 amps/sec
 6 a X, £30 000 Y, £40 000 Z, £65 000
 b Z c X, £1200 Y, 1880 Z, 2600
 d Look for the lowest interest rate. Make sure you can continue to pay if the interest rate increases.
 7 a £7200 b £2700 c £310 d £85
 8 a 740 pence b £280 c £14 000
 9 a 2000 b 286 c $1600 \leq x \leq 22400$

page 161 **Exercise 36** 3

- 1 B
 2 a C b A c D d B
 3 D
 4

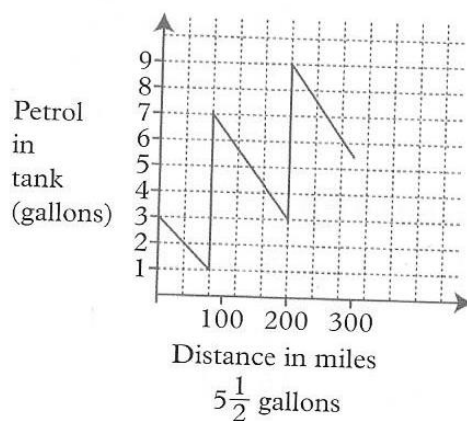


- 5 X → B Y → C Z → A
 6 P



- 7
 Cost per student
 No, it is not linear.
 Number of students

- 8 a 6 gallons
 b i 40 mpg ii 30 mpg
 c $33\frac{1}{3}$ mpg



page 164 **Exercise 37** 2

- 1 a $x = 3, y = 7$ b $x = 1, y = 3$
 c $x = 11, y = -1$
 2 $x = 2, y = 4$ 3 $x = 2, y = 3$
 4 $x = 3, y = 1$ 5 $x = 1, y = 5$
 6 $a = 5, b = 3$
 7 a $x = 4, y = 0$ b $x = 1, y = 6$
 c $x = -2, y = -3$ d $x = 8, y = -1$
 e $x = -0.6, y = 1.2$

page 166 **Exercise 38** 2

- 1 $x = 2, y = 1$ 2 $x = 4, y = 2$
 3 $x = 3, y = 1$ 4 $x = -\frac{1}{3}, y = -2\frac{1}{3}$

- 5 $x = 3, y = 2$
 7 $x = 2, y = 1$
 9 $x = 3, y = -1$
 11 $a = 5, b = \frac{1}{4}$
 13 $m = \frac{1}{2}, n = 4$
 15 $x = 6, y = 3$
 17 $m = 2, n = 1$

- 6 $x = 5, y = -2$
 8 $x = 5, y = 3$
 10 $a = 2, b = -3$
 12 $a = 1, b = 3$
 14 $w = 2, x = 3$
 16 $x = \frac{1}{2}, z = -3$
 18 $c = \frac{39}{23}, d = \frac{-58}{23}$

page 167 **Exercise 39** 2

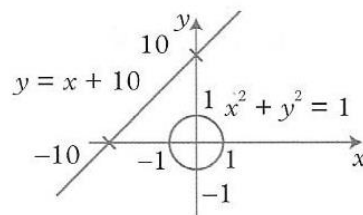
- 1 $x = 2, y = 4$ 2 $x = 1, y = 4$
 3 $x = 2, y = 5$ 4 $x = 3, y = 7$
 5 $x = 5, y = 2$ 6 $a = 3, b = 1$
 7 $x = -2, y = 3$ 8 $x = 4, y = 1$
 9 $x = \frac{5}{7}, y = 4\frac{3}{7}$ 10 $x = 1, y = 2$
 11 $x = 2, y = 3$ 12 $x = 4, y = -1$
 13 $x = 1, y = 2$ 14 $a = 4, b = 3$
 15 $x = 4, y = 3$ 16 $x = 5, y = -2$
 17 $x = 3, y = -1$ 18 $x = 5, y = 0.2$

page 168 **Exercise 40** 2

- 1 $9\frac{1}{2}$ and $5\frac{1}{2}$ 2 6 and 3
 3 5 and 2 4 8 and 5
 5 $? = 10\frac{1}{2}, * = 7\frac{1}{2}$ 6 $54^\circ, 63^\circ, 63^\circ$
 7 $c = \pounds 3, p = \pounds 4$
 8 TV costs $\pounds 200$, DVD player costs $\pounds 450$
 9 $b = 3\frac{1}{2}$ oz, $w = 2$ oz
 10 $(100b + 140j)$
 11 $m = 4, c = -3$
 12 15 two pence coins; 25 five pence coins
 13 14 ten pence coins; 7 fifty pence coins
 14 20
 15 Current 4 m/s, Herring 10 m/s
 16 $\frac{5}{7}$
 17 mouse is 3, owner is 10
 18 $a = 1, b = 2, c = 5$
 19 $a = 1, b = 3, c = 4$

page 170 **Exercise 41** 3

- 1 a $x = -1, y = 3$ or $x = 4, y = 8$
 b $x = 3, y = 13$ or $x = 5, y = 27$
 2 a $x = 3, y = 7$ or $x = 5, y = 17$
 b $x = \frac{1}{2}, y = \frac{1}{2}$ or $x = 4, y = 32$
 3 $(-3, -2)$ and $(2, 3)$
 4 $x = -2, y = -4$ or $x = 4, y = 2$
 5 $(1, -4)$ and $(4, 8)$
 6 Solving simultaneously gives $2x^2 + 20x + 99 = 0$ which has no solutions. However, it is easy to see that there are no solutions from a sketch graph:



- 7 b $(3, 4), (-4, -3)$ 8 $(2, 8)$

page 171 **Test yourself**

- 1 a $\frac{2}{3}$ b $n(n-3)$
 c $2x^2 + 9x - 5$ d $m^4 - 2m^2 + m$
 2 $\frac{4}{(x-3)}$
 4 a $3bc$ b $2x + 5y$
 c m^3 d $6np$
 5 2.26 6 $4.2(4.15)$
 7 a $4n + 1$ b Diagram 50
 8 a n^2 b $7n - 9$
 9 $y = -2x + 5$
 10 $x = 1, y = 2$ or $x = -\frac{1}{2}, y = \frac{17}{4}$
 11 a 3 b $-4n + 6$
 12 a $-5, -1, 3, 7$ b 4
 c 100
 13 a $(90 - \frac{1}{2}x)^\circ$ b $p = 4, q = -1$
 14 $x = -3, y = 5$ or $x = -5, y = 3$
 15 a $5x + 4y$ b $x = 1\frac{2}{5}, y = -1\frac{1}{2}$
 c i $nx + (n-1)y$ ii 15
 16 $x = 1.5$
 17 a $3xy$ b $5a + 9b$

4 Geometry 1

page 176 Exercise 1 1

- 1 70° 2 70°
 3 48° 4 $a = 40^\circ, b = 140^\circ$
 5 60° 6 $x = 122^\circ, y = 116^\circ$
 7 135° 8 $a = 28^\circ$
 9 20° 10 $e = 70^\circ, f = 75^\circ$
 11 $a = 36^\circ, x = 36^\circ$ 12 $a = 60^\circ, b = 40^\circ$
 13 72° 14 98°
 15 80° 16 $x = 95^\circ, y = 50^\circ$
 17 $a = 87^\circ, b = 74^\circ$ 18 $a = 65^\circ, c = 103^\circ$
 19 $a = 70^\circ, b = 60^\circ$ 20 65°
 21 46°
 22 a $x = a, y = b$
 b $a + b + c = x + y + c = 180^\circ$
 (angles on a straight line)
 23 a $p + q + r = 180^\circ$ b $q + x = 180^\circ$
 c $x = 180^\circ - q = p + r$
 24 136° 25 80°
 26 66° 27 $27\frac{1}{2}$

page 180 Exercise 2 1

- 2 a 115° b 90° c 80°
 4 Rhombus 5 True
 6 False
 7 a Rectangle b Square
 c Trapezium d Parallelogram
 8 a Trapezium b Rectangle
 c Square d Parallelogram
 e Isosceles triangle
 9 Any trapezium with 2 right angles

page 181 Exercise 3 1

- 1 C(5, 1), D(0, 0)
 2 a 180° b 180°
 c Sum of angles $= a + c + d + f + e + b$
 $= a + b + c + d + e + f$
 $= 180^\circ + 180^\circ = 360^\circ$
 3 a 72° b 108° c 80°

- 4 a 40° b 30° c 110°
 5 a 116° b 32° c 58°
 6 53°
 7 a 26° b 26° c 77°
 8 150° 9 110°
 10 a 54° b 72° c 36°
 11 a 60° b 15° c 75°

page 184 Exercise 4 1

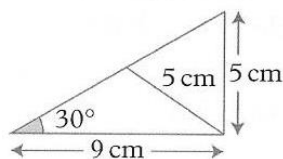
- 1 a $a = 80^\circ, b = 70^\circ, c = 65^\circ, d = 86^\circ, e = 59^\circ$
 b $a + b + c + d + e = 80^\circ + 70^\circ + 65^\circ + 86^\circ + 59^\circ = 360^\circ$ as required.
 2 Interior angle of a hexagon is 120° .
 $360^\circ \div 120^\circ = 3$ (an integer)
 Interior angle of a pentagon is 108° .
 $360^\circ \div 108^\circ = 3.3$ (not an integer)
 3 a $a = 36^\circ$ b 144° c No
 4 a i 40° ii 20° iii 8°
 iv 6°
 b i 140° ii 160° iii 172°
 iv 174°
 5 $p = 101^\circ, q = 79^\circ, m = 70^\circ, n = 130^\circ, x = 70^\circ$
 6 24 sides 7 9 sides 8 20 sides
 9 b i 1080° ii 1440°
 10 a 150° b 30° c $\frac{360^\circ}{12} = 30^\circ$
 11 20 sides

page 186 Exercise 5 1

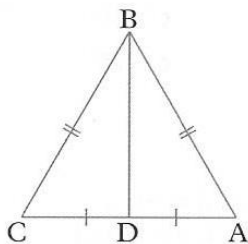
- 1 A and G, B and O, C and F, H and P, I and N, J and K
 2 a, b, f are congruent. c, e are similar. d, g are neither

page 188 Exercise 6 2

- 1 Yes (SSS) 2 Yes (SAS) 3 No
 4 Yes (AAS) 5 No 6 Yes (AAS)
 7 CDA, DEB, EAC, ABD
 8



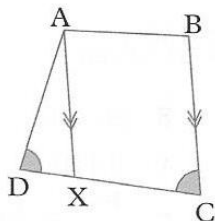
- 9 $AB = BC$
 $AD = DC$
 BD is common
Therefore, $\triangle ABD \equiv \triangle CBD$ (SSS)
 $\angle A$ corresponds to $\angle C$ & therefore under the congruency, $A = C$.



- 10 $\angle OAT = 90^\circ = \angle OBT$; $OA = OB$ (radii);
 OT is common.
Therefore, $\triangle OAT \equiv \triangle OBT$ (RHS). Therefore
 $AT = BT$ as required.

- 11 Since $LY = LX$, $LM = LN$ and angle L is common, the two triangles are congruent (SAS).

- 12 $\angle AXD = \angle BCD$ (corresponding angles)
 $\therefore \angle AXD = \angle ADX$
 $\therefore \triangle ADX$ is isosceles (base angles equal)



- 13 $\angle NYM = \angle MYZ$ and
 $\angle MZN = \angle NZY$.

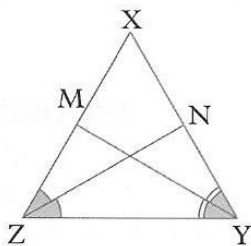
But triangle XZY is isosceles, so $\angle Z = \angle Y$.

Thus $\angle NYM = \angle MYZ = \angle MZN = \angle NZY$.

Therefore, $\triangle MYZ \equiv \triangle NZY$ (AAS i.e.

$\angle NZY = \angle MYZ$, $\angle NYZ = \angle MZY$ and ZY is common)

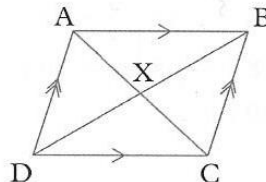
Therefore $YM = ZN$.



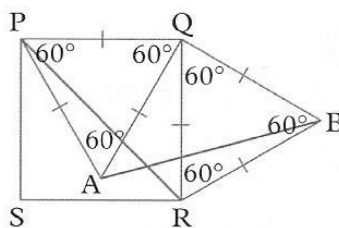
- 14 a $DX = XC$, so $\triangle DXC$ is isosceles, i.e.
angle $C =$ angle D . But angle $C = \angle XAB$ and angle $D = \angle XBA$.
Therefore, $\angle XAB = \angle XBA$ so $\triangle ABX$ is isosceles. Therefore $AX = BX$.

- b $AX = BX$ and $XC = XD$,
so $AX + XC = BX + XD$, i.e. $AC = BD$
c $DZ = DV + VZ = ZC + VZ = VC$
 $AC = BD$ (proven in b) and angle
 $D =$ angle C as DXC is isosceles.
Therefore, $\triangle DBZ \equiv \triangle CAV$ (SAS).

- 15 $\angle ABX = \angle XDC$ (alternate angles)
 $\angle BAX = \angle XCD$ (alternate angles)
 $AB = CD$ (parallelogram)
 $\therefore \triangle ABX \equiv \triangle CDX$ (AAS)
 $\therefore BX = XD$ and $AX = XC$



- 16 $PQ = QA$
 $QR = QB$
Angle $PQR = 90^\circ$
Angle $AQR = 90^\circ - 60^\circ = 30^\circ$
Therefore, $\angle AQB = 30^\circ + 60^\circ = 90^\circ = \angle PQR$
 $\therefore \triangle PQR \equiv \triangle AQB$ (SAS)
 $\therefore PR = AB$ as required.

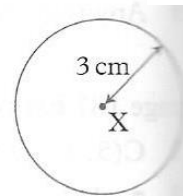


page 191 **Exercise 7** 2

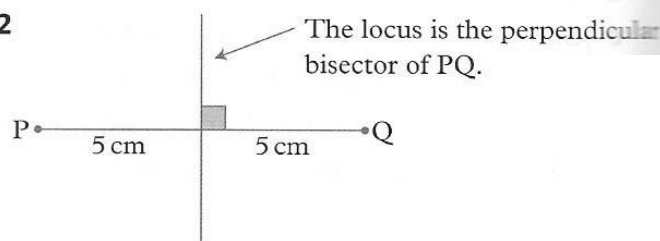
Students' own constructions

page 192 **Exercise 8** 2

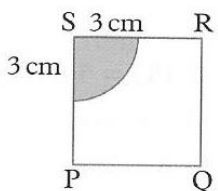
- 1 P moves on a circle
center X radius 3 cm.



2



-

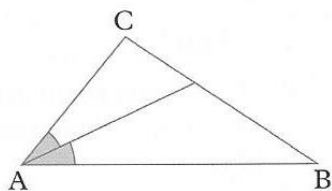


-

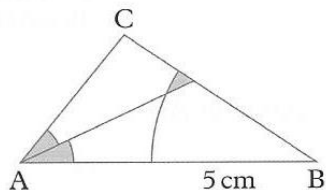
-

2. 

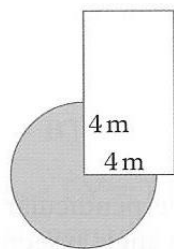
3 a Locus is angle bisector of A.



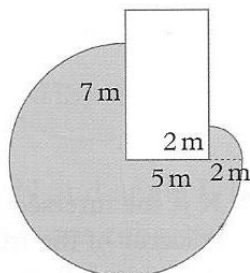
b



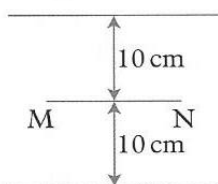
4 a



b



5

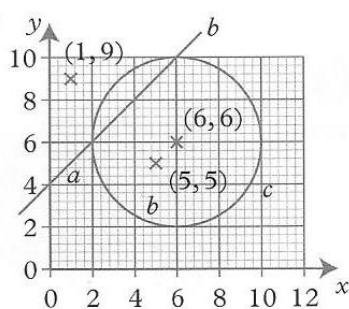


6 A plane containing the perpendicular bisector of the line joining the 2 fixed points.

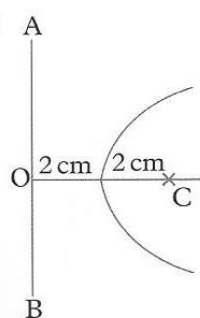
7 A circle diameter AB

8 Students' own construction

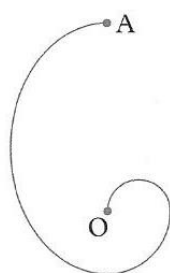
9



10



11



page 196 **Exercise 10** **2**

- | | |
|--------------------------------------|--------------------------------------|
| 1 10 cm | 2 4.1 cm |
| 3 10.6 cm | 4 5.7 cm |
| 5 4.2 cm | 6 9.9 cm |
| 7 4.6 cm | 8 5.2 cm |
| 9 $\sqrt{97}$ cm | 10 9.8 cm (2 sf) |
| 11 3.5 m (2 sf) | 12 40.3 km (3 sf) |
| 13 12.7 cm (3 sf) | 14 5.7 cm (2 sf) |
| 15 a 5 | b 40 |
| 16 9.5 cm (2 sf) | 17 32.6 cm (3 sf) |
| 18 a 14.1 cm (3 sf) | b 57.1 cm ² (3 sf) |
| 19 374 cm ² (3 sf) | |

page 199 **Exercise 11** **3**

- | | |
|---|--------------------------------------|
| 1 5.4 (2 sf) | |
| 2 PQ = 5.83, QR = 6, PR = 5.83; Yes. | |
| 3 6.6 (2 sf) | 4 5.6 (2 sf) |
| 5 8.7 (2 sf) | 6 5.7 (2 sf) |
| 7 6.6 (2 sf) | 8 $x = \sqrt{5} = 2.2$ (2 sf) |
| 9 a 5 cm | b 7.8 cm (2 sf) |
| 10 a 6.4 cm (1 dp) | b 13.6 cm (1 dp) |
| 11 6.34 m (3 sf) | 12 4.6 cm (2 sf) |
| 13 a 7.5 (1 dp) | b 12.5 (1 dp) |
| c 14.9 (1 dp) | |
| 14 24 cm | 15 10 feet |
| 16 b 8.6 (1 dp) | c 16.4 (1 dp) |
| 17 a $x = 4$ | b 20.6 (1 dp) |
| 18 a i 13 | ii 25 iii 9 |
| b Enter results from (a) into table. | |
| c a is an odd number, c is always $b + 1$. | |
| d 11, 60, 61; 13, 84, 85; 15, 112, 113; Yes they do. | |
| 19 29.5 cm (1 dp) | |

page 202 **Exercise 12** **2** **3**

- | |
|--|
| 1 A (2, 4, 0) B (0, 4, 3) C (2, 4, 3) D (2, 0, 3) |
| 2 a B(3, 0, 0) C(3, 4, 0) Q(3, 0, 2) R(3, 4, 2) |
| b i (0, 2, 0) ii (0, 4, 1) iii $(1\frac{1}{2}, 4, 0)$ |
| c i $(1\frac{1}{2}, 2, 0)$ ii $(1\frac{1}{2}, 2, 2)$ |
| iii $(1\frac{1}{2}, 4, 1)$ d $(1\frac{1}{2}, 2, 1)$ |

3 a C(2, 2, 0) R(2, 2, 3) B(2, -2, 0)
P(0, -2, 3) Q(2, -2, 3)

b i $(2, -2, 1\frac{1}{2})$ **ii** (1, -2, 3)

4 i 5 **ii** 5.83 **iii** 6.40

5 i $(2, 3\frac{1}{2}, 5)$ **ii** $(2, 7, 2\frac{1}{2})$ **iii** $(2, 3\frac{1}{2}, 0)$

6 (20, 45, 5)

7 a 4 **b** 5 **c** $5\sqrt{2}$

8 Square-based pyramid

9 a 10 **b** 45°

10 29.9 m

page 204 **Exercise 13** 1

1 34 cm^2 **2** 33 cm^2 **3** 54 cm^2

4 18 cm^2 **5** 20 cm^2 **6** 25 cm^2

7 23 cm^2 **8** 31 cm^2 **9** 35 cm^2

10 54 cm^2 **11** 51 cm^2

12 a 4 cm **b** $5\frac{1}{2}\text{ cm}$ **c** 4.3 cm

13 248 cm^2 **14** 33 cm^2 **15** 39 cm^2

16 39 cm^2

17 a 6 cm **b** 5 cm **c** 7 cm

19 Mark

20 a A 16 cm B 14 cm C 18 cm

page 208 **Exercise 14** 1

1 42 cm^2 **2** 22 cm^2 **3** 103 cm^2

4 60.5 cm^2 **5** 143 cm^2 **6** 9 cm^2

7 13 cm **8** 15 cm **9** 2500

10 a 25 cm^2 **b** 21 cm^2 **c** 11.8 cm^2 (1 dp)

d 19.7 cm^2 (1 dp) **e** 21 cm^2

f 16.4 cm^2 (1 dp)

11 24 cm^2 **12** 40 cm^2

14 46 cm^2 **15** 47 cm^2 **16** 81.75 cm^2

17 a 6.0 cm **b** 7.2 cm

c 7.0 cm **d** 4.6 cm

18 a $b \sin C$

page 209 **Exercise 15** 1 2

1 80 m^2

2 a 18 cm **b** 8 cm^2

3 a 8.5 m **b** 10 m **c** 4 m

4 45 cm^2 **5** 2.4 cm

6 a $\frac{1}{3}$ **b** $\frac{4}{9}$ **c** 25 cm^2

7 Check student's work.

8 1100 m **9** 6 **10** 14

11 1849 **12** 10 cm

13 a 60°

b Triangle = 3.90 cm^2 ,
Hexagon = 23.38 cm^2

14 123.6 m^2 **15** 57.1 cm^2 **16** 10.7 cm

17 4.1 cm **18** 4.85 cm **19** 7.23 cm

20 a $\frac{360^\circ}{n}$

b i $\frac{1}{2} \sin\left(\frac{360^\circ}{n}\right)$ **ii** $\frac{n}{2} \sin\left(\frac{360^\circ}{n}\right)$

c 3.1395; 3.14157 It is approaching π .

21 18.7 cm

page 213 **Exercise 16**

1 a 34.6 cm **b** 25.1 cm **c** 37.7 cm

d 15.7 cm **e** $10\pi\text{ cm}$ **f** $13\pi\text{ cm}$

g $2\pi\text{ cm}$ **h** 4.4 $\pi\text{ cm}$

2 13 mm or 1.3 cm **3** 8.5 m (2 sf)

4 400 m **5** 22.6 cm (3 sf)

6 212 **7** $360 + 90\pi\text{ cm}$

8 a 95.0 cm^2 **b** 50.3 cm^2

c 113 cm^2 **d** 19.6 cm^2

e 78.5 cm^2 **f** 133 cm^2

g 3.14 cm^2 **h** 15.2 cm^2

9 29.5 cm^2 (3 sf) **10** 124.7 cm^2 (1 dp)

11 $100 - 25\pi\text{ cm}^2$ **12** 4.6 kg (2 sf)

page 215 **Exercise 17**

Answers are given to an appropriate degree of accuracy.

1 a 31.4 cm **b** 78.5 cm^2

2 a 21.4 cm **b** 28.3 cm^2

3 a 128.5 cm **b** 981.7 cm^2

4 a 56.6 cm **b** 190.1 cm^2

5 a 53.7 m **b** 198.5 m^2

6 a 28.1 m **b** 54.7 m^2

7 a 20.6 cm **b** 24.6 cm^2

- 8 a** 25.1 cm **b** 31.4 cm²
9 a 20.3 cm **b** 24.6 cm²
10 a 37.2 cm **b** 92.9 cm²
11 a 25.1 cm **b** 13.7 cm²
12 a 25.1 cm **b** 25.1 cm²
13 a 18.8 cm **b** 12.6 cm²

page 217 **Exercise 18** ①

Answers are given to an appropriate degree of accuracy.

- 1** 2.2 cm **2** 0.32 m
3 a 11.5 m **b** 41.4 km
c 3.7 m **d** 2.4 m
e 1.6×10^7 km
4 9.3 cm **5** 17.8 cm
6 14.2 mm **7** 497 000 km²
8 42.9 **9** 30 discs can be cut.
a 1508 cm² **b** 508 cm²
10 5305 **11** 29
12 40.8 m²
13 a 80 **b** 7
14 5.4 cm **15** 117.7 m²
16 a 32.99 cm **b** 70.88 cm²
17 a 98 cm² **b** 14 cm²
18 796 m²
19 a 4×4 **b** radius 2
c side is $4\sqrt{3}$ or 6.93
20 57.5°
21 He actually needed to take off 2π metres,
 so 6 m would give a good estimate.
22 1.72 cm

page 220 **Exercise 19** ①

- 1** 2:1 **2** 112 cm²
3 $\frac{7}{16}$ **4** 0.586 m
5 20% **6** 7.172 cm
7 112.5° **8** 60°
9 55.4 cm² **10** 8 cm **11** 4:1
12 a 2.41 (3 sf) **b** 1.85 (3 sf) **c** $1 + \sqrt{2}$

page 223 **Exercise 20** ②

Answers are given to an appropriate degree of accuracy.

- 1 a** 2.09 cm **b** 7.85 cm **c** 4.36 cm
2 15.36 cm
3 a 8.7 cm² **b** 40.6 cm² **c** 18.8 cm²
4 a 6.28 cm **b** 61.1 cm² **c** 11.64 cm
d 150.5 cm² **e** 3945 cm²
5 a 7.1 cm² **b** 19.5 cm²
6 17.8 cm **7** 74.2 cm³ **8** 5.94 cm²
9 a 3.98 cm **b** 74.9°
10 a 12 cm **b** 30°
11 a 30° **b** 10.5 cm

page 225 **Exercise 21** ②

- 1 a** 85.9° **b** 57.3° **c** 6.25 cm
2 30.6 cm² **3** 57.3°
4 a 36°
b Arc DC = $\frac{36}{360} \cdot 2\pi r$
 $= \frac{36}{360} \cdot 10\pi$
 $= \square \therefore \text{Perimeter} = 5 \times \text{Arc DC}$
 $= 5\square$
5 a 6.1 cm **b** 27.6 cm **c** 28.6 cm²
6 1850 metres
7 a 18 cm **b** 38.2°
8 a 10 cm **b** 43.0°

$$\begin{aligned}
 \mathbf{9 \ a} \quad \text{Area } \triangle ABC &= \frac{1}{2} AC \times AB \\
 &= \frac{1}{2} \times 1 \times 1 \tan x \\
 &= \frac{1}{2} \tan x
 \end{aligned}$$

$\therefore$ Shaded area in this Δ

$$\begin{aligned}
 &= \frac{1}{2} \tan x - \frac{x}{360} \times \pi \times 1^2 \\
 &= \frac{1}{2} \tan x - \frac{\pi x}{360}
 \end{aligned}$$

This equals area of sector ECD

$$\therefore \frac{1}{2} \tan x - \frac{\pi x}{360} = \frac{\pi x}{360}$$

$$\therefore \frac{1}{2} \tan x = \frac{\pi x}{180}$$

$$\therefore 90 \tan x = \pi x$$

$$\therefore \left(\frac{90}{\pi}\right) \tan x = x$$

b $x = 66.8$

10 Let A = unshaded area and r = radius of circle.

Then A + area (2) = area of semi-circle

$$= \frac{1}{2} \pi r^2$$

A + area (1) = area of $\triangle ABC$

$$= \frac{1}{2} BC \times AC$$

$$= \frac{1}{2} \times 2r \times 2r \tan x$$

$$= 2r^2 \tan x$$

Since area (1) = area (2)

$$\therefore 2r^2 \tan x = \frac{1}{2} \pi r^2$$

$$\therefore \tan x = \frac{1}{4} \pi$$

$$\therefore \tan x = \frac{\pi}{4}$$

$$x = 38.1^\circ$$

page 228 **Exercise 22** (2)

1 a 72.6 cm^2 **b** 24.5 cm^2 **c** 48.1 cm^2

2 a 5.08 cm^2 **b** 82.8 cm^2 **c** 5.14 cm^2

3 a $60^\circ, 9.06 \text{ cm}^2$ **b** $106.3^\circ, 11.2 \text{ cm}^2$

4 3 cm **5** 3.97 cm

6 a 13.49 cm^2 **b** 404.7 cm^3

7 a 129.9 cm^2 **b** 184 cm^2

8 19.6 cm^2

9 $0.31r^2$ (or $r^2(\pi - 2\sqrt{2})$)

10 a 8.4 cm **b** 54.5 cm **c** 10.4 cm

11 81.2 cm^2

page 231 **Exercise 23** (1)

1 $48 \text{ cm}^3, 88 \text{ cm}^2$ **2** $30 \text{ cm}^3, 62 \text{ cm}^2$

3 $60 \text{ cm}^3, 104 \text{ cm}^2$ **4** 125 cm^3

5 50 minutes

6 a $x = 3 \text{ cm}$ **b** $x = 5.5 \text{ cm}$ **c** $x = 2.5 \text{ cm}$

7 b 1 000 000 or 10^6 **c** 6 m^2

page 233 **Exercise 24** (1)

1 a 150 cm^3 **b** 60 cm^3 **c** 57 cm^3

d 32 cm^3 **e** 94.5 cm^3 **f** 110 cm^3

2 c 116 cm^2 **d** 64.8 cm^2 (1 d.p.)

e 177 cm^2 **f** 188 cm^2

3 2400 cm^3

4 a 200 m^2 **b** 2400 m^3

5 a 62.8 cm^3 **b** 113.1 cm^3 **c** 502.7 cm^3

6 a 502.7 cm^3 **b** 760.3 cm^3

7 10 litres **8** 7.1 kg (2 sf)

9 a 141.4 cm^3 **b** 25.1 cm^3

10 769.7 cm^3 **11** $x = 7\frac{7}{15} \text{ g/cm}^3$ (or 7.46°)

page 235 **Exercise 25** (1)

1 3.98 cm **2** 6.37 cm **3** 1.89 cm

4 9.77 cm **5** 7.38 cm **6** 1273 cm

7 4.24 litres **8** 106 cm/s

9 Volume = 1570 cm^3 Weight = 12.6 kg

10 No, approximately 2300 bricks are needed.

11 1.2 cm **12** 53 times **13** 191 cm

page 237 **Exercise 26** (2)

1 40 cm^3 **2** 33.5 cm^3 **3** 66.0 cm^3

4 89.8 cm^3 **5** 339 cm^3 **6** 144 cm^3

7 4.71 kg **8** 262 cm^3 **9** 359 cm^3

10 235 cm^3 **11** 5 m

12 $3.6 \times 10^{-3} \text{ mm}$ **13** 10 balls of radius 2 cm

14 415 cm^3 **15** 106 s **16** 488 cm^3

17 37 500 000 **18** 1.05 cm^3 **19** $10\frac{2}{3} \text{ cm}^3$

20 1.93 kg

page 239 **Exercise 27** (2)

1 a 3.91 cm **b** 2.43 cm **c** 7.16 cm

2 6.4 cm **3** 23.9 cm

4 a 125 **b** 2.7×10^7

5 a 0.36 cm **b** 0.43 cm

6 a 6.7 cm b 39.1 cm

7 NC = 4 cm Volume = 4.2 cm^3

8 53.6 cm^3 9 74.5 cm^3

10 122.5 cm^3 11 54.5 litres

12 a 2.9 m^3 b 1.7 m

13 a $16\pi \text{ cm}$ b 8 cm c 6 cm

14 1481 cm^3

page 242 **Exercise 28** 2

1 a $36\pi \text{ cm}^2$ b $40\pi \text{ cm}^2$ c $60\pi \text{ cm}^2$

d $1.4\pi \text{ cm}^2$

2 a 40π b 28π c **48π**

d 24π

3 £3 870 4 **£409.50** 5 303 cm^2

6 675 cm^2 7 1.62×10^8 years

8 a 1.59 cm b 4.77 cm

9 1.64 cm 10 2.12 cm 11 3.46 cm

12 94 cm^3 13 44.6 cm^2 14 377 cm^2

15 slant ht. = 20 cm base radius = 10 cm

16 a 3.72 cm b 41.9 cm^2

17 122.6 cm^2 18 297.6 cm^3

page 246 **Exercise 29** 2

1 A and G, C and J, K and M, L and F

3 a, c, e, and f 4 C 5 12 cm

6 9 cm 7 a = 2.5 cm, e = 3 cm

8 $6\frac{3}{4} \text{ cm}$ 9 $3\frac{1}{5} \text{ cm}$

10 t = 5.25 cm, y = 5.6 cm 11 7.7 cm

12 No

13 a Yes b No c No d Yes

e Yes f No g No h Yes

14 a Angle B is common to both, and they each have a right angle $\therefore$ the 3rd angle is also equal.

b 11.2 cm c 4.2 cm

15 6 cm 16 6 cm 17 4.5 cm

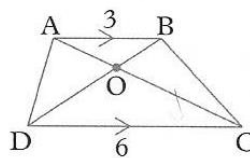
page 249 **Exercise 30** 2

1 16 m

2 3.75 m

3 10.8 m

4 a



$\angle AOB = \angle DOC$ (vertically opposite)

$\angle OAB = \angle OCD$ (alternate angles)

$\angle OBA = \angle ODC$ (alternate angles)

$\therefore$ triangles are similar

b $AO = 2 \text{ cm}$, $DO = 6 \text{ cm}$

5 $m = 6$, $n = 6$ 6 $w = 6\frac{2}{3}$, $v = 5\frac{1}{3}$

7 $x = 1\frac{1}{11}$ or $3\frac{2}{3}$

8 $x = 0.618$; ratio of sides = 1.618

9 $x = 5$

10 a $\triangle ABD$ is similar to $\triangle ACB$

$\therefore \frac{AB}{AC} = \frac{AD}{AB}$

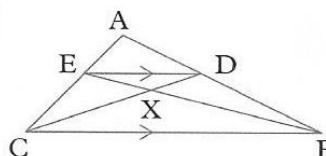
$\therefore \frac{x}{z} = \frac{p}{x}$

$\therefore x^2 = pz$

b $y^2 = qz$

c $x^2 + y^2 = pz + qz = z(p + q) = zz = z^2$ as required

11



a $\angle A$ is common. $\angle E = \angle C$ and $\angle D = \angle B$ (corresponding angles)

$\therefore \triangle ADE$ is similar to $\triangle ABC$

b $\angle EXD = \angle BXC$ (vertically opposite)

$\angle EDX = \angle XCB$ (alternate)

$\angle DEX = \angle CBX$ (alternate)

$\therefore \triangle DXE$ is similar to $\triangle BXC$

c As the triangles in (a) are similar,

$\frac{AD}{AB} = \frac{ED}{CB}$

As the triangles in (b) are similar,

$\frac{ED}{CB} = \frac{EX}{XB}$

Therefore, $\frac{AD}{AB} = \frac{EX}{XB}$ as required.

page 252 **Exercise 31** **3**

- 1 16 cm^2
- 2 27 cm^2
- 3 11.25 cm^2
- 4 14.5 cm^2
- 5 180 cm^2
- 6 12 cm^2
- 7 8 cm
- 8 18 cm
- 9 $4\frac{1}{2} \text{ cm}$
- 10 $7\frac{1}{2} \text{ cm}$
- 11 9, 12, 15 cm
- 12 a $500\,000 \text{ cm}^2$
- b 50 m^2
- 13 $4\frac{1}{2}$ hours
- 14 150 tiles
- 15 360 tiles
- 16 $5r$
- 17 a $16\frac{2}{3} \text{ cm}^2$
- b $10\frac{2}{3} \text{ cm}^2$
- 18 a 25 cm^2
- b 21 cm^2
- 19 24 cm^2
- 20 Less
- 21 6.3 cm (2 sf)
- 22 $\sqrt{2}$ or 1.414 (3 dp)
- 23 $\frac{4}{9}$

page 257 **Exercise 32** **3**

- 1 480 cm^3
- 2 540 cm^3
- 3 160 cm^3
- 4 4500 cm^3
- 5 81 cm^3
- 6 11 cm^3
- 7 16 cm^3
- 8 $85\frac{1}{3} \text{ cm}^3$
- 9 4 cm
- 10 21 cm
- 11 4.6 cm
- 12 9 cm
- 13 6.6 cm
- 14 4.5 cm
- 15 168.75 cm^3
- 16 $106.3125 \text{ cm}^3 \left(106\frac{5}{16}\right)$
- 17 12 cm
- 18 a $2:3$ b $8:27$
- 19 $8:125$
- 20 60 cm
- 21 $\pounds 12.80$

22

	On model	On actual ship
Length	42 cm	21 m
Capacity of hold	500 cm^3	62.5 m^3
Area of sails	700 cm^2	175 m^2
Number of cannon	12	12
Deck area	370 cm^2	92.5 m^2

- 23 54 kg
- 24 240 cm^2
- 25 $9.375 \text{ litres} \left(9\frac{3}{8}\right)$
- 26 2812.5 cm^2
- 27 100 g

page 260 **Test yourself**

1 $7x - 60 = 360$

$x = 60^\circ$

2 144°

3 70 cm^2

4 $\angle ABC = \angle BCD$ (alternate angles)

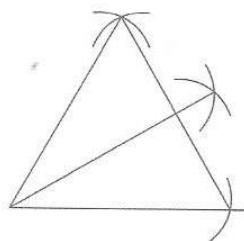
$\angle CAB = 90^\circ = \angle CDB$

(angles in a semi-circle)

Side BC is common.

Therefore, $\triangle ABC \equiv \triangle DCB$ (AAS)

- 5 First construct an equilateral triangle, then bisect one of the angles.



6 **1.75 hours**

7 **$5x^2$**

8 250 cm^2

9 No, angle is 68°

10 18.2 cm^2

11 15.9 cm (1 dp)

12 26.9 cm (1 dp)

13 $18 + 4\pi \text{ cm}$

14 Length = 22.99 cm (2 dp) Height = 10 cm

15 Students' own construction

16 a $160\pi \text{ cm}^3$

b $28\pi \text{ cm}^2$

17 $a = 18 \text{ cm}$, $b = 3.5 \text{ cm}$

18 1200 cm^3

19 7.2 cm

20 a 628 cm^3

b 0.628 litres

5 Algebra 2

page 266 **Exercise 1** **1**

1 $x = e - b$

2 $x = m + t$

3 $x = a + b + f$

4 $x = A + B - h$

5 $x = y$

6 $x = b - a$

7 $x = m - k$

8 $x = w + y - v$

9 $x = \frac{b}{a}$

10 $x = \frac{m}{h}$

$$\begin{array}{lll}
11 \ x = \frac{(a+b)}{m} & 12 \ x = \frac{(c-d)}{k} & 13 \ x = \frac{(e+n)}{v} \\
14 \ x = \frac{(y+z)}{3} & 15 \ x = \frac{r}{p} & 16 \ x = \frac{(h-m)}{m} \\
17 \ x = \frac{(a-t)}{a} & 18 \ x = \frac{(k+e)}{m} & 19 \ x = \frac{(m+h)}{u} \\
20 \ x = \frac{(t-q)}{e} & 21 \ x = \frac{(v^2+u^2)}{k} & 22 \ x = \frac{(s^2-t^2)}{g} \\
23 \ x = \frac{(m^2-k)}{a} & 24 \ x = \frac{(m+v)}{m} & 25 \ x = \frac{(c-a)}{b} \\
26 \ x = \frac{(y-t)}{s} & 27 \ x = \frac{(z-y)}{c} & 28 \ x = \frac{a}{h} \\
29 \ x = \frac{2b}{m} & 30 \ x = \frac{(cd-ab)}{k} & 31 \ x = \frac{c}{a} + b \\
32 \ x = \frac{e}{c} + d & 33 \ x = \frac{n^2}{m} - m & 34 \ x = \frac{t}{k} + a \\
35 \ x = \frac{k}{h} + h & 36 \ x = \frac{n}{m} - b & 37 \ x = 2a \\
38 \ x = \frac{d}{c} - a & 39 \ x = \frac{e}{m} - b
\end{array}$$

page 267 Exercise 2 1

$$\begin{array}{lll}
1 \ x = tm & 2 \ x = en & 3 \ x = pa \\
4 \ x = tam & 5 \ x = abc & 6 \ x = ey^2 \\
7 \ x = a(b+c) & 8 \ x = t(c-d) & \\
9 \ x = m(s+t) & 10 \ x = k(h+i) & 11 \ x = \frac{ab}{c} \\
12 \ x = \frac{mz}{y} & 13 \ x = \frac{hc}{d} & 14 \ x = \frac{em}{n} \\
15 \ x = \frac{hb}{e} & 16 \ x = c(a+b) & 17 \ x = m(h+k) \\
18 \ x = \frac{mu}{y} & 19 \ x = t(h-k) & \\
20 \ x = (a+b)(z+t) & 21 \ x = \frac{e}{t} & \\
22 \ x = \frac{e}{a} & 23 \ x = \frac{h}{m} & 24 \ x = \frac{cb}{a} \\
25 \ x = \frac{nd}{c} & 26 \ x = \frac{m}{t^2} & 27 \ x = \frac{h}{\sin 20^\circ} \\
28 \ x = \frac{e}{\cos 40^\circ} & 29 \ x = \frac{m}{\tan 46^\circ} & 30 \ x = \frac{b^2c^2}{a^2}
\end{array}$$

page 268 Exercise 3 1

$$\begin{array}{lll}
1 \ x = a - y & 2 \ x = h - m & 3 \ x = z - q \\
4 \ x = b - v & 5 \ x = k - m & 6 \ x = \frac{h-d}{c}
\end{array}$$

$$\begin{array}{lll}
7 \ x = \frac{y-c}{m} & 8 \ x = \frac{k-h}{e} & 9 \ x = \frac{a^2-d}{b} \\
10 \ x = \frac{m^2-n^2}{t} & 11 \ x = \frac{v^2-w}{a} & 12 \ x = y - y^2 \\
13 \ x = \frac{k-m}{t^2} & 14 \ x = \frac{b-e}{c} & 15 \ x = \frac{h-z}{g} \\
16 \ x = \frac{c-a-b}{d} & 17 \ x = \frac{v^2-y^2}{k} & 18 \ x = \frac{d-h}{f} \\
19 \ x = b - \frac{c}{a} & 20 \ x = m - \frac{n}{h} & 21 \ c - \frac{t}{m} = a \\
22 \ p - \frac{w}{v} = a & 23 \ q - \frac{e}{d} = a & 24 \ b^2 - r^2 = a \\
25 \ a = x - 2f^2 & 26 \ a = \frac{B-ED}{A} & 27 \ a = \frac{D-BN}{E} \\
28 \ a = \frac{h-bx}{f} & 29 \ a = \frac{v^2-Cd}{h} & 30 \ a = \frac{TN}{M} - B \\
31 \ a = \frac{BM+ef}{fN} & 32 \ a = M - \frac{EF}{T} & 33 \ \frac{2}{(3y-1)} = x \\
34 \ \frac{5}{(4z+2)} = x & 35 \ \frac{A}{C-B} = x & 36 \ \frac{V}{H-G} = x \\
37 \ \frac{r}{n+t} = x & 38 \ \frac{b}{q-d} = x & 39 \ \frac{m}{t+n} = x \\
40 \ \frac{b}{d-h} = x & 41 \ \frac{d}{C-e} = x & 42 \ \frac{m}{r-e^2} = x \\
43 \ \frac{n}{b-t^2} = x & 44 \ \frac{d}{mn-b} = x & 45 \ \frac{N}{2M} - P = x \\
46 \ \frac{B}{6A} - c = x & 47 \ \frac{m^2}{n-p} = x & 48 \ \frac{q}{w-t} = x
\end{array}$$

page 269 Exercise 4 1

$$\begin{array}{lll}
1 \ x = \pm \sqrt{\frac{h}{c}} & 2 \ x = \pm \sqrt{\frac{f}{b}} & 3 \ x = \pm \sqrt{\frac{m}{t}} \\
4 \ x = \pm \sqrt{\frac{a+b}{y}} & 5 \ x = \pm \sqrt{\frac{t+a}{m}} & 6 \ x = \pm \sqrt{a+b} \\
7 \ x = \pm \sqrt{t-c} & 8 \ x = \pm \sqrt{z-y} & \\
9 \ x = \pm \sqrt{a^2+b^2} & 10 \ x = \pm \sqrt{m^2-t^2} & \\
11 \ x = \pm \sqrt{a^2-n^2} & 12 \ x = \pm \sqrt{\frac{c}{a}} & 13 \ x = \pm \sqrt{\frac{n}{h}} \\
14 \ x = \pm \sqrt{\frac{z+k}{c}} & 15 \ x = \pm \sqrt{\frac{c-b}{a}} & 16 \ x = \pm \sqrt{\frac{e+h}{d}} \\
17 \ x = \pm \sqrt{\frac{m+n}{g}} & 18 \ x = \pm \sqrt{\frac{z-y}{m}} &
\end{array}$$

$$19 \ x = \pm \sqrt{\frac{f-a}{m}}$$

$$20 \ x = \pm \sqrt{b^2 - a^2}$$

$$21 \ 4z^2 = x$$

$$22 \ 9y^2 + 2 = x \quad 23 \ D^2 - C = x$$

$$24 \ \frac{c^2 - b}{a} = x$$

$$25 \ \frac{b^2 + t}{g} = x \quad 26 \ d - t^2 = x$$

$$27 \ n - c^2 = x$$

$$28 \ c - g^2 = x \quad 29 \ \frac{D-B}{A} = x$$

$$30 \ \pm \sqrt{g} = x$$

$$31 \ \pm \sqrt{B} = x \quad 32 \ \pm \sqrt{A+M} = x$$

$$33 \ \pm \sqrt{C-m} = k \quad 34 \ \pm \sqrt{\frac{n}{m}} = k \quad 35 \ \frac{ta}{z} = k$$

$$36 \ \pm \sqrt{a-n} = k \quad 37 \ \pm \sqrt{A+B^2} = k$$

$$38 \ \pm \sqrt{t^2 - m} = k \quad 39 \ \frac{M^2}{A^2} - B = k$$

$$40 \ \frac{N}{B^2} = k \quad 41 \ a^2 - t^2 = k \quad 42 \ \frac{4}{\pi^2} - t = k$$

$$43 \ \pm \sqrt{\frac{b+c^2}{a}} = k \quad 44 \ \pm \sqrt{x^2 - b} = k$$

page 270 Exercise 5 1

$$1 \ y = \frac{2x+5p}{3}$$

$$2 \ y = 3$$

$$3 \ \frac{D-B}{2N}$$

$$4 \ \frac{E+D}{3M}$$

$$5 \ \frac{2b}{(a-b)}$$

$$6 \ \frac{e+c}{m+n}$$

$$7 \ \frac{3}{x+k}$$

$$8 \ \frac{C-D}{R-T}$$

$$9 \ \frac{z+x}{a-b}$$

$$10 \ \frac{nb-ma}{m-n}$$

$$11 \ \frac{d+bx}{x-1}$$

$$12 \ \frac{a-ab}{b+1}$$

$$13 \ \frac{d-c}{c+d}$$

$$14 \ \frac{M(b-a)}{a+b}$$

$$15 \ \frac{n^2-mn}{m+n}$$

$$16 \ \frac{m^2+5}{z-m}$$

$$17 \ \frac{n^2+2}{n-1}$$

$$18 \ \frac{e-b^2}{b-a}$$

$$19 \ \frac{3x}{a+x}$$

$$20 \ \frac{e-c}{a-d}$$

$$21 \ \frac{d}{(a-c-b)}$$

$$22 \ \frac{ab}{(m+n-a)}$$

$$23 \ \frac{s-t}{b-a}$$

$$24 \ 2x$$

$$25 \ \frac{1}{3}V$$

$$26 \ \frac{a(b+c)}{b-2a}$$

$$27 \ \frac{5x}{3}$$

$$28 \ -\frac{4z}{5}$$

$$29 \ \frac{mn}{p^2-m}$$

$$30 \ \frac{n(m+1)}{4+m}$$

page 270 Exercise 6 1

$$1 \ a = \frac{v-u}{t}$$

$$b \ 2$$

$$2 \ x = \frac{360A}{\pi r^2}$$

$$3 \ a \ k = \frac{Py}{m}$$

$$b \ y = \frac{mk}{P}$$

$$4 \ a \ n = pR + d$$

$$b \ 1255$$

$$5 \ r = \sqrt{\frac{A}{\pi}}$$

$$6 \ h = \frac{V}{\pi r^2}$$

$$7 \ r = \sqrt{\frac{A}{4\pi}}; r = 3\sqrt{\frac{3V}{4\pi}}$$

page 271 Exercise 7 1

$$1 \ x = \frac{h+d}{a}$$

$$2 \ y = \frac{m-k}{z}$$

$$3 \ y = \frac{f}{d} - e$$

$$4 \ k = \frac{d}{m} - a$$

$$5 \ m = \frac{c-a}{b}$$

$$6 \ e = \pm \sqrt{\frac{b}{a}}$$

$$7 \ t = \pm \sqrt{\frac{z}{y}}$$

$$8 \ x = \pm \sqrt{e+c} \quad 9 \ y = \frac{b+n}{m}$$

$$10 \ z = \frac{b}{a} - a$$

$$11 \ x = \frac{a}{d}$$

$$12 \ k = mt$$

$$13 \ u = mn$$

$$14 \ x = \frac{y}{d}$$

$$15 \ m = \frac{a}{t}$$

$$16 \ g = \frac{d}{n}$$

$$17 \ t = k(a+b) \quad 18 \ e = \frac{v}{y}$$

$$19 \ y = \frac{m}{c}$$

$$20 \ a = \pm \sqrt{bm} \quad 21 \ m = \frac{b}{g} - a$$

$$22 \ g = \frac{x^2}{h} - h$$

$$23 \ t = y - z$$

$$24 \ e = \pm \sqrt{\frac{c}{m}}$$

$$25 \ x = \frac{t}{a} - y$$

$$26 \ v = \frac{y^2 + t^2}{u} \quad 27 \ k = \pm \sqrt{c-t}$$

$$28 \ w = k - m$$

$$29 \ n = \frac{b-c}{a}$$

$$30 \ y = \frac{c}{m} - a$$

$$31 \ x = pq - ab$$

$$32 \ k = \frac{a^2 - t}{b}$$

$$33 \ z = \frac{w}{v^2}$$

$$34 \ u = t - c$$

$$35 \ c = \frac{t}{x}$$

$$36 \ w = \frac{k}{m} - n$$

$$37 \ m = \frac{v-t}{x}$$

$$38 \ y = \frac{c}{a} - b$$

$$39 \ c = a - \frac{e}{m}$$

$$40 \ a = \pm \sqrt{\frac{c}{b}}$$

$$41 \ p = \frac{a}{q}$$

$$42 \ n = \pm \sqrt{\frac{a}{e}}$$

$$43 \ f = \pm \sqrt{\frac{h}{m}}$$

$$44 \ x = \pm \sqrt{\frac{V}{n}}$$

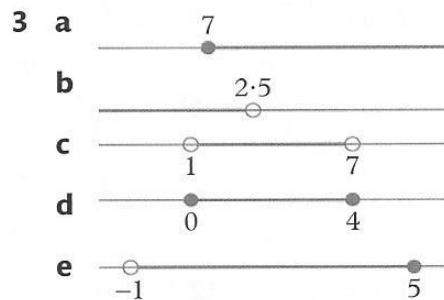
$$45 \ c = \frac{v-t^3}{a}$$

$$46 \ y = \frac{b^3 - a^3}{a} \quad 47 \ h = \pm \sqrt{\frac{b+d}{a}} \quad 48 \ k = \frac{bc - h^2}{h}$$

$$49 \ n = \pm \sqrt{u^2 - v^2} \quad 50 \ z = b - \frac{b^3}{m}$$

page 272 Exercise 8 2

- 1 a < b > c >
d > e < f >
2 a $x > 2$ b $x \leq 5$ c $x < 100$
d $-2 \leq x \leq 2$ e $x > -6$ f $3 < x \leq 8$
g $4 < x < 7$ h $-5 \leq x \leq 0$ i $-1 \leq x < 3$



- 4 a $A \geq 16$ b $3 < A \leq 70$
c $150 < T < 175$ d $h \geq 1.75$
5 a True b True c True
6 7, -6, 8.5 7 $2 < x \leq 7$ 8 $3 \leq x < 5$

page 274 Exercise 9 2

- 1 $x > 13$ 2 $x < -1$ 3 $x < 12$
4 $x \leq 2\frac{1}{2}$ 5 $x > 3$ 6 $x \geq 8$
7 $x < \frac{1}{4}$ 8 $x \geq -3$ 9 $x < -8$
10 $x < 4$ 11 $x > -9$ 12 $x < 8$
13 $x > 3$ 14 $x \geq 1$ 15 $x < 1$
16 $x > 2\frac{1}{3}$ 17 $x < -3$ 18 $x > 7\frac{1}{2}$
19 $x > 0$ 20 $x < 0$ 21 $x > 5$
22 $5 \leq x \leq 9$ 23 $-1 < x < 4$ 24 $5\frac{1}{2} \leq x \leq 6$
25 $1\frac{1}{3} < x < 8$ 26 $-8 < x < 2$ 27 $\frac{1}{4} < x < 1\frac{1}{5}$
28 Student's own answer

page 275 Exercise 10 3

- 1 $x > 8$ 2 1, 2, 3, 4, 5, 6
3 7, 11, 13, 17, 19 4 4, 9, 16, 25, 36, 49

- 5 -4, -3, -2, -1
6 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
7 2, 3, 5, 7, 11
8 2, 4, 6, 8, 10, 12, 14, 16, 18
9 1, 2, 3, 4

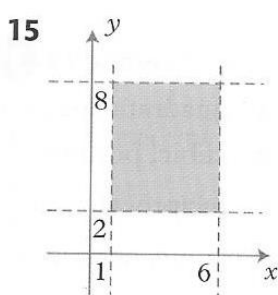
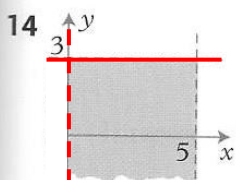
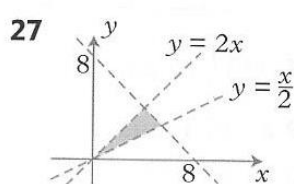
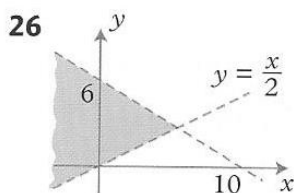
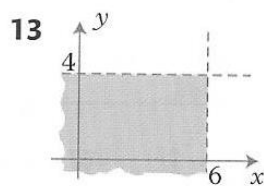
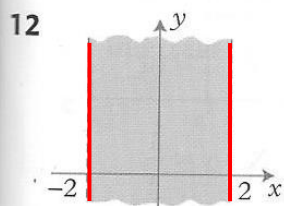
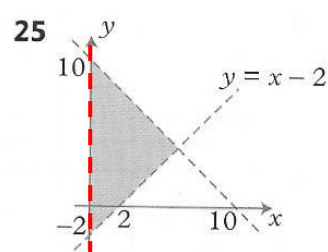
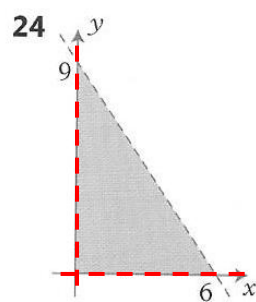
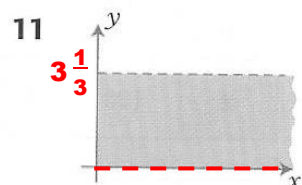
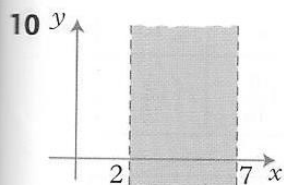
- 10 5
11 a 16 b -16 c 20 d -5
12 >
13 $\frac{1}{2}$ (other answers are possible)
14 19 15 17 16 $x > 3\frac{2}{3}$
17 b i $-10 < x < 10$
ii $-9 < x < 9$ iii $x > 6$ or $x < -6$
18 $-5 < x < 5$ 19 $-4 \leq x \leq 4$
20 $x > 1$ or $x < -1$ 21 $x \geq 6$ or $x \leq -6$
22 all values of x except $x = 0$
23 $-2 < x < 2$
24 a $2 \leq pq \leq 40$ b $\frac{1}{2} \leq \frac{p}{q} \leq 10$
c $-2 \leq p - q \leq 9$ d $3 \leq p + q \leq 14$
25 7 26 5 27 6
28 3, 4, 5 29 $30^\circ < x < 90^\circ$
30 $0 \leq x < 75.5^\circ$

page 277 Exercise 11 3

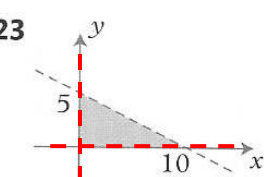
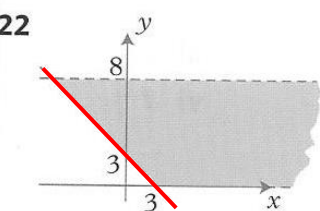
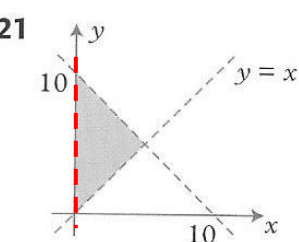
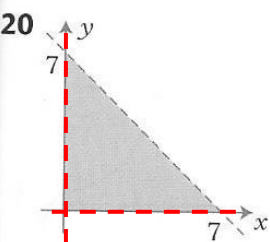
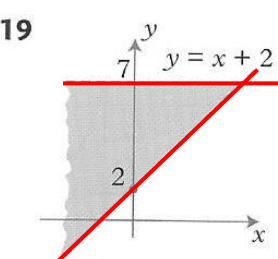
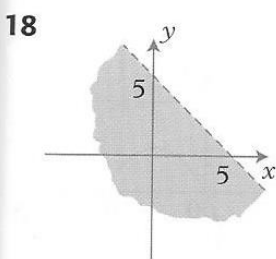
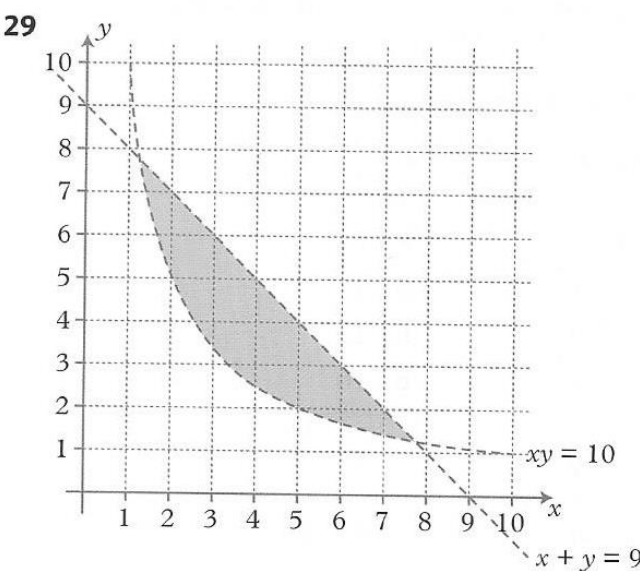
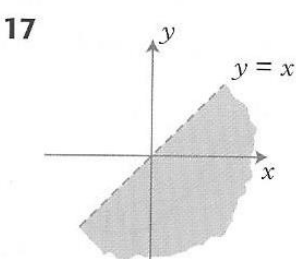
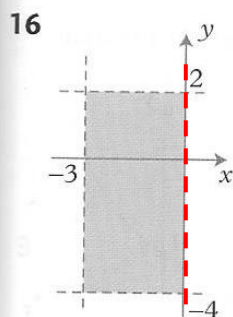
- 1 a [2, 4] b (2, 6] c [-1, 3]
d $(4, \infty^+)$ e $(1, \infty^-)$ f $[-2, \infty^-)$
2 a $(5, \infty^-)$ b $(3, \infty^+)$ c $[8, \infty^+)$
d $[3, \infty^+)$ e $(\infty^-, 2]$ f $\left[1\frac{1}{2}, \infty^-\right)$
g (6, 8) h [-1, 1] i (-2, 1]
j [-4, 4] k (-5, 5) l $[-\sqrt{5}, \sqrt{5}]$
3 a [2, 32] b [3, 12]
c [-2, 7] d $\left[\frac{1}{2}, 8\right]$

page 279 Exercise 12 3

- 1 $x \geq 3$ 2 $y \leq 2\frac{1}{2}$
3 $1 \leq x \leq 6$ 4 $x < 7$ and $y < 5$
5 $y \geq x$ 6 $x + y \leq 10$
7 $2x - y \leq 3$ 8 $x \leq 8, y \geq -2, y \leq x$
9 a $x \geq 0, x + y < 7, y > x$
b $y \geq 0, y \leq x + 2, x + y \geq 6$



- 28 A $x + y < 5, y \geq x + 1$
 B $x + y < 5, y \leq x + 1$
 C $x + y > 5, y \leq x + 1$
 D $x + y > 5, y \geq x + 1$



Answers are (6, 2), (5, 3), (4, 3), (4, 4), (3, 4), (3, 5), (2, 6).

page 283 **Exercise 13** 2 3

- 1 a $S = ke$ b $v = kt$ c $x = kz^2$
 d $y = k\sqrt{x}$ e $T = k\sqrt{L}$
 2 $k = \frac{3}{2}$ a 9 b $2\frac{2}{3}$
 3 a 35 b 11
 4 a 75 b ± 4

5

x	1	3	4	$5\frac{1}{2}$
z	4	12	16	22

6

r	1	2	4	$1\frac{1}{2}$
V	4	32	256	$13\frac{1}{2}$

7 $333\frac{1}{3} \text{ N/cm}^2$

9 a 675 joules

10 a 9000 N

11 $p \propto w^3$

8 180 m; 2 secs

b 1.15 cm

b 25 m/s

12 50 625 : 1

page 285 **Exercise 14** 2 3

1 a $x = k \times \frac{1}{y}$

b $s = k \times \frac{1}{t^2}$

c $t = k \times \frac{1}{\sqrt{q}}$

d $m = k \times \frac{1}{\omega}$

e $z = k \times \frac{1}{t^2}$

2 a 6

b $\frac{1}{2}$

3 a 6

b $1\frac{1}{2}$

4 a 1

b 4

5 a 36

b ± 4

6 a 6

b 16

7

y	2	4	1	$\frac{1}{4}$
z	8	4	16	64

8

t	2	5	20	10
v	25	4	$\frac{1}{4}$	1

9 a 6

b 50

10 a 2.5 m^3

b 200 N/m^2

11 a 3 hours

b 48

12 6 cm

13 80

14 a 2 days

b 200 days

15 a 20 mins

b 2 mins

16

x	1	2	4	10
z	100	$12\frac{1}{2}$	$1\frac{9}{16}$	$\frac{1}{10}$

17

v	1	4	36	10000
y	12	6	2	$\frac{3}{25}$

18 V $y \propto x^2$ W $y \propto x$ X $y \propto \frac{1}{x}$
Y $y \propto \frac{1}{x^2}$ Z $y \propto \sqrt{x}$

page 289 **Exercise 15** 3

1 a quadratic, negative x^2

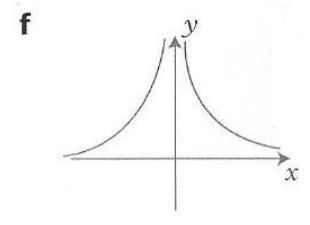
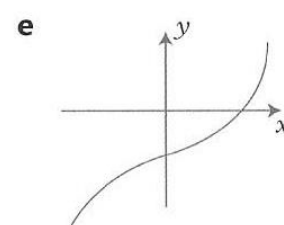
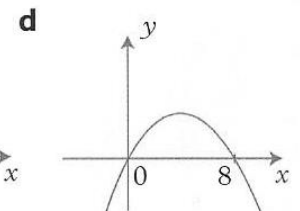
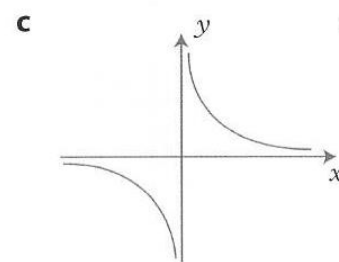
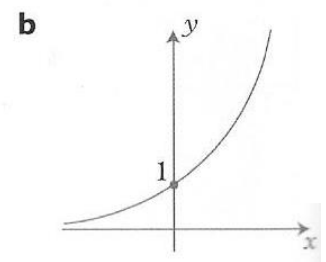
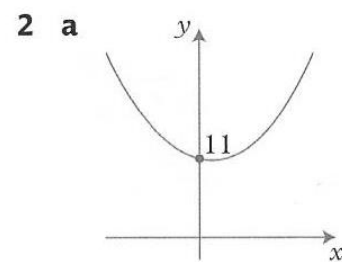
b cubic, positive x^3

c reciprocal, $y = \frac{k}{2}$ where k is positive

d cubic, negative x^3

e quadratic, positive x^2

f exponential, $y = k(a^x)$ where k is positive

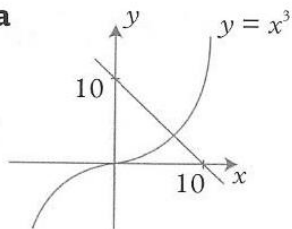


3 i c
iv e

ii b
v f

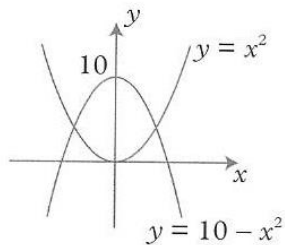
iii a
vi d

4 a



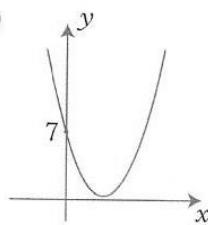
Intersect once

b

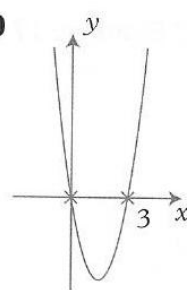


Intersect twice

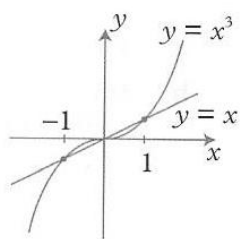
9



10

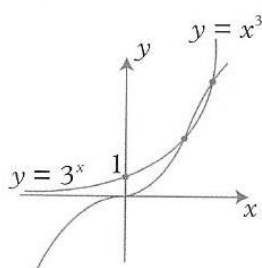


c



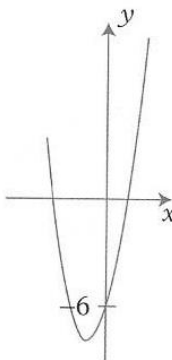
Intersect 3 times

d

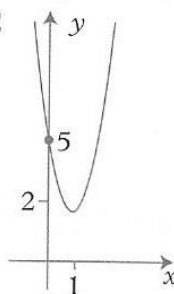


Intersect twice

11

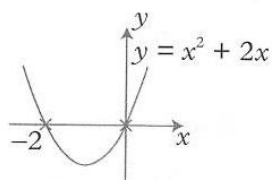


12

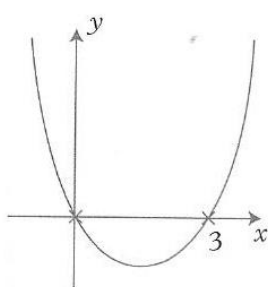


page 291 **Exercise 16** 1

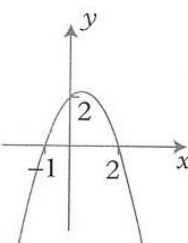
1



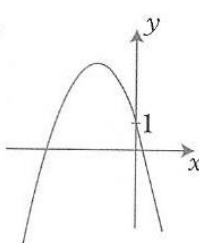
2



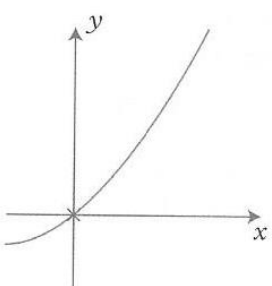
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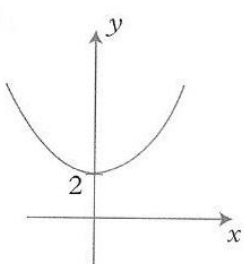
14



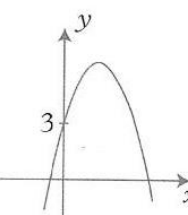
3



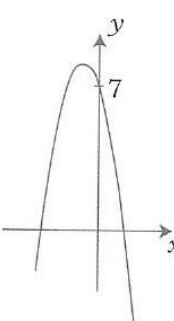
4



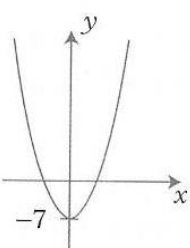
15



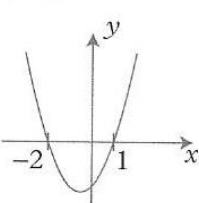
16



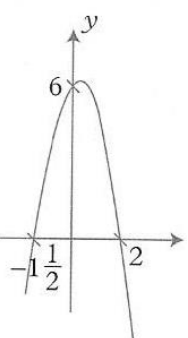
5



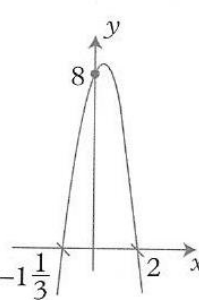
6



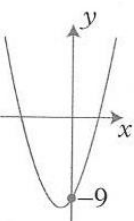
17



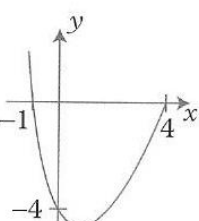
18



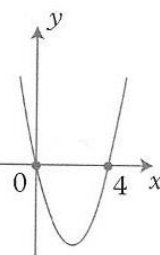
7



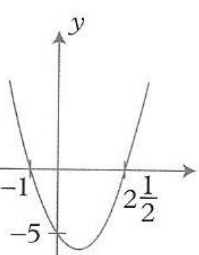
8



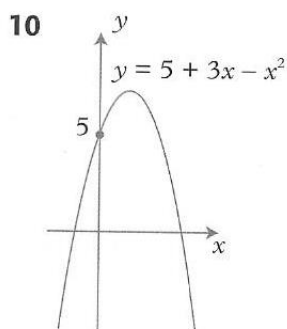
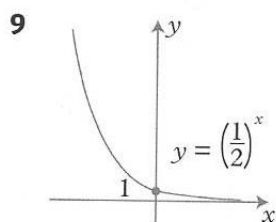
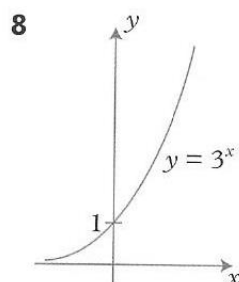
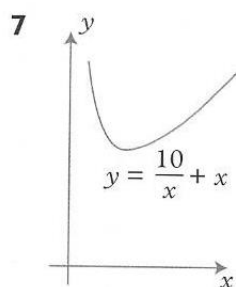
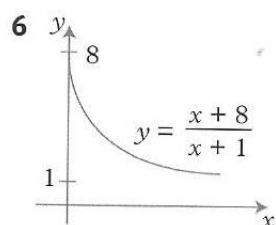
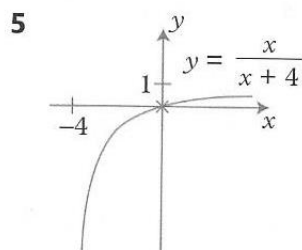
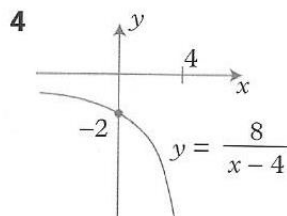
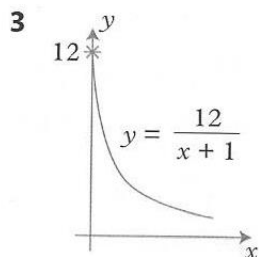
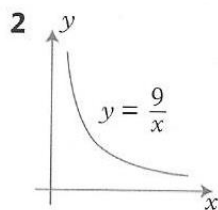
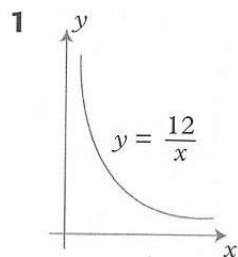
19



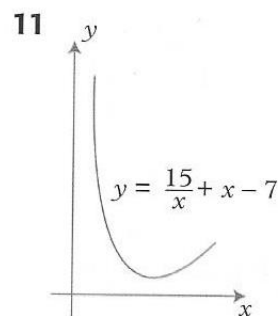
20



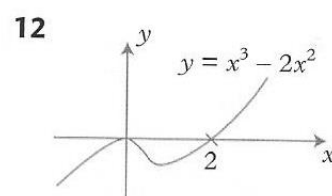
page 292 **Exercise 17** **2** **3**



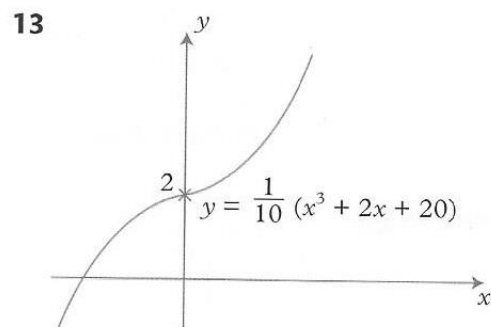
- a** 7.25
b $x = 3.8$ and -0.8



- a** 0.75
b 1.2



- a** 3.1
b 3.3



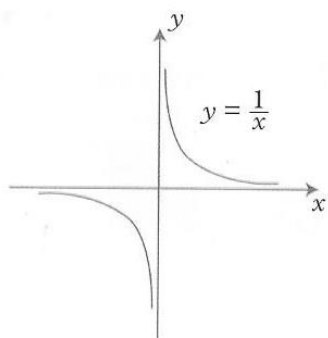
- a** -2.5
b 1.8

- 14** 5 m, 10 m **15** 6 **16** 7.3 yrs
- 17** **A** linear **B** quadratic **C** cubic
D reciprocal **E** cubic **F** quadratic
G cubic **H** exponential
I reciprocal **J** exponential
- 18** **a** 6 **b** 8 **c** 5
- 19** **W** $(x+1)(x-4)$ **X** $x^2 - 4x$
Y $9 - x^2$ **Z** $5x - x^2$

page 295 **Exercise 18** **3**

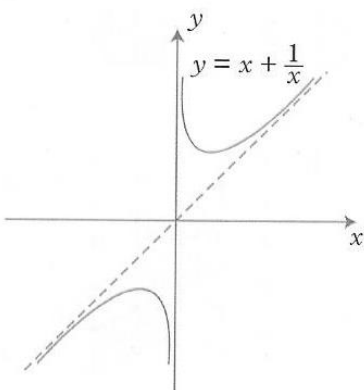
- 1** **a** 10.7 cm^2 **b** $1.7 \text{ cm} \times 5.3 \text{ cm}$
c 12.25 cm^2 **d** $3.5 \text{ cm} \times 3.5 \text{ cm}$
e A square
- 2** **a** $60 - 2x \text{ m}$ **b** $x(60 - 2x) \text{ m}^2$
c Dome shaped parabola crossing x -axis at $x = 0$ and $x = 30$.
d $15 \text{ m} \times 30 \text{ m}$
- 3** **a** 2.5 secs **b** 31.25 m
c $2 < t < 3$ seconds

4

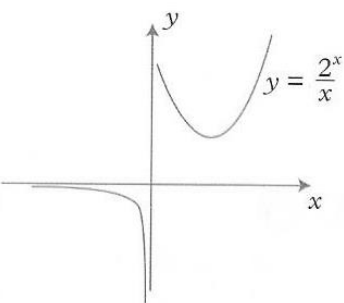


5 B is cheaper. Perhaps buy from A if quality is important.

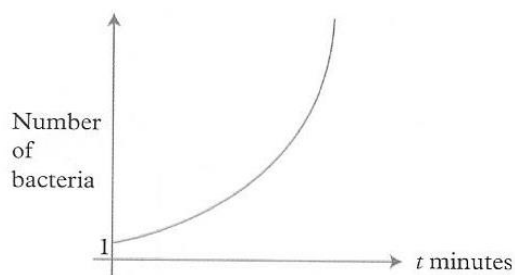
6



7



8 a



b 96 minutes

page 297 **Test yourself**

1 $p = \frac{1}{5}(6 - 3q)$ or $1\frac{1}{5} - \frac{3}{5}q$

2 $x = \frac{1}{8}(6y + 5)$ 3 $n > 2$

4 a $x \leq 3$ b $x > -2$ c $-1, 0, 1, 2, 3$

5 $x \leq 5, y \geq 0, y \leq x - 1$

6 **1.33**

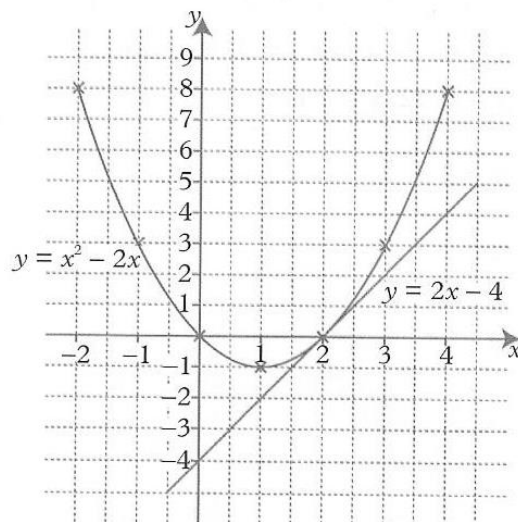
7 a $y = 18x^2$ b $y = 4\frac{1}{2}$

8 $\frac{2}{3}$

9 a

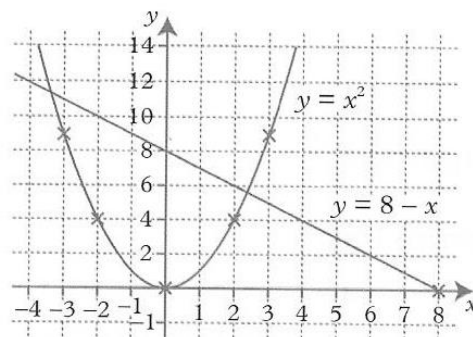
x	-2	-1	0	1	2	3	4
y	8	3	0	-1	0	3	8

b



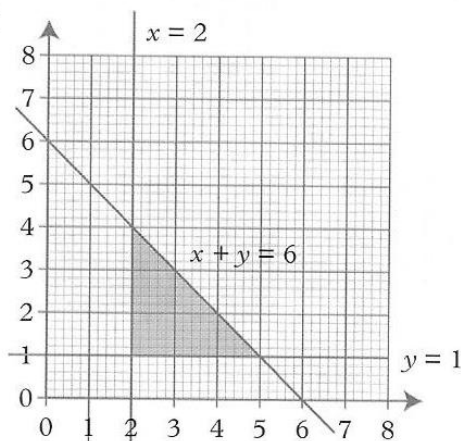
c $x = 3, x = -1$

10 a $(2.4, 5.6)$



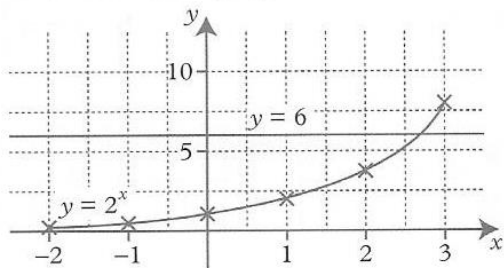
b No, no possible solutions of the equations.

11



12 a $x = -1, y = -16, x = 1, y = -8$

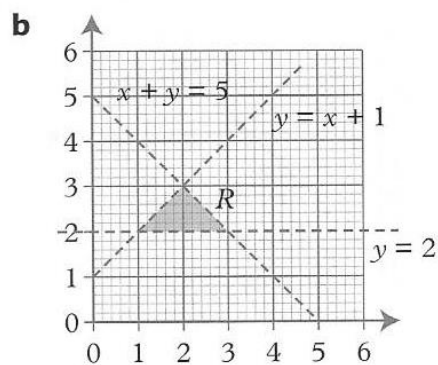
b Students' own graph



c $x = 0, y = 0$, or $x = 2, y = -16$

d $x = 2.52, y = -12.1$

13 a $x > 2$



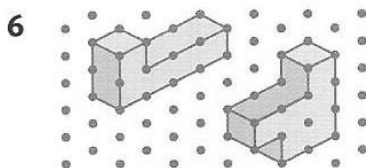
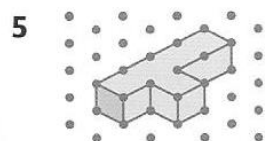
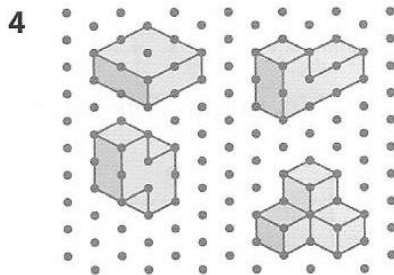
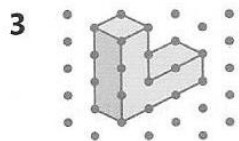
14 a i $y = \frac{36}{x}$

ii 72

b 6

6 Geometry 2

page 301 Exercise 1 1



7 Object B

plan view



view from
left



view from
right



Object C

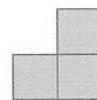
plan view



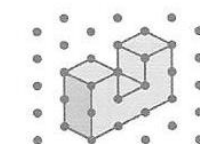
view from
left



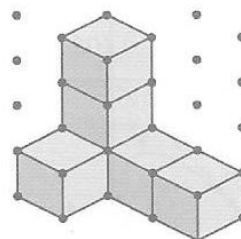
view from
right



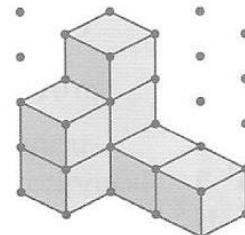
8 a



b



c

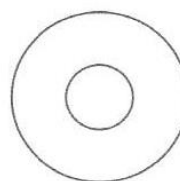


page 303 Exercise 2 1 2

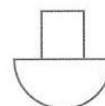
1 a AX BZ CY

b AZ BY CX

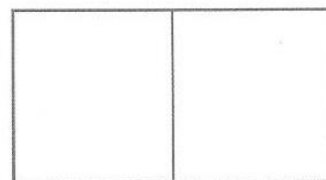
2 a i



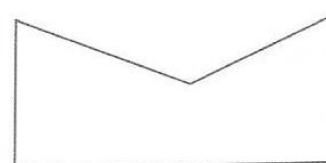
ii

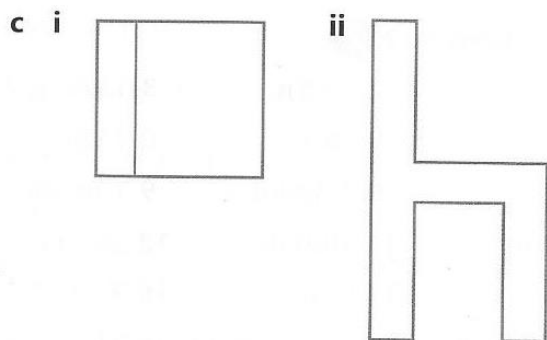


b i

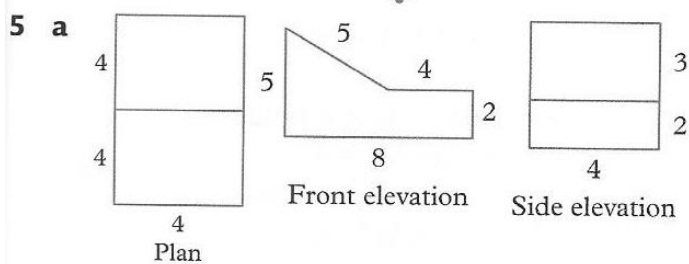
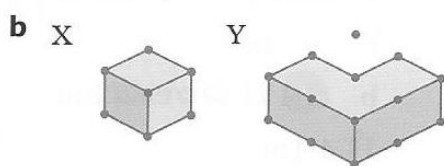
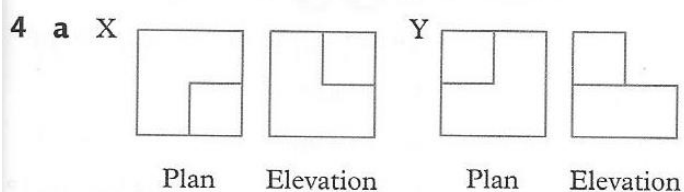


ii





3 W = cylinder, X = square-based pyramid, Y = cone, Z = sphere

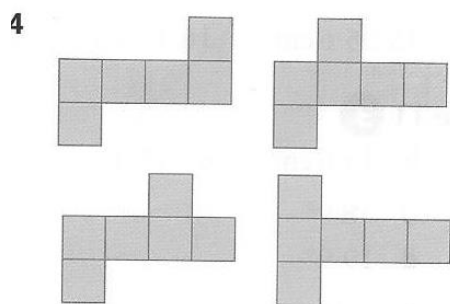
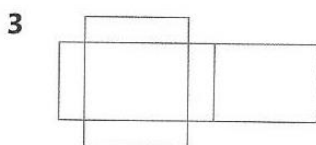
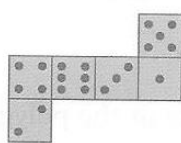


b 88 cm^3 , 140 cm^2

page 305 Exercise 3 1

1 a, b and d

2 For example:

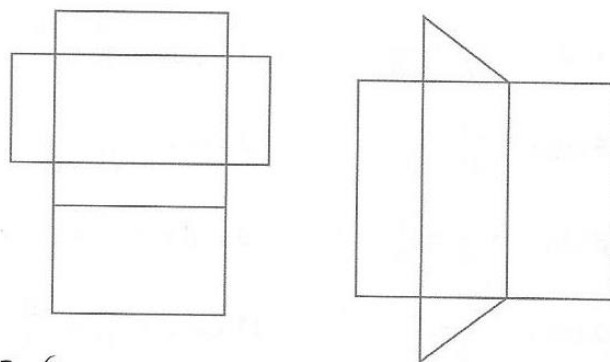


5 a Triangular prism, 6 vertices, 5 faces

b Square-based pyramid, 5 vertices, 5 faces

6 a For example:

b For example:



7 a 6

b 4

c $a = 10$, $b = 6$, $c = 10$, $d = 10$

d 64 cm^3

8 $a = 1.41$, $b = 1.41$, $c = 1.73$, $x = 1.41$, $y = 1.73$

page 307 Exercise 4 1

1 a 1 **b** 1

2 a 1 **b** 1

3 a 4 **b** 4

4 a 2 **b** 2

5 a 0 **b** 6

6 a 0 **b** 2

7 a 0 **b** 2

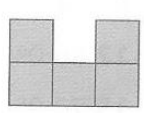
8 a 4 **b** 4

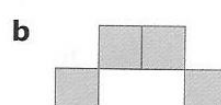
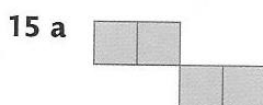
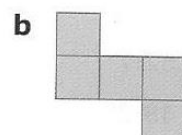
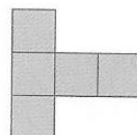
9 a 0 **b** 4

10 a 4 **b** 4

11 a 6 **b** 6

12 a ∞ **b** ∞

13 a 



page 308 **Exercise 5** 2

$$2 \sin x = \frac{O}{H} = \frac{5}{13}$$

$$3 \sin y = \frac{O}{H} = \frac{6}{10}$$

$$4 \sin z = \frac{O}{H} = \frac{7}{25}$$

$$5 \cos w = \frac{A}{H} = \frac{4}{5}$$

$$6 \cos x = \frac{A}{H} = \frac{12}{13}$$

$$7 \cos y = \frac{A}{H} = \frac{8}{10}$$

$$8 \tan w = \frac{O}{A} = \frac{3}{4}$$

$$9 \tan x = \frac{O}{A} = \frac{5}{12}$$

$$10 \tan y = \frac{O}{A} = \frac{6}{8}$$

$$11 \cos z = \frac{A}{H} = \frac{24}{25}$$

$$12 \tan z = \frac{O}{A} = \frac{7}{24}$$

page 309 **Exercise 6** 2

- | | | |
|------------|------------|------------|
| 1 3.01 cm | 2 5.35 cm | 3 3.13 cm |
| 4 7.00 cm | 5 73.1 cm | 6 15.4 cm |
| 7 5.31 cm | 8 7.99 cm | 9 11.6 cm |
| 10 11.4 cm | 11 961 cm | 12 19.7 cm |
| 13 46.0 cm | 14 34.9 cm | 15 9.39 cm |
| 16 8.23 cm | 17 35.6 cm | 18 80.2 cm |
| 19 4.86 cm | 20 6.98 cm | |

page 311 **Exercise 7** 2

- | | | |
|---------------------------------|---------------------------------|------------|
| 1 18.4 cm | 2 9.15 cm | 3 10.7 cm |
| 4 17.1 cm | 5 13.7 cm | 6 126 cm |
| 7 6.88 cm | 8 11.8 cm | 9 17.6 cm |
| 10 11.4 cm | 11 $x = 5.00$ cm, $y = 5.55$ cm | |
| 12 $x = 13.1$ cm, $y = 27.8$ cm | 13 4.26 cm | |
| 14 3.50 cm | 15 26.2 cm | 16 8.82 cm |

page 312 **Exercise 8** 2

- | | | |
|-----------------|-----------------|-----------------|
| 1 38.7° | 2 48.6° | 3 31.0° |
| 4 54.5° | 5 38.7° | 6 17.5° |
| 7 38.9° | 8 59.0° | 9 41.3° |
| 10 62.7° | 11 54.3° | 12 66.0° |
| 13 48.2° | 14 12.4° | 15 72.9° |
| 16 56.9° | 17 36.9° | 18 41.8° |
| 19 78.0° | 20 89.4° | |

page 314 **Exercise 9** 2

- | | | |
|----------------|-------------------------|-----------------|
| 1 68.0° | 2 3.65 m | 3 14 m |
| 4 20.6° | 5 56.7° | 6 15 m |
| 7 90 cm | 8 4.32 cm | 9 7.66 cm |
| 10 66 km | 11 189 km | 12 25.7 km |
| 13 180 km | 14 37 m | 15 36.4° |
| 16 10.3 cm | 17 72° , 8.23 cm | 18 71.1° |

page 317 **Exercise 10** 2 3

- | | | |
|---|-------------------------|-----------------------|
| 1 91.2° | 2 1.29 m to 2.11 m | 3 2.6 m |
| 4 a 26 km | b 23 km | |
| 5 a 89 km | b 179 km | |
| 6 a 484 km | b 858 km | c 985 km, 061° |
| 7 954 km, 133° | 8 76.5 m/s | |
| 9 a 11.1 m | b 11.1 s | c 222 m |
| 10 2.9 m | 11 4.4 m | |
| 12 a $\sin A = 0.8$, $\cos A = 0.6$,
$(\sin A)^2 + (\cos A)^2 = 1$
$\sin A = 0.385$, $\cos A = 0.923$,
$(\sin A)^2 + (\cos A)^2 = 1$
$\sin A = 0.447$, $\cos A = 0.894$,
$(\sin A)^2 + (\cos A)^2 = 1$ | | |
| b In each case $(\sin A)^2 + (\cos A)^2 = 1$. | | |
| c Yes | | |
| 13 a $\frac{360^\circ}{n}$ | b $\frac{180^\circ}{n}$ | |
| c $MB = \sin\left(\frac{180^\circ}{n}\right)$, $AB = 2 \sin\left(\frac{180^\circ}{n}\right)$ | | |
| d $2n \sin\left(\frac{180^\circ}{n}\right)$ | | |
| e 6.282, 6.283; perimeter $\approx 2\pi$ as the polygon is almost a circle. | | |

- | | | |
|-----------|------------|----------|
| 14 3.13 m | 15 25.6 cm | 16 27 cm |
|-----------|------------|----------|

page 321 **Exercise 11** 3

- | | | |
|-------------|----------------|----------------|
| 1 a 13 cm | b 13.6 cm | c 17.1° |
| 2 a 4 m | b 38.9° | |
| c 11.2 m | d 19.9° | |
| 3 a 8.49 cm | b 8.49 cm | |
| c 10.4 cm | d 35.3° | |

4 a 14.1 cm b 18.7 cm c 69.3°

5 a AC = 11.3 cm, AY = 12.4 cm b 23.8°

6 a ZX = 10 cm, KX = 9.4 cm

b 26.6° c 32.5°

7 a 4.47 cm b 7.48 cm c 15.5°

8 58.0° 9 a 57.5° b 61.0°

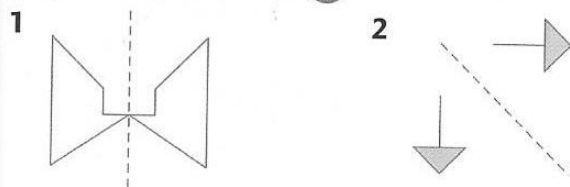
10 a $\frac{h}{\tan 25^\circ}$ b $\frac{h}{\tan 33^\circ}$ c 22.7 m

11 22.6 m 12 55 m

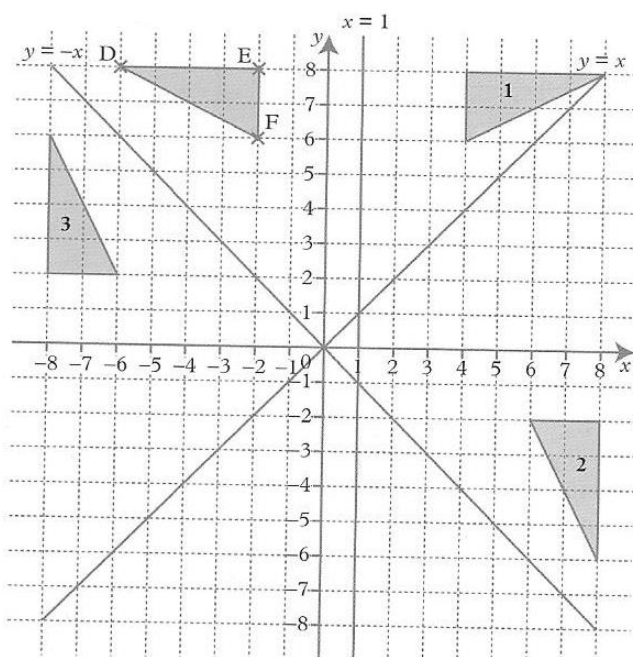
13 a $25\sqrt{\frac{3}{2}}$ b $3\sqrt{\frac{41}{2}}$

14 a 38.7° b 23.0°

page 324 **Exercise 12** 1

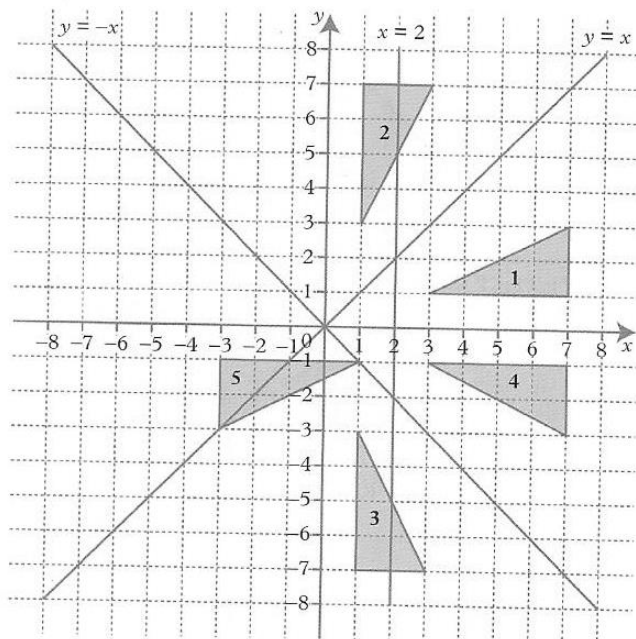


3 a-b



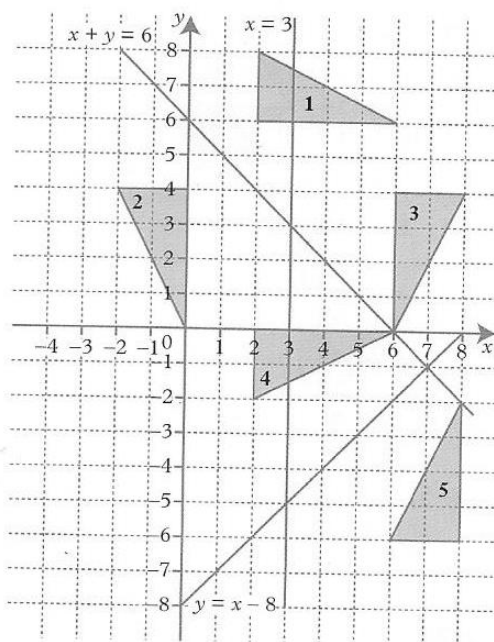
c i (8, 8) ii (8, -6) iii (-8, 6)

4 a-e



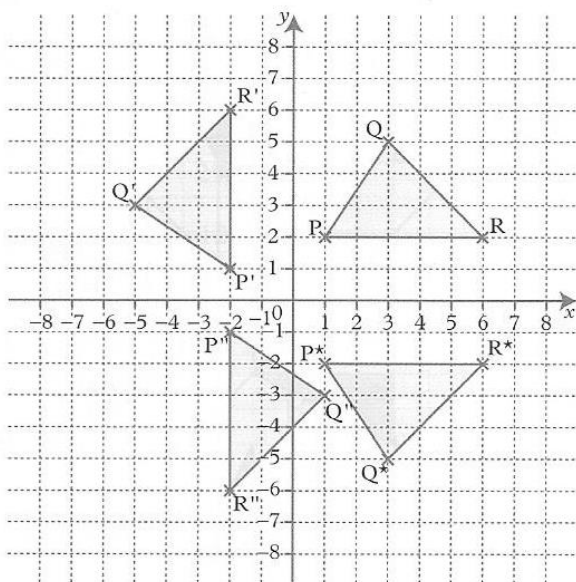
f (-3, -1), (-3, -3), (1, -1)

5 a-e



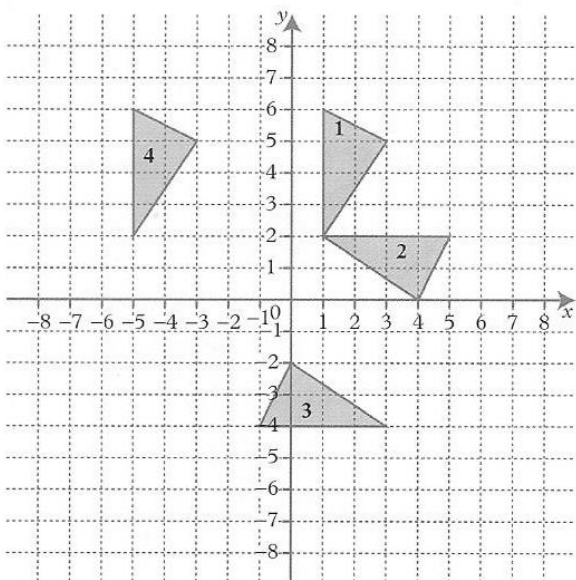
f (8, -2), (8, -6), (6, -6)

6 a-b



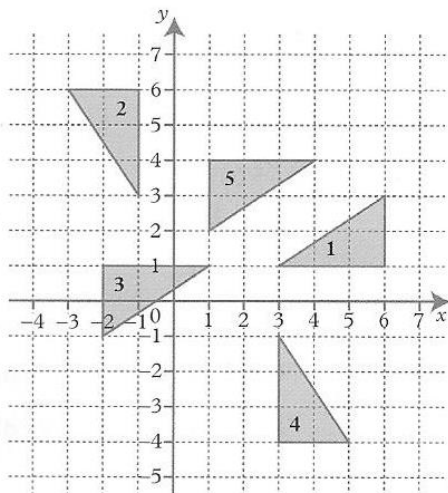
c $P'(-2, 1)$, $P''(-2, -1)$, $P^*(1, -2)$

7 a-d



e $(-5, 2)$, $(-5, 6)$, $(-3, 5)$

8 a

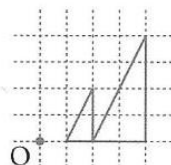


- b i Rotation 90° anticlockwise, centre $(0, 0)$
- ii Rotation 180° , centre $(2, 1)$
- iii Rotation 90° clockwise, centre $(2, 0)$
- iv Rotation 180° , centre $(3\frac{1}{2}, 2\frac{1}{2})$
- v Rotation 90° anticlockwise, centre $(6, 1)$
- vi Rotation 90° clockwise, centre $(1, 3)$

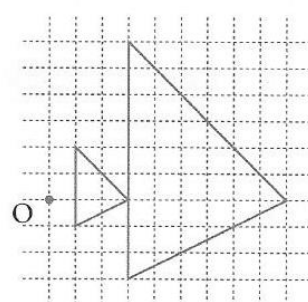
page 326 Exercise 13 3

- 1 a $\begin{pmatrix} 7 \\ 3 \end{pmatrix}$ b $\begin{pmatrix} 0 \\ -9 \end{pmatrix}$ c $\begin{pmatrix} 9 \\ 10 \end{pmatrix}$
- d $\begin{pmatrix} -10 \\ 3 \end{pmatrix}$ e $\begin{pmatrix} -1 \\ 13 \end{pmatrix}$ f $\begin{pmatrix} 10 \\ 0 \end{pmatrix}$
- g $\begin{pmatrix} -9 \\ -4 \end{pmatrix}$ h $\begin{pmatrix} -10 \\ 0 \end{pmatrix}$

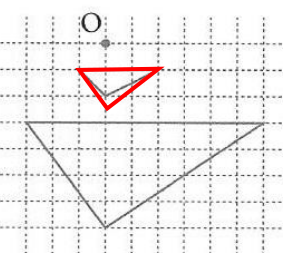
2



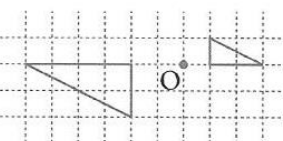
3



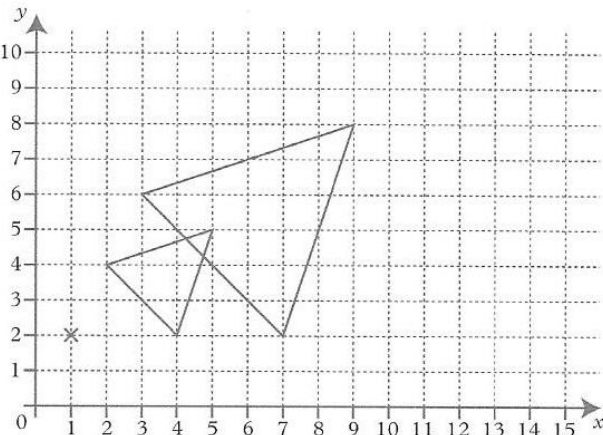
4

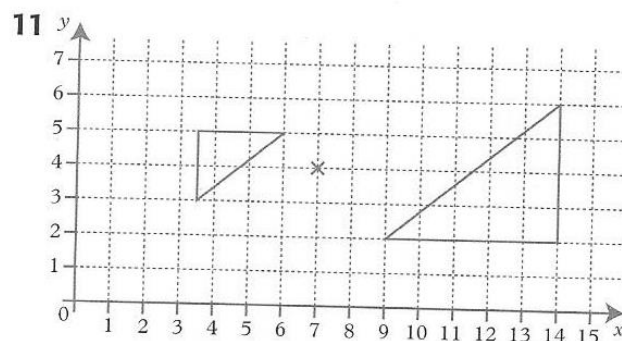
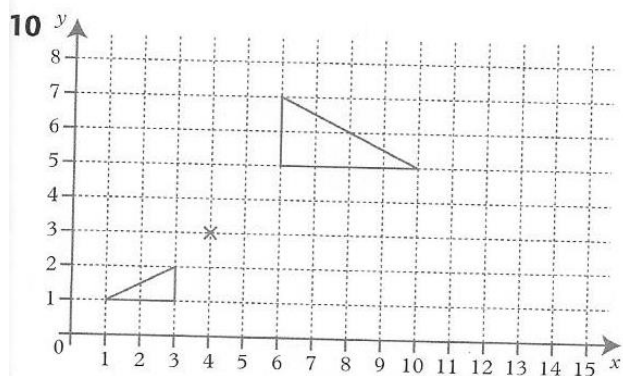
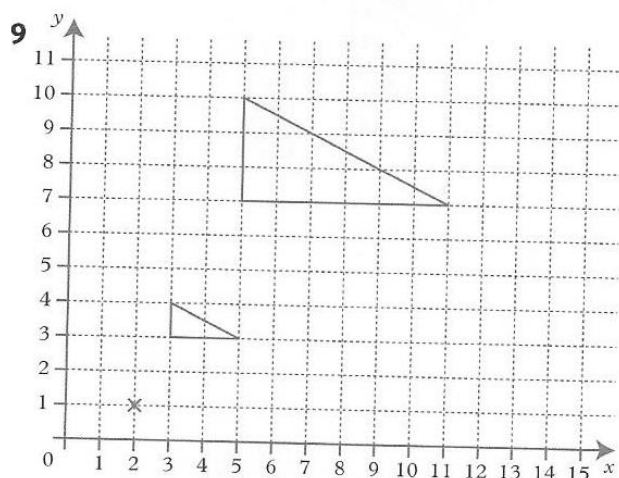
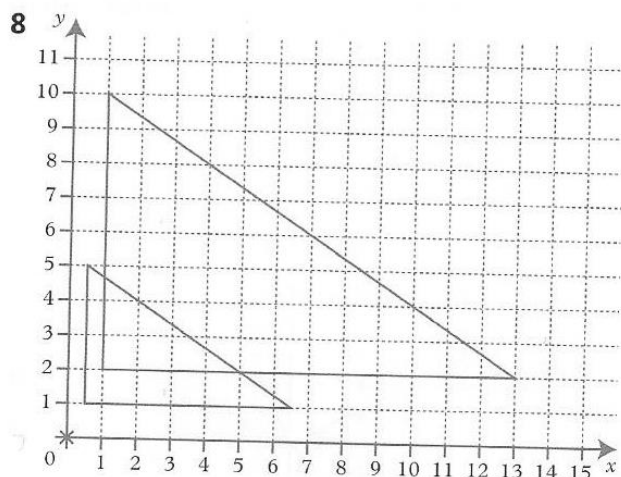
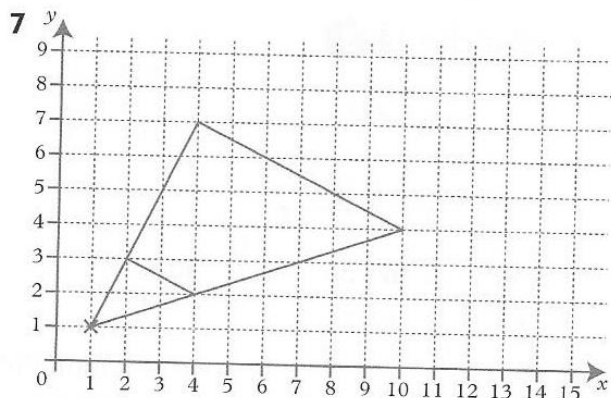


5

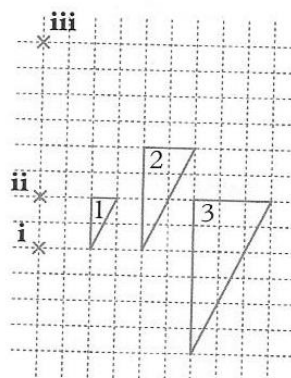


6



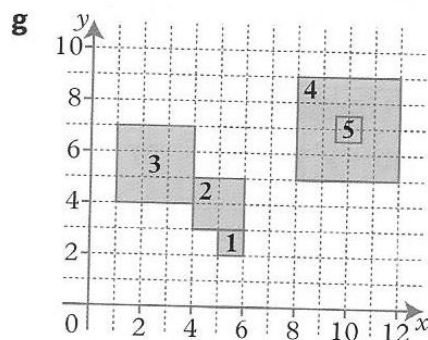


12 a



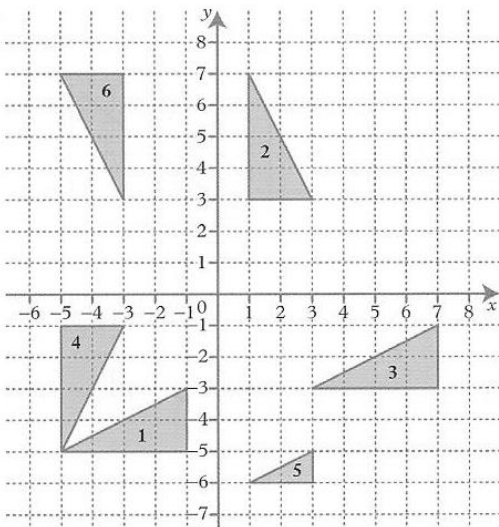
b $1\frac{1}{2}$

- 13 a** Enlargement scale factor 2, centre (6, 1)
b Enlargement scale factor 3, centre (7, 1)
c Enlargement scale factor 4, centre (4, 1)
d Enlargement scale factor 2, centre (0, 1)
e Enlargement scale factor $\frac{2}{3}$, centre (10, 1)
f Enlargement scale factor $\frac{1}{4}$, centre (4, 1)



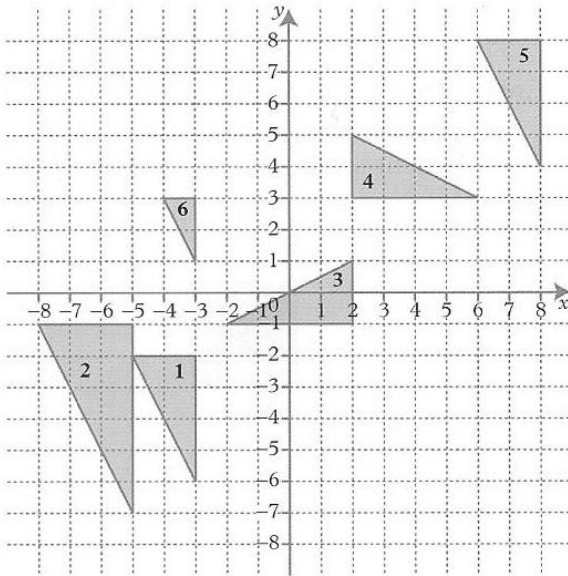
- 14 a** Rotation 90° clockwise, centre (0, -2)
b Reflection in $y = x$
c Translation $\begin{pmatrix} 3 \\ 7 \end{pmatrix}$
d Enlargement scale factor 2, centre (-5, 5)
e Translation $\begin{pmatrix} -7 \\ -3 \end{pmatrix}$
f Reflection in $y = x$

15



- a Rotation 90° clockwise, centre $(4, -2)$
 b Translation $\begin{pmatrix} 8 \\ 2 \end{pmatrix}$
 c Reflection in $y = x$
 d Enlargement scale factor $\frac{1}{2}$, centre $(7, -7)$
 e Rotation 90° anticlockwise, centre $(-8, 0)$
 f Enlargement scale factor 2, centre $(-1, -9)$
 g Rotation 90° anticlockwise, centre $(7, 3)$

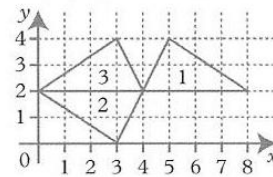
16



- a Enlargement scale factor $1\frac{1}{2}$, centre $(1, -4)$
 b Rotation 90° clockwise, centre $(0, -4)$
 c Reflection in $y = -x$
 d Translation $\begin{pmatrix} 11 \\ 10 \end{pmatrix}$
 e Enlargement scale factor $\frac{1}{2}$, centre $(-3, 8)$
 f Rotation 90° anticlockwise, centre $(\frac{1}{2}, 6\frac{1}{2})$
 g Enlargement scale factor 3, centre $(-2, 5)$

page 328 **Exercise 14** 3

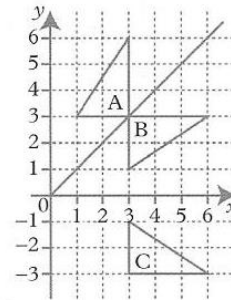
1 a-b

c Reflection
in $x = 4$

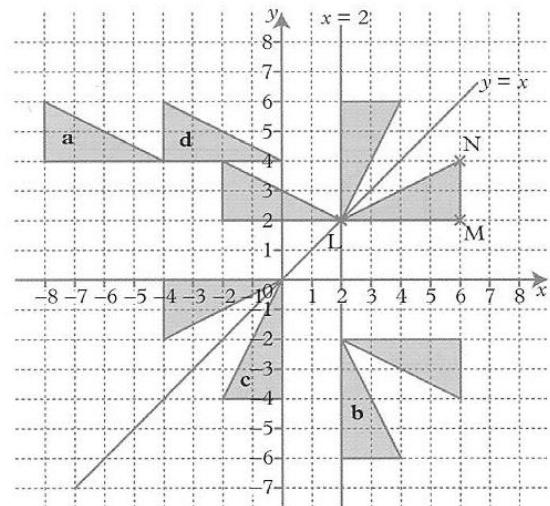
- d i no ii no
 iv no v no

iii yes

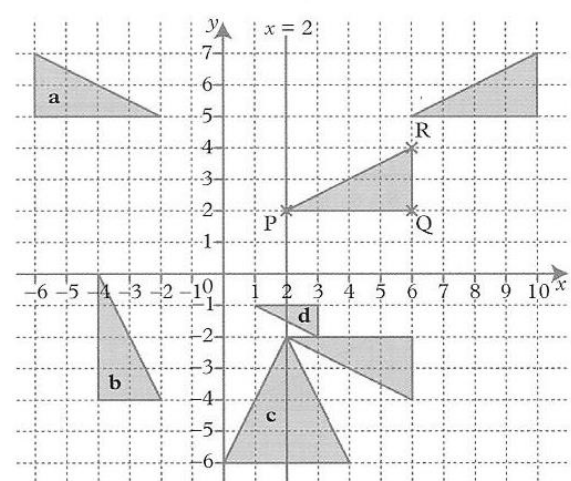
2 a-b

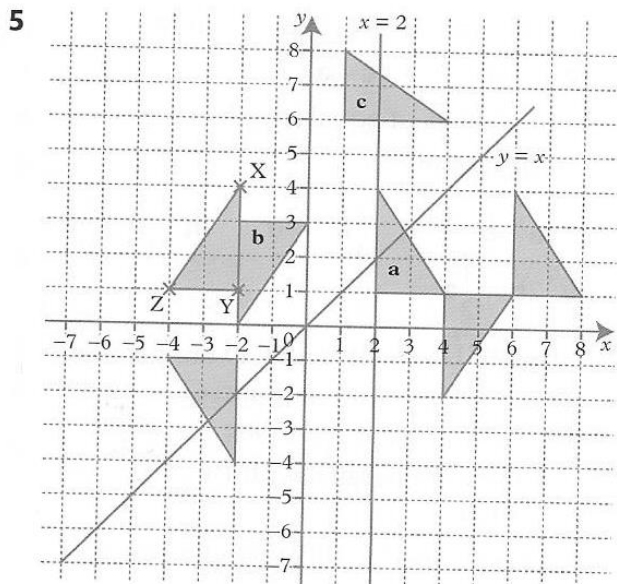
c Rotation 90°
clockwise,
centre $(0, 0)$

3

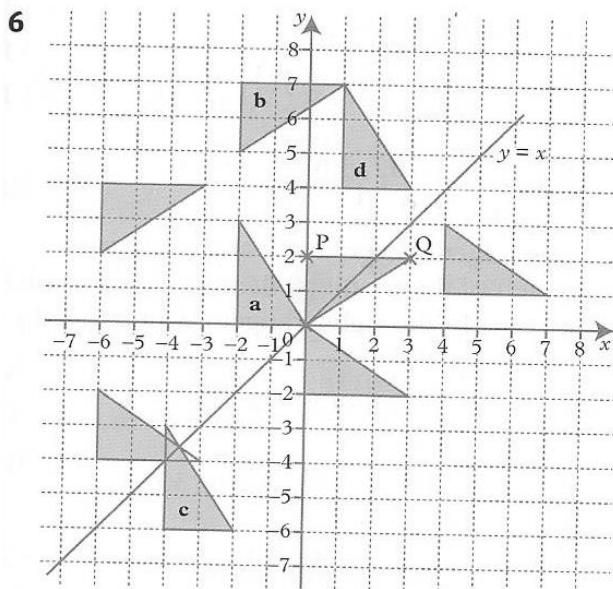
a $(-4, 4)$ b $(2, -2)$ c $(0, 0)$ d $(0, 4)$

4

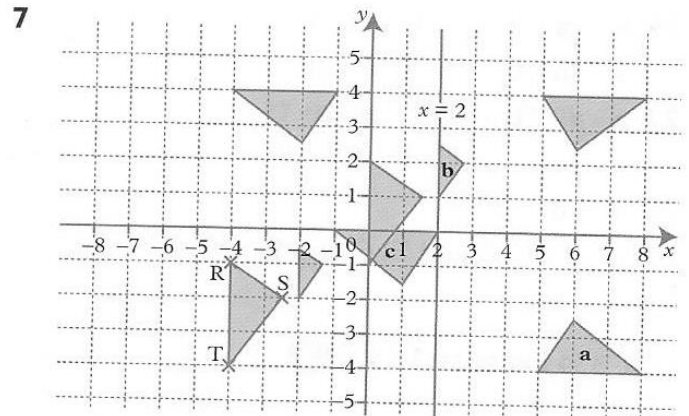
a $(-2, 5)$ b $(-4, 0)$ c $(2, -2)$ d $(1, -1)$ All transformations change position,
only H changes size, area and perimeter.



- a Reflection in $x = 0$
 b Rotation 180° , centre $(-2, 2)$
 c Rotation 90° clockwise, centre $(2, 2)$



- a Rotation 90° anticlockwise, centre $(0, 0)$
 b Translation $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$
 c Rotation 90° anticlockwise, centre $(2, -4)$
 d Rotation 90° anticlockwise, centre $\left(-\frac{1}{2}, 3\frac{1}{2}\right)$



- a Rotation 90° anticlockwise, centre $(2, 2)$
 b Enlargement scale factor $\frac{1}{2}$, centre $(8, 6)$
 c Rotation 90° clockwise, centre $\left(-\frac{1}{2}, -3\frac{1}{2}\right)$

- 8 A Reflection in $x = 2$
 B Rotation 180° , centre $(1, 1)$
 C Translation $\begin{pmatrix} 6 \\ -2 \end{pmatrix}$
 D Reflection in $y = x$
 E Reflection in $y = 0$
 F Translation $\begin{pmatrix} -4 \\ -3 \end{pmatrix}$
 G Rotation 90° anticlockwise, centre $(0, 0)$
 H Enlargement scale factor 2, centre $(0, 0)$

page 332 **Exercise 15** 2

- | | | | |
|-----------------|---------------|---------------|---------------|
| 1 d | 2 $2c$ | 3 $3c$ | 4 $3d$ |
| 5 $5d$ | 6 $3c$ | 7 $-2d$ | 8 $-2c$ |
| 9 $-3c$ | 10 $-c$ | 11 $c + d$ | 12 $c + 2d$ |
| 13 $2c + d$ | 14 $3c + d$ | 15 $2c + 2d$ | |
| 16 $\vec{QI}$ | 17 $\vec{QU}$ | 18 $\vec{QH}$ | 19 $\vec{QB}$ |
| 20 $\vec{QF}$ | 21 $\vec{QJ}$ | | |
| 22 a $2a + b$ | b $2a + 2b$ | c $-a - b$ | |
| d $4a + 2b$ | e $2a - 2b$ | f $2a + b$ | |
| 23 a $\vec{CO}$ | b $\vec{TN}$ | | |
| c $\vec{FT}$ | d $\vec{KC}$ | | |
| 24 a $-a$ | b $a + b$ | | |
| c $2a - b$ | d $b - a$ | | |
| 25 a $a + b$ | b $a - 2b$ | | |
| c $b - a$ | d $-a - b$ | | |

- 26 a $-a - b$ b $3a - b$
 c $2a - b$ d $b - 2a$
 27 a $a - 2b$ b $a - b$
 c $2a$ d $3b - 2a$
 28 a or d
 29 A and D, B and E, C and F

page 334 **Exercise 16** **2** **3**

- 1 a **a** b **$b - a$** c $2b$
 d $-2a$ e $2b - 2a$ f $b - a$
 g $a + b$ h b i $2a - b$
 j $a - 2b$
- 2 a **a** b **$b - a$** c $3b$
 d $-2a$ e $3b - 2a$ f $1\frac{1}{2}b - a$
 g $a + 1\frac{1}{2}b$ h **$1\frac{1}{2}b$** i **$2a - b$**
 j $a - 3b$
- 3 a **$2a$** b **$b - a$** c $2b$
 d $-3a$ e $2b - 3a$ f $b - 1\frac{1}{2}a$
 g $1\frac{1}{2}a + b$ h $\frac{1}{2}a + b$ i $3a - b$
 j $a - 2b$
- 4 a **$\frac{1}{2}a$** b **$b - a$** c $4b$
 d $-1\frac{1}{2}a$ e $4b - 1\frac{1}{2}a$ f $2\frac{2}{3}b - a$
 g $\frac{1}{2}a + 2\frac{2}{3}b$ h $2\frac{2}{3}b - \frac{1}{2}a$
 i $1\frac{1}{2}a - b$ j $a - 4b$
- 5 $\frac{1}{2}s - \frac{1}{2}t$ 6 $\frac{1}{3}a + \frac{2}{3}b$
- 7 $a - b + c$ 8 $2m + 2n$
- 9 a $b - a$ b $b - a$ c $2b - 2a$
 d $b - 2a$ e $b - 2a$ f $2b - 3a$
- 10 a $y - z$ b $\frac{1}{2}y - \frac{1}{2}z$ c $\frac{1}{2}y + \frac{1}{2}z$
 d $-x + \frac{1}{2}y + \frac{1}{2}z$ e $-\frac{2}{3}x + \frac{1}{3}y + \frac{1}{3}z$
 f $\frac{1}{3}x + \frac{1}{3}y + \frac{1}{3}z$

- 11 a i $2b - 2a$ ii $2c - 2b$ iii **b**
 iv **$c - a$** v **$c - a$**
 b Parallel lines of equal length
 c Parallelogram

- 12 a i **$a - b$** ii $\frac{1}{3}a - \frac{1}{3}b$ iii $\frac{2}{3}b - \frac{1}{6}a$
 iv $2b - \frac{1}{2}a$
 b $\vec{CE} = 3\vec{CD}$, so CE and CD are parallel.
 They have a common point, C, so C, D, E
 lie on the same straight line.
 14 $k = 2$ They are parallel with BC, twice the
 length of EF
 15 $r + s$ s equal and parallel parallelogram

page 338 **Exercise 17** **2**

- 1 a 1, 0.866, 0.5, 0, -0.5, -0.866, -1, -0.866,
 -0.5, 0, 0.5, 0.866, 1
 b Accurate graph of $y = \cos x$
- 2 Accurate graph of $y = \sin x$
- 3 0, 0.364, 0.839, 1.732, 5.671, -5.671, -1.732,
 -0.839, -0.364, 0,
 0.364, 0.839, 1.732, 5.671, -5.671, -1.732,
 -0.839, -0.364, 0
 a The tangent is very large and positive to
 the left of these points, then very large and
 negative to the right. Tangent is undefined
 at 90° and 270° .
 b-c Accurate graph of $y = \tan x$ with
 asymptotes.
- 4 $\cos 60^\circ = \cos 300^\circ$, $\sin 50^\circ = \sin 130^\circ$,
 $\sin 70^\circ = \sin 110^\circ$
- 5 $\tan 45^\circ = \tan 225^\circ$, $\sin 180^\circ = \cos 270^\circ$,
 $\cos 30^\circ = \cos 330^\circ$, $\tan 60^\circ = \tan 240^\circ$
- 6 162° 7 153°
- 8 a 140° b 110° c 50°
- 9 290° 10 315°
- 11 a 350° b 304° c 60°
- 12 220° 13 160° 14 82°
- 15 315° 16 240° 17 250°
- 18 $\sin 270^\circ = \cos 180^\circ$, $\sin 90^\circ = \cos 360^\circ$,
 $\tan 20^\circ = \tan 200^\circ$, $\tan 150^\circ = \tan 330^\circ$

page 340 **Exercise 18** 3

- 1 $58.0^\circ, 122.0^\circ$ 2 $20.5^\circ, 159.5^\circ$
 3 $53.1^\circ, 306.9^\circ$ 4 $45^\circ, 225^\circ$
 5 a $19.8^\circ, 160.2^\circ$ b $72.0^\circ, 108.0^\circ$
 c $30^\circ, 150^\circ$ d $60^\circ, 120^\circ$
 6 a $46.1^\circ, 133.9^\circ$ b $72.5^\circ, 287.5^\circ$
 c $78.7^\circ, 258.7^\circ$ d $220.5^\circ, 319.5^\circ$
 7 $30^\circ, 150^\circ, 210^\circ, 330^\circ$
 8 $45^\circ, 135^\circ, 225^\circ, 315^\circ$

	30°	45°	60°	120°	135°	150°
sin	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$
cos	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	$\frac{1}{2}$	$-\frac{1}{\sqrt{2}}$	$-\frac{\sqrt{3}}{2}$
tan	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	$\sqrt{3}$	-1	$-\frac{1}{\sqrt{3}}$

- 10 a $0^\circ < x < 180^\circ$ b $90^\circ < x < 270^\circ$
 11 Accurate graphs of $\sin \theta$, $\cos \theta$ and $\tan \theta$.
 12 a For example, $-270^\circ, 90^\circ, 450^\circ$
 b For example, $-270^\circ, -90^\circ, 90^\circ, 270^\circ$
 13 a 0 b 1

page 342 **Exercise 19** 3

- 1 6.38 m 2 12.5 m 3 5.17 cm
 4 40.4 cm 5 7.81 m 6 6.68 m
 7 8.61 cm 8 9.97 cm 9 8.52 cm
 10 15.2 cm

page 343 **Exercise 20** 3

- 1 35.8° 2 42.9° 3 32.3°
 4 37.8° 5 $\angle R = 35.5^\circ, \angle T = 48.5^\circ$
 6 68.8° 7 64.6° 8 34.2°
 9 50.6° 10 39.1° 11 39.5°
 12 21.6° 13 $72.5^\circ, 107.5^\circ$

page 345 **Exercise 21** 3

- 1 6.24 cm 2 6.05 cm 3 5.47 cm
 4 9.27 cm 5 10.1 cm 6 8.99 cm
 7 5.87 cm 8 4.24 cm 9 11.9 cm

- 10 154 cm 11 25.2° 12 71.4°
 13 115.0° 14 111.1° 15 24.0°
 16 92.5° 17 99.9° 18 38.2°
 19 137.8° 20 34.0°

page 347 **Exercise 22** 3

- 1 a 50.2 km b 055°
 2 35.6 km 3 25.2 km
 4 a = 10.3 cm, b = 11.6 cm, c = 4.86 cm,
 d = 37.2°, e = 94.1° , f = 42.6°
 5 92.9° 6 40.4 m
 7 54.7 m 8 14.5 cm
 9 a 9.85 km b 086°
 10 a 29.6 km b 050°
 11 141 km
 12 a 10.8 m b 72.6° c 32.6°
 13 $048^\circ, 378$ km
 14 a 62.2° b 2.33 km
 15 101° 16 8.85 m
 17 a $c^2 + 36 - 6c = 28$ b $c = 2$ or 4
 c The sine rule gives the same answers.
 18 a $\cos C = \frac{x}{b} \Rightarrow x = b \cos C$
 b $h^2 = b^2 - x^2$
 c $c^2 = h^2 + (a - x)^2$
 d $h^2 = c^2 - (a - x)^2$ (part c)
 = $c^2 - a^2 - x^2 + 2ax$
 and $h^2 = b^2 - x^2$ (part b)
 So $c^2 - a^2 - x^2 + 2ax = b^2 - x^2$
 $c^2 = a^2 + b^2 - 2ax$
 $c^2 = a^2 + b^2 - 2ab \cos C$
 (using $x = b \cos C$ from part a)

- 19 9.64 m 20 48.2°
 21 a 5.66 cm b 4.47 cm c 3.74 cm
 22 70.2°
 23 41.9°

page 352 **Exercise 23** 3

- 1 a = 27° , b = 30° 2 c = 20° , d = 45°
 3 c = 58° , d = 41° , e = 30°
 4 f = 40° , g = h = 55°
 5 a = 32° , b = 80° , c = 43°

- 6** $y = 34^\circ$ **7** $t = 43^\circ$ **8** $a = 92^\circ$
9 $b = 42^\circ$ **10** $c = 46^\circ, d = 44^\circ$
11 $e = 49^\circ, f = 41^\circ$ **12** $g = 76^\circ, h = 52^\circ$
13 $x = 48^\circ$ **14** $y = 32^\circ$ **15** $x = 22^\circ$
16 $a = 36^\circ, x = 36^\circ$

page 354 **Exercise 24** **3**

- 1** $a = 94^\circ, b = 75^\circ$ **2** $c = 101^\circ, d = 84^\circ$
3 $x = 92^\circ, y = 116^\circ$ **4** $c = 60^\circ, d = 45^\circ$
5 $h = 37^\circ$ **6** $m = 118^\circ$
7 $e = 36^\circ, f = 72^\circ$ **8** $y = 35^\circ$
9 $x = 18^\circ$ **10** $m = 90^\circ$
11 $a = 30^\circ$ **12** $x = 22.5^\circ$
13 $n = 58^\circ, t = 64^\circ, w = 45^\circ$
14 $a = 32^\circ, b = 40^\circ, c = 40^\circ$
15 $a = 18^\circ, c = 72^\circ$ **16** $x = 55^\circ$
17 $e = f = g = 41^\circ$ **18** $z = 8^\circ$
19 $x = 30^\circ, y = 115^\circ$ **20** $x = 80^\circ, z = 10^\circ$

page 356 **Exercise 25** **3**

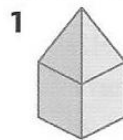
- 1** $a = 18^\circ$ **2** $b = 53^\circ$ **3** $c = 77^\circ$
4 $x = 40^\circ, y = 65^\circ, z = 25^\circ$
5 $c = 30^\circ, e = 15^\circ$ **6** $f = 50^\circ, g = 40^\circ$
7 $h = 70^\circ, i = 40^\circ, k = 40^\circ$
8 $m = 108^\circ, n = 36^\circ$ **9** $x = 50^\circ, y = 68^\circ$
10 $a = 74^\circ, b = 32^\circ$ **11** $e = 36^\circ$
12 $k = 63^\circ, m = 54^\circ$
13 $k = 50^\circ, m = 50^\circ, n = 80^\circ, p = 80^\circ$
14 **a** p **b** $2p$ **c** $90 - 2p$
15 $x = 70^\circ, y = 20^\circ, z = 55^\circ$
16 $\angle RQP = 90^\circ$ $\angle PRQ = a$

page 358 **Exercise 26** **3**

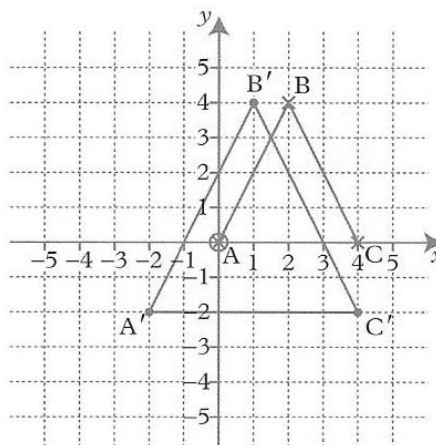
- 1** $a = 137^\circ$ **2** $b = 120^\circ$
3 $c = d = 30^\circ, e = 27^\circ$ **4** $f = 49^\circ$
5 $g = 18^\circ$ **6** $h = 110^\circ$
7 $i = 52^\circ, j = 128^\circ$ **8** $k = 45^\circ, l = 135^\circ$
9 $m = 35^\circ, n = 50^\circ$ **10** $p = 69^\circ$
11 $q = 78^\circ$ **12** $r = 200^\circ, s = 100^\circ$

- 13** $a = 45^\circ$ **14** $b = 30^\circ, c = 60^\circ$
15 $d = 72^\circ$ **16** $e = 19^\circ$
17 $f = 50^\circ$ **18** $g = 58^\circ, h = 90^\circ$
19 $i = 45^\circ$ **20** $j = 96^\circ, k = 68^\circ$
21 $m = 28^\circ$

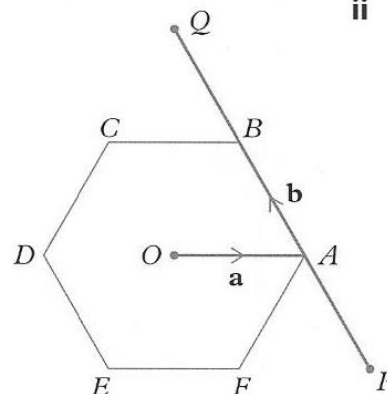
page 360 **Test yourself**



- 2** **a** 24.1 cm (l.d.p.) **b** 14.7 cm (l.d.p.)
3 3.21 m
4 Yes, as the bearing of 037 degrees takes the ship within the locus of a radius of a circle 2.5 cm from point C.
5 Rotation 180° about (1, 0)
6 **a** 12.9 m (l.d.p.) **b** 21.0° (l.d.p.)
7 **a** $\frac{5}{2}$ **b** 60 degrees **c** 8 cm
8 Rotation 90° clockwise about point (2, 1)
9 **a, b, c**



- 10** **a** $a - b$ **b** $\frac{(2a+3b)}{5}$
11 **a** **i** $a + b$ **ii** $b - a$ **iii** $a + 2b$
b **i** **ii** $3b$



12 a $a + 1\frac{1}{2}b$ b $a - 1\frac{1}{2}b$

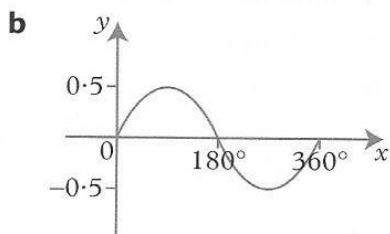
c $\frac{1}{2}a - \frac{1}{4}b$ d $\frac{1}{2}a + \frac{3}{4}b$

13 a $BD = 8 \sin 54^\circ = 6.47 \text{ cm}^2$ (2 dp)

b 20.9 cm^2

c 6.71 cm

14 a i $114^\circ, 246^\circ$ ii $41^\circ, 319^\circ$



15 a 72 cm

b 129.8 cm

16 114.8° (l.d.p)

17 a $\angle ABC = \frac{1}{2}$ angle at centre $= 54^\circ$

$\angle ADC = 180^\circ - \angle ABC$ (opposite angles of a cyclic quadrilateral)

$\therefore \angle ADC = 180^\circ - 54^\circ = 126^\circ$ as required

b $\angle CAO = \frac{1}{2} (180^\circ - 108^\circ)$ as $\triangle OAC$ is isosceles

$= 36^\circ$

$\angle OAE = 90^\circ$ (Tangent and radius)

$\therefore \angle CAE = 90^\circ - 36^\circ = 54^\circ$

18 a 47°

b 43°

19 a 34° b 34° c 17° d 73° e 56°

25 False

28 True

31 True

34 6^5

37 6^5

40 2^5

43 5^{-5}

46 2^7

26 True

29 True

32 False

35 2^{13}

38 8

41 2^{19}

44 3^{-10}

47 7^2

27 True

30 True

33 5^6

36 3^4

39 6^4

42 10^{100}

45 3^7

48 5^{-1}

page 369 Exercise 2 3

1 27

2 1

3 $\frac{1}{9}$

4 25

5 2

6 4

7 9

8 2

9 27

10 3

11 $\frac{1}{3}$

12 $\frac{1}{2}$

13 1

14 $\frac{1}{5}$

15 10

16 8

17 32

18 4

19

¹ 1	6		² 1	³ 3
0		⁴ 9		2
	⁵ 4	9		
⁶ 8	0		⁷ 9	⁸ 6
⁹ 1	2	5		4

20 a $\frac{1}{2}$

b $-\frac{1}{2}$

c $\frac{3}{2}$

21 a $\frac{1}{9}$

b $\frac{1}{8}$

c $100^6 = 1 \times 10^{12}$

22 10

23 1000

24 $\frac{1}{1000}$

25 $\frac{1}{9}$

26 1

27 $1\frac{1}{2}$

28 $\frac{1}{25}$

29 $\frac{1}{10}$

30 $\frac{1}{4}$

31 $\frac{1}{4}$

32 100 000

33 1

34 $\frac{1}{32}$

35 $\frac{1}{10}$

36 $\frac{1}{5}$

37 $1\frac{1}{2}$

38 1

39 9

40 $1\frac{1}{2}$

41 $\frac{3}{10}$

42 64

43 $\frac{1}{100}$

44 $1\frac{2}{3}$

45 $\frac{1}{100}$

46 a $\frac{1}{n}$

47 a 0 b -1

c -3

48 -3

49 38

page 371 Exercise 3 3

1 A = F; B = D; C = H; E = G

2 a True

b True

c False

d True

e False

f True

7 Algebra 3

page 368 Exercise 1 2

1 3^4

2 $4^2 \times 5^3$

3 3×7^3

4 $2^3 \times 7$

5 10^{-3}

6 5^{-4}

7 $15^{\frac{1}{2}}$

8 $1000^{\frac{1}{2}}$

9 a^8

10 $17^{\frac{1}{3}}$

11 11^{-1}

12 $5^{\frac{3}{2}}$

13 True

14 False

15 True

16 True

17 False

18 False

19 False

20 True

21 True

22 True

23 False

24 True

- 3 a $3 + 2\sqrt{2}$ b $7 - 4\sqrt{3}$ c 18
d $14 - 6\sqrt{5}$ e $6 + 4\sqrt{2}$ f 8
- 4 a True b True c False
d True e False f True
- 5 a 4 b $4\sqrt{2}$ c $10\sqrt{3}$ d $9\sqrt{2}$
e $5\sqrt{5}$ f $5\sqrt{3}$ g $5\sqrt{5}$ h $\sqrt{3}$
i 2 j $\frac{3}{2}$ k $\frac{5}{2}$ l $\frac{4}{3}$
- 6 a $2\sqrt{3}$
b i $4\sqrt{2}$ ii $4\sqrt{3}$
iii $3\sqrt{2}$ iv $\frac{2\sqrt{3}}{3}$
- 7 a $4(\sqrt{2} - 1)$
b i $2(\sqrt{3} - 1)$ ii $\sqrt{5} - 2$ iii $\frac{10(\sqrt{7} + 2)}{3}$
- 8 $28\sqrt{3}$ metres 9 a $4\sqrt{2}$ b $6\sqrt{2}$

page 372 Exercise 4 3

- | | | | |
|--------------|---------------------|-------------|---------------|
| 1 3^6 | 2 5^{12} | 3 7^{10} | 4 x^6 |
| 5 2^{-2} | 6 1 | 7 7^2 | 8 y^2 |
| 9 2^{21} | 10 10^{99} | 11 x^7 | 12 y^{13} |
| 13 z^4 | 14 z^{100} | 15 m | 16 e^{-5} |
| 17 y^2 | 18 w^6 | 19 y | 20 x^{10} |
| 21 1 | 22 w^{-5} | 23 w^{-5} | 24 x^7 |
| 25 a^8 | 26 k^3 | 27 1 | 28 x^{29} |
| 29 y^2 | 30 x^6 | 31 z^4 | 32 t^{-4} |
| 33 $4x^6$ | 34 $16y^{10}$ | 35 $6x^4$ | 36 $10y^5$ |
| 37 $15a^4$ | 38 $8a^3$ | 39 3 | 40 $4y^2$ |
| 41 $2.5y$ | 42 $32a^4$ | 43 $108x^5$ | 44 $4z^{-3}$ |
| 45 $2x^{-4}$ | 46 $\frac{5}{2}y^5$ | 47 1 | 48 $21w^{-3}$ |
| 49 $2n^4$ | 50 $2x$ | | |

page 373 Exercise 5 3

- | | | | |
|-------------------------|-----------------------|----------------------|---------------------|
| 1 $x = 3$ | 2 $x = 4$ | 3 $x = -1$ | 4 $x = -2$ |
| 5 $x = 3$ | 6 $x = 3$ | 7 $x = 1$ | 8 $x = \frac{1}{5}$ |
| 9 $x = 0$ | 10 $x = -4$ | 11 $x = 2$ | 12 $x = -5$ |
| 13 $x = 1$ | 14 $x = \frac{1}{18}$ | | |
| 15 a (0, 1) | b $x = 0$ | | |
| 16 a $a = -3$ | b $b = 1$ | c $c = 5$ | |
| 17 a $p = 2\frac{1}{2}$ | b $q = 1000$ | c $r = 1\frac{3}{4}$ | |
| 18 a $n = 4$ | b $n = -1$ | c $n = 0$ | |

19 $x = 2$ or -4

20 a $x = 3.60$ b $x = 5.44$

21 a

n	1	2	3	4	5	6	7	8	9	10
Last digit of 7^n	7	9	3	1	7	9	3	1	7	9

b i 1 ii 7 iii 3

22 21

23 a 512 b 6 hours c 2^{21}

24 a 976 b 20 hours

25 a 2519.42 b 9 years

26 $x^6 = (x^3)^2 = (-1)^2 = 1$; $x^7 = xx^6 = x$;
 $x^{60} = (x^6)^{10} = 1$; $x^{61} = xx^{60} = x$

page 376 Exercise 6 2

- | | |
|------------------------|-----------------------|
| 1 $(x + 2)(x + 5)$ | 2 $(x + 3)(x + 4)$ |
| 3 $(x + 3)(x + 5)$ | 4 $(x + 3)(x + 7)$ |
| 5 $(x + 2)(x + 6)$ | 6 $(y + 5)(y + 7)$ |
| 7 $(y + 3)(y + 8)$ | 8 $(y + 5)^2$ |
| 9 $(y + 3)(y + 12)$ | 10 $(a - 5)(a + 2)$ |
| 11 $(a - 4)(a + 3)$ | 12 $(z + 3)(z - 2)$ |
| 13 $(x - 7)(x + 5)$ | 14 $(x - 8)(x + 3)$ |
| 15 $(x - 4)(x - 2)$ | 16 $(y - 3)(y - 2)$ |
| 17 $(x - 3)(x - 5)$ | 18 $(a - 3)(a + 2)$ |
| 19 $(a + 9)(a + 5)$ | 20 $(b - 7)(b + 3)$ |
| 21 $(x - 4)^2$ | 22 $(y + 1)^2$ |
| 23 $(y - 7)(y + 4)$ | 24 $(x - 5)(x + 4)$ |
| 25 $(x - 20)(x + 12)$ | 26 $(x - 11)(x - 15)$ |
| 27 $(y - 9)(y + 12)$ | 28 $(x + 7)(x - 7)$ |
| 29 $(x + 3)(x - 3)$ | 30 $(x + 4)(x - 4)$ |
| 31 $2(x + 2)(x + 4)$ | |
| 32 a $2(x + 5)(x - 3)$ | b $3(x + 2)(x + 5)$ |
| c $3(x + 3)(x + 5)$ | d $2(n + 2)(n - 5)$ |
| e $5(a - 2)(a + 3)$ | f $4(x + 4)(x - 4)$ |

page 377 Exercise 7 3

- | | |
|-----------------------|----------------------|
| 1 $(2x + 3)(x + 1)$ | 2 $(2x + 1)(x + 3)$ |
| 3 $(3x + 1)(x + 2)$ | 4 $(2x + 3)(x + 4)$ |
| 5 $(3x + 2)(x + 2)$ | 6 $(2x + 5)(x + 1)$ |
| 7 $(3x + 1)(x - 2)$ | 8 $(2x + 5)(x - 3)$ |
| 9 $(2x + 7)(x - 3)$ | 10 $(3x + 4)(x - 7)$ |
| 11 $(3x + 2)(2x + 1)$ | 12 $(x - 3)(3x - 2)$ |

13 $(3y - 5)(y - 2)$

15 $(2x + 1)(5x + 2)$

17 $(4x + 1)(2x - 3)$

19 $(4y - 3)(y - 5)$

14 $(3y - 1)(2y + 3)$

16 $(6x - 1)(x - 3)$

18 $(3x + 2)(4x + 5)$

20 $(6x - 15)(x - 2)$

31 $x = 2, x = -2, x = 1$ or $x = -1$

32 $x = 2, x = -2, x = 3$ or $x = -3$

33 $x = 2, x = -2, x = \frac{1}{2}$ or $x = -\frac{1}{2}$

34 $x = 2$ or $x = 1$

page 377 **Exercise 8** 2 3

1 $(y + a)(y - a)$

3 $(x + t)(x - t)$

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

7 $\left(x + \frac{1}{2}\right)\left(x - \frac{1}{2}\right)$

9 $(2x - y)(2x + y)$

11 $(5x - 2y)(5x + 2y)$

13 $\left(2x - \frac{z}{10}\right)\left(2x + \frac{z}{10}\right)$

15 $a(a - b)(a + b)$

17 $2x(2x + y)(2x - y)$

19 1 200 000

21 $10\,000 - 9 = (100 + 3)(100 - 3) = 103 \times 97$

2 $(m + n)(m - n)$

4 $(y - 1)(y + 1)$

6 $(a - 5)(a + 5)$

8 $\left(x + \frac{1}{3}\right)\left(x - \frac{1}{3}\right)$

10 $(a - 2b)(a + 2b)$

12 $(3x - 4y)(3x + 4y)$

14 $x(x + 1)(x - 1)$

16 $x(2x + 1)(2x - 1)$

18 $y(y + 3)(y - 3)$

20 12 000 000

page 379 **Exercise 10** 2

1 $x = 0$ or $x = 3$

3 $x = 0$ or $x = 1$

5 $x = 4$ or $x = -4$

7 $x = \frac{1}{2}$ or $x = -\frac{1}{2}$

9 $y = 0$ or $y = -1\frac{1}{2}$

11 $x = 0$ or $x = 5\frac{1}{2}$

13 $x = \frac{1}{2}$ or $x = -\frac{1}{2}$

15 $x = 0$ or $x = \frac{1}{12}$

17 $x = 11$ or $x = 0$

19 $x = 0$ or $x = 1$

2 $x = 0$ or $x = -7$

4 $x = \frac{1}{3}$ or $x = 0$

6 $x = 7$ or $x = -7$

8 $x = \frac{2}{3}$ or $x = -\frac{2}{3}$

10 $a = 0$ or $a = 1\frac{1}{2}$

12 $x = \frac{1}{4}$ or $x = -\frac{1}{4}$

14 $x = 0$ or $x = \frac{5}{8}$

16 $x = 6$ or $x = 0$

18 $x = 0$ or $x = 1\frac{1}{2}$

20 $x = 0$ or $x = 4$

page 378 **Exercise 9** 2 3

1 $x = -3$ or $x = -4$

3 $x = 3$ or $x = -5$

5 $x = 2$ or $x = 6$

7 $x = 2$ or $x = 3$

9 $x = 2$ or $x = -7$

11 $x = -4$ or $x = \frac{2}{3}$

13 $x = 1\frac{1}{2}$ or $x = \frac{2}{3}$

15 $x = \frac{3}{5}$ or $x = -\frac{1}{2}$

17 $x = \frac{1}{2}$ or $x = \frac{5}{6}$

19 $x = -1$

21 $x = -5$

23 $x = -\frac{1}{3}$ or $x = \frac{1}{2}$

25 $x = 13$ or $x = -5$

27 $x = -2$ or $x = \frac{1}{10}$

29 $x = \frac{2}{9}$ or $x = -\frac{1}{4}$

2 $x = -2$ or $x = -5$

4 $x = 2$ or $x = -3$

6 $x = -3$ or $x = -7$

8 $x = 5$ or $x = -1$

10 $x = 2$ or $x = -\frac{1}{2}$

12 $x = 1\frac{1}{2}$ or $x = -5$

14 $x = 7$ or $x = \frac{1}{4}$

16 $x = 8$ or $x = 7$

18 $x = 7$ or $x = -9$

20 $x = 3$

22 $x = 7$

24 $x = 2$ or $x = -1\frac{1}{4}$

26 $x = -3$ or $x = \frac{1}{6}$

28 $x = 1$

30 $x = -\frac{1}{4}$ or $x = \frac{3}{5}$

page 380 **Exercise 11** 3

1 $x = -\frac{1}{2}$ or $x = 5$

3 $x = -\frac{1}{2}$ or $x = -\frac{2}{3}$

5 $x = 1$ or $x = \frac{2}{5}$

6 $x = 1\frac{1}{2}$ or $x = \frac{1}{3}$

7 $x = -0.63$ or $x = -2.37$

8 $x = -0.27$ or $x = -3.73$

9 $x = 0.72$ or $x = 0.28$

10 $x = 6.70$ or $x = 0.30$

11 $x = 0.19$ or $x = -2.69$

12 $x = 0.85$ or $x = -1.18$

13 $x = 0.61$ or $x = -3.28$

14 $x = 4$ or $x = -1\frac{2}{3}$

15 $x = 5$ or $x = -1\frac{1}{2}$

16 $x = 3.56$ or $x = -0.56$

17 $x = 0.16$ or $x = -3.16$

18 $x = 2\frac{1}{3}$ or $x = -\frac{1}{2}$

$$19 \ x = -\frac{1}{3} \text{ or } x = -8$$

$$20 \ x = 1\frac{2}{3} \text{ or } x = -1$$

$$21 \ x = 2.28 \text{ or } x = 0.22$$

$$22 \ x = -0.35 \text{ or } x = -5.65$$

$$23 \ x = -\frac{2}{3} \text{ or } x = \frac{1}{2}$$

$$24 \ x = 2.58 \text{ or } x = -0.58$$

$$25 \ a \ A(0.21, 0), B(4.79, 0)$$

b The graph doesn't go through $y = 0$.

26 not less than zero

page 381 Exercise 12 3

$$1 \ x = 2 \text{ or } x = -3$$

$$2 \ x = -3 \text{ or } x = -7$$

$$3 \ x = 2 \text{ or } x = -0.5$$

$$4 \ x = 1 \text{ or } x = 4$$

$$5 \ x = \frac{1}{2} \text{ or } x = -1\frac{2}{3}$$

$$6 \ x = -0.39 \text{ or } x = -4.28$$

$$7 \ x = 6.16 \text{ or } x = -0.16$$

$$8 \ x = 3$$

$$9 \ x = 2 \text{ or } x = -1\frac{1}{3}$$

$$10 \ x = -3 \text{ or } x = -1$$

$$11 \ x = -22.66 \text{ or } x = 0.66$$

$$12 \ x = 2 \text{ or } x = -7$$

$$13 \ x = 7 \text{ or } x = \frac{1}{4}$$

$$14 \ x = \frac{3}{5} \text{ or } x = -\frac{1}{2}$$

$$15 \ x = 0 \text{ or } x = 3\frac{1}{2}$$

$$16 \ x = \frac{1}{4} \text{ or } x = -\frac{1}{4}$$

$$17 \ x = 1.27 \text{ or } x = -2.77$$

$$18 \ x = 1 \text{ or } x = -\frac{2}{3}$$

$$19 \ x = 2 \text{ or } x = -\frac{1}{2}$$

$$20 \ x = 0 \text{ or } x = 3$$

21 Yes

$$22 \ a \ x = 3 \text{ or } x = -\frac{1}{2}$$

$$b \ x = 6 \text{ or } x = -4$$

$$23 \ a \ x = -1$$

$$b \ x = 0.6258$$

$$c \ x = 0.5961$$

$$d \ x = 0.2210$$

page 383 Exercise 13 3

$$1 \ (x+4)^2 - 16$$

$$2 \ (x-6)^2 - 36$$

$$3 \ \left(x + \frac{1}{2}\right)^2 - \frac{1}{4}$$

$$4 \ (x+2)^2 - 3$$

$$5 \ (x-3)^2$$

$$6 \ (x+1)^2 - 16$$

$$7 \ (x+8)^2 - 59$$

$$8 \ (x-5)^2 - 25$$

$$9 \ \left(x + \frac{3}{2}\right)^2 - \frac{9}{4}$$

$$10 \ a \ x = 6 \text{ or } x = 2$$

$$b \ x = -3 \text{ or } x = -7$$

$$c \ x = -1 \text{ or } x = 5$$

$$11 \ a \ x = 0.65 \text{ or } x = -4.65$$

$$b \ x = 3.56 \text{ or } x = -0.56$$

$$c \ x = 0.08 \text{ or } x = -12.08$$

12 Involves the square root of a negative number.

$$13 \ f(x) = (x+3)^2 + 3$$

$$\text{as } (x+3)^2 \geq 0$$

$$\text{then } f(x) \geq 3$$

$$14 \ g(x) = x^2 - 7x + \frac{1}{4}$$

$$= \left(x - \frac{7}{2}\right)^2 - 12$$

$$\text{as } \left(x - \frac{7}{2}\right)^2 \geq 0$$

$$\text{then } g(x) \geq -12$$

$$15 \ a \ 2(x+1)^2 - 1$$

$$b \ 3(x-1)^2 - 1$$

$$c \ 2\left(x + \frac{1}{4}\right)^2 + \frac{15}{8}$$

$$16 \ a \ 3$$

$$b \ x = -2$$

$$c \ \frac{1}{3}$$

$$17 \ a \ \frac{3}{4}$$

$$b \ x = \frac{1}{2}$$

$$c \ \frac{4}{3}$$

18 Simplifies to $(x+2)^2$ which is never negative.

page 386 Exercise 14 2 3

$$1 \ a \ 3$$

$$b \ x = 3, x = 1$$

$$c \ x = 2, y = -1$$

$$2 \ a \ -9$$

$$b \ x = 3, x = -3$$

$$c \ x = 0, y = -9$$

$$3 \ a \ -8$$

$$b \ x = 4, x = -2$$

$$c \ x = 1, y = -9$$

$$4 \ a \ -0.4, 2.4$$

$$b \ -0.8, 3.8$$

$$c \ -1, 3$$

$$d \ 1$$

$$5 \ a \ -2.5, 1.5$$

$$b \ -0.7, 2.7$$

$$c \ -2, 2$$

$$6 \ -0.3, 3.3$$

$$7 \ 0.6, 3.4$$

$$8 \ 0.3, 3.7$$

$$9 \ c \ i \ 1, 4$$

$$ii \ 0.3, 3.7$$

$$10 \ a \ y = 3$$

$$b \ y = -2$$

$$c \ y = x + 4$$

$$d \ y = x$$

$$e \ y = 6$$

$$11 \ a \ y = 6$$

$$b \ y = 0$$

$$c \ y = 4$$

$$d \ y = 2x$$

$$e \ y = 2x + 4$$

$$12 \ a \ y = -4$$

$$b \ y = 2x$$

$$c \ y = x - 2$$

$$d \ y = -3$$

$$e \ y = 2$$

$$13 \ b \ i \ -3.3, 0.3 \ ii \ -4.5, 1.5$$

$$iii \ -3, 1$$

$$14 \ a \ -1.6, 3.6$$

$$b \ -1.3, 2.3$$

$$c \ -1.4, 3.4$$

$$15 \ a \ 1.7, 5.3$$

$$b \ 0.2, 4.8$$

- 16 a $-2.4, 0.9$ b $-2.8, 1.8$
 17 a $-3.8, 3.8$ c $-2.8, 2.8$
 18 $0 < k < 4$

page 389 **Exercise 15** 2 3

- 1 a $2, 4, (3, -1)$ b $3, 5, (4, -1)$
 c $-1, 3, (1, -4)$ d $-2, 4, (1, -9)$
 e $0, 6, (3, -9)$ f $1, -5, (-2, -9)$
 g $-3, 3, (0, -9)$ h $0, 4, (2, 4)$
 i $-1, 3, (1, 4)$
 2 a It does not cross the x -axis. b $(-1, 2)$
 3 $\frac{1}{2}, 3, (1\frac{3}{4}, -3\frac{1}{8})$

page 390 **Exercise 16** 2 3

- 1 8, 11 2 11, 13 3 12 cm
 4 6 cm 5 $x = 11$ 6 8, 9, 10
 7 a $x(x-1)(x+1) = 15x$
 c $x(x+4)(x-4)$ d 3, 4, 5
 8 156.5 km 9 $x = 4$
 10 10 cm, 24 cm 11 4.3 seconds
 12 2.5 cm 13 $x = 1$ m
 14 9 cm or 13 cm
 15 a $n(n+2)$ b $n(n+2) = 255, n = 15$
 16 $x = 2$ cm 17 $x = 3$ cm or $x = 9.5$ cm
 18 $x = 6$ cm
 19 $\frac{40}{x}$ hours, $\frac{40}{x-2}$ hours, 10 km/h
 20 4 km/h 21 20 mph 22 4, -1
 23 2, 5 24 $\frac{3}{4}$
 25 a y and $2x$ b $2x^2 = y^2$
 c $x = 59.5$ cm, $y = 84.1$ cm d 29.7 cm

page 395 **Exercise 17** 3

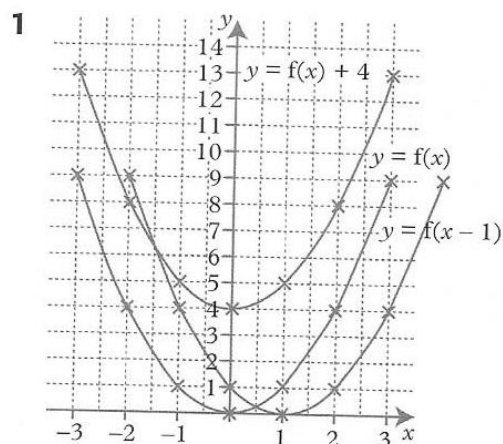
- 1 a $2 \leq x \leq 5, x = [2, 5]$
 b $1 \leq x \leq 6, x = [1, 6]$
 c $x \leq 2$ or $x \geq 7, x = [2, \infty^-) \cup [7, \infty^+)$
 d $-1 < x < 4, x = (-1, 4)$
 e $-2 \leq x \leq 3, x = [-2, 3]$
 f $-3 \leq x \leq 4, x = [-3, 4]$
 g $-3 \leq x \leq 2, x = [-3, 2]$
 h $-5 < x < 4, x = (-5, 4)$
 i $x < 1$ or $x > 3, x = (1, \infty^-) \cup (3, \infty^+)$

- 2 $x \geq 2, x = [2, \infty^+)$
 3 $0 < x \leq 1, x = [1, 0)$

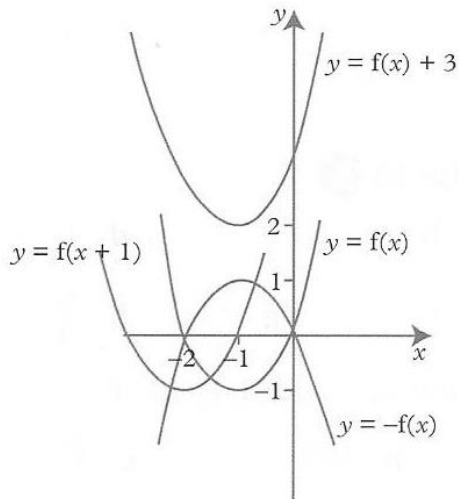
page 395 **Exercise 18** 3

- 1 a $\frac{5}{7}$ b $5y$ c $\frac{1}{2}$ d 4
 e $\frac{x}{2y}$ f 2 g $\frac{a}{2}$ h $\frac{2b}{3}$
 2 A and G, B and E, C and H, D and F
 3 a a b $\frac{10m}{3}$ c $\frac{2xy}{9}$
 d $\frac{4}{aq}$ e $\frac{8}{3}$ f $\frac{y^2}{5x}$
 g $2a$ h 1
 4 a $\frac{a}{5b}$ b a c $\frac{7}{8}$
 d $\frac{3}{4-x}$ e $\frac{5+2x}{3}$ f $\frac{3x+1}{x}$
 g $\frac{4+5a}{5}$ h $\frac{b}{3+2a}$
 5 a 6 b 4 c $2a$
 6 A and F, B and H, C and E, D and G
 7 a $\frac{x+2y}{3xy}$ b $\frac{6-b}{2a}$ c $\frac{4a+2b}{b}$
 d $x-2$
 8 a $\frac{x+2}{x-3}$ b $\frac{x}{x+1}$ c $\frac{x+4}{2(x-5)}$
 d $\frac{x+5}{x-2}$ e $\frac{x+3}{x+2}$ f $\frac{x+5}{x-2}$

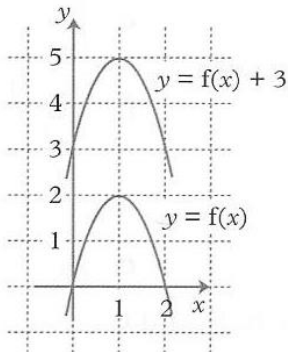
page 399 **Exercise 19** 3



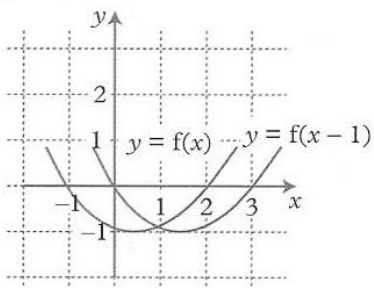
2

3 a $A(0, -2)$ b $A(7, 0)$ 4 a $A(-2, -1)$, $B(0, -3)$, $C(2, 0)$ b $A(0, 1)$, $B(2, 3)$, $C(4, 0)$

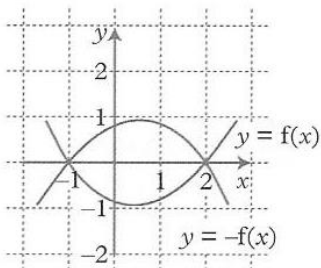
5



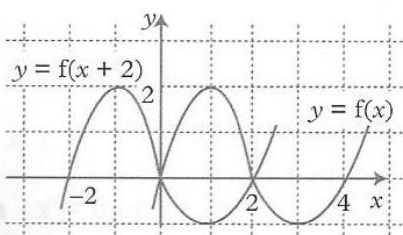
6



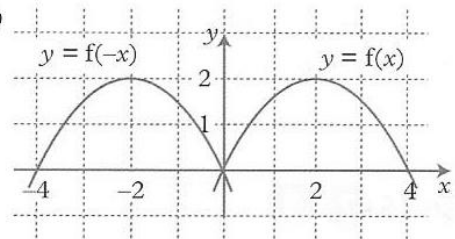
7



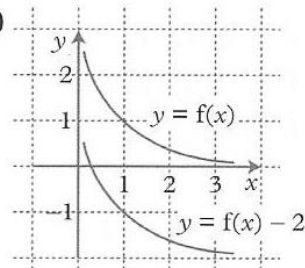
8



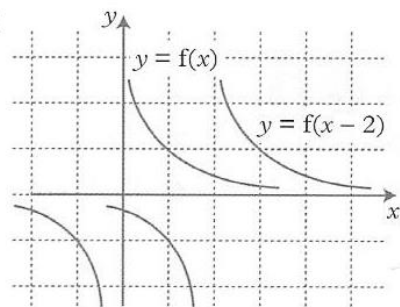
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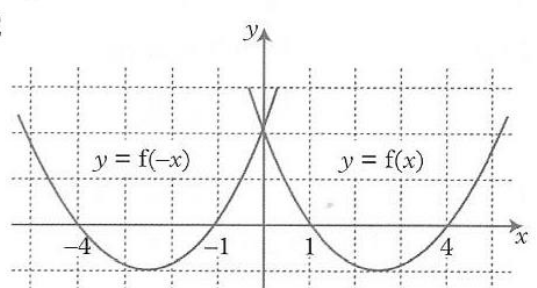
10



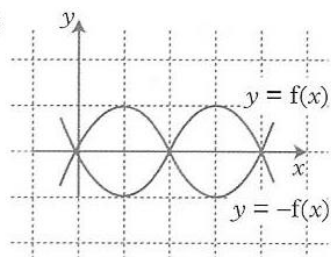
11



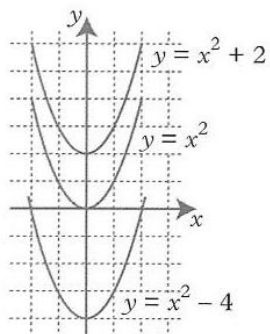
12



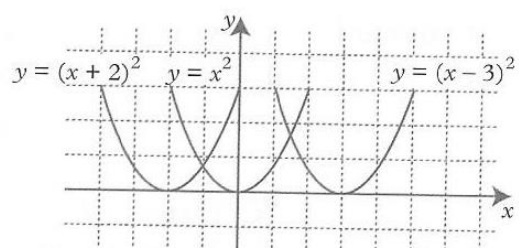
13

page 401 **Exercise 20** 3

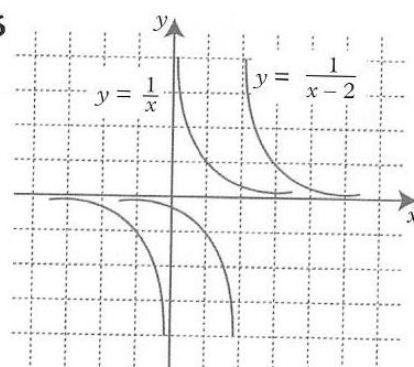
1



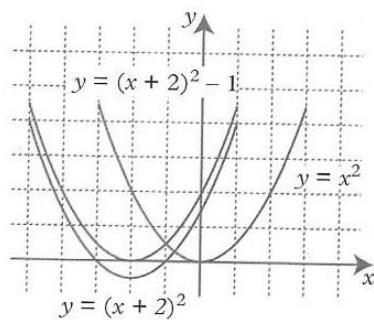
2



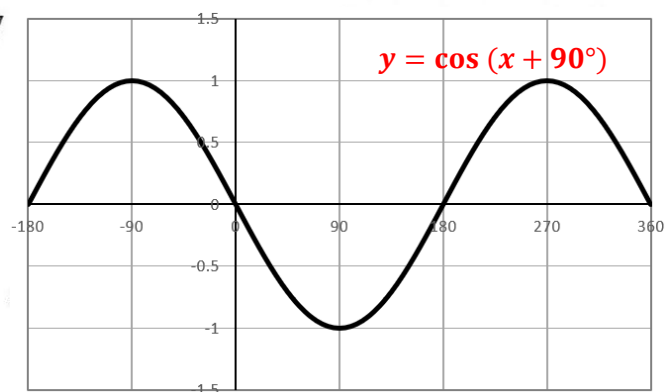
6



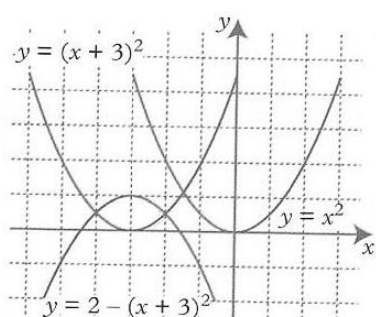
3



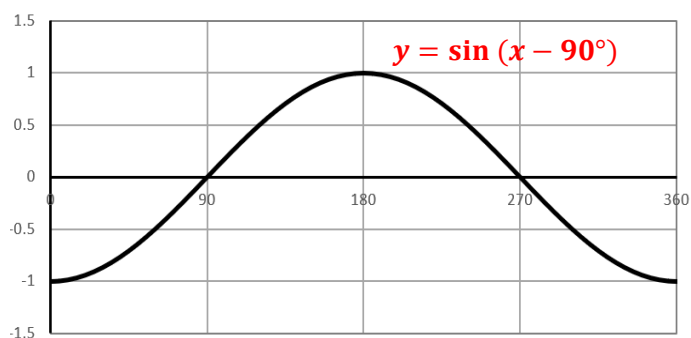
7



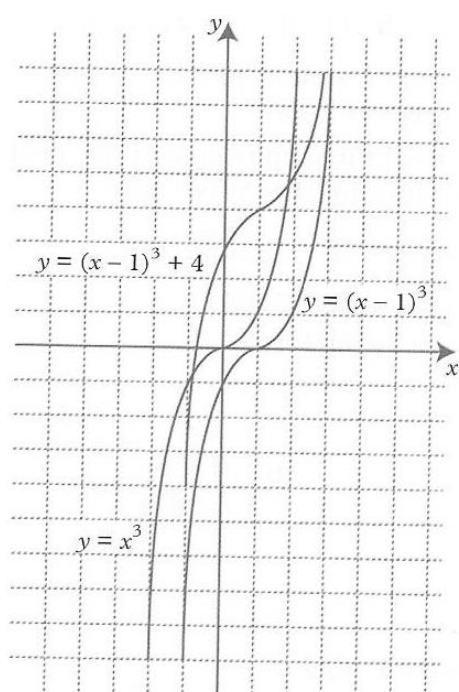
4



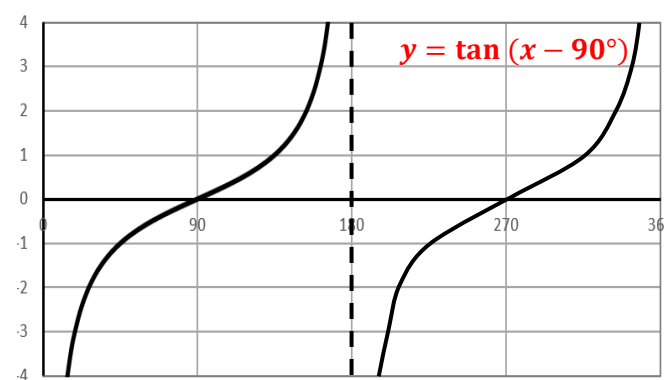
8a



5



8b



9 a $A(1, 5)$ b $A(5, -4)$

10 a $y = x^2 + 3x + 5$

b $y = (x - 2)^2 + 3(x - 2)$

c $y = -x^2 - 3x$

11 a $a = 2, b = 3$

b $y = g(x)$ is $y = x^2$ shifted 2 units right and 3 units up

12 a $A(2, 4)$

b $B\left(0, \frac{1}{5}\right), C(3, 1), D(-3, 1)$

page 404 **Exercise 21** 3

1 a $x^2 + y^2 = 25$

b $x^2 + y^2 = 49$

c $x^2 + y^2 = \frac{1}{4}$

d $x^2 + y^2 = 0.36$

e $x^2 + y^2 = 2\frac{1}{4}$

f $x^2 = y^2 = 3$

g $x^2 + y^2 = 5$

h $x^2 + y^2 = 28$

2 a $(0, 0), 5$

b $(0, 0), 6$

c $(0, 0), 13$

d $(0, 0), \frac{1}{2}$

e $(0, 0), 0.3$

f $(0, 0), \sqrt{13}$

3 a, b, d yes

c no

4 a expand $x^2 + 2xy + y^2 = 27 + 2xy$

$x^2 + y^2 = 27$

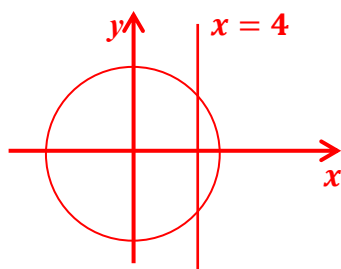
so radius $= \sqrt{27} = 3\sqrt{3}$

b expand to get $x^2 + y^2 = 5$

so radius $= \sqrt{5}$

5 none

6 a



b twice, $(4, 3), (4, -3)$

c i twice $(6, 8), (-6, 8)$

ii once $(3, 0)$ iii none

7 $(6, 6), (-6, -6)$

page 406 **Exercise 22** **3**

1 $2, -\frac{1}{2}, y = -\frac{1}{2}x + 2\frac{1}{2}$

2 a $\sqrt{8}, y = 4 - x$ b $\sqrt{32}, y = 8 - x$

c $\sqrt{10}, y = 10 - 3x$ d $\sqrt{20}, y = 10 - 2x$

3 a $y = 6 - x$ b $y = 13 - 1\frac{1}{2}x$

c $y = -\frac{3}{4}x + 12\frac{1}{2}$ d $y = 6\frac{2}{3} - \frac{1}{3}x$

4 a (15, 0) b (5.8, 0)

page 407 **Test yourself**

1 a i 10 ii $4\sqrt{5}$

b $\frac{403}{999}$

2 a $x = 20$

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

c $2ab(3b - 1)$

d $(3x - 4)(x + 3)$

3 $\frac{2\sqrt{3}+3}{3}$ or $\frac{2}{3}\sqrt{3} + 1$

4 a (3, 3.5) b $-\frac{9}{5}$ (or $-1\frac{4}{5}$)

5 b = -5, c = -14

6 a $x(2x + 1) + 5x = 95$

$2x^2 + 6x - 95 = 0$

b 5.55

7 a $(2n - 3)(n + 1)$

b 17×11

8 $4(x + 2)(x + 9) = 912$; $x = 10$ Dimensions are 4, 12, 19 cm

9 a (0, 12) b (2, 16) c (-2, 0)

10 $\frac{2x}{(x-5)}$

11 a i (0, 1) ii (90°, 0)

12 a (-2, 3) b (1, 3) c (2, 6)

13 a Graph moved two units to right. Point touches x -axis at (2, 0).

b Graph moved three units up and reflected in x -axis. Point touches y -axis at (0, -3).

14 a $(\sqrt{32} + \sqrt{2})^2 = 32 + 2\sqrt{2}\sqrt{32} + 2$
 $= 34 + 2\sqrt{64}$
 $= 34 + 16$
 $= 50$

b $5\sqrt{3}$ cm

15 a $a = 4, b = 5$ b M is at (4, 5)

8 Statistics

page 412 **Exercise 1** **1** **2**

1 a population b population c sample
d population e sample

2 Class discussion

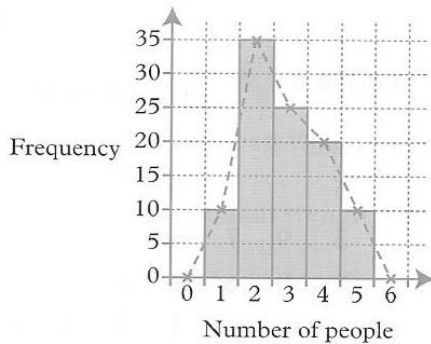
- 3 a categorical b discrete c discrete
d discrete e continuous f continuous
g categorical h discrete

page 415 **Exercise 2 1**

1 For example, Isola, because the snowfall is greater on average.

2 a 20% b 20 – 24 and 30 – 34

3 a – b



4 a 62

b The mean weight is lower for A. The range is higher for B.

c For example, B could be rugby, as weight of player varies with position.

5 a The fertiliser made the plants taller, on average.

b The fertiliser had no effect on the weights.

6 Height has been used to represent production, but the width of the picture also varies, making the difference 100k much greater.

7 The profit axis does not start at zero, so the increase in profit looks much greater than it is.

8 a i $\frac{1}{8}$ ii $\frac{1}{6}$ iii $\frac{5}{12}$
iv $\frac{1}{12}$ v $\frac{1}{8}$ vi $1\frac{1}{12}$

b i £15 ii £20 iii £50 iv £10

9 a £425 b £150 c £250 d £75

10 a i 8 min ii 34 min iii 10 min
b 18°

11 270° , 12° , 23° , 54° , 1°

12 18° , 54° , 54° , 234°

13 a 22.5% b 45° , 114°

14 8

page 420 **Exercise 3 1**

1 a Median = 5, Mean = 6, Mode = 4, Range = 9

b Median = 7, Mean = 9, Mode = 7, Range = 19

c Median = 8, Mean = 6.5, Mode = 9, Range = 11

d Median = 3.5, Mean = 3.5, Mode = 4, Range = 8

2 a 10 b 13

3 6

4 a 5 b 35

5 76 kg 6 7°C

7 a 16 years b 170 cm c 50 kg

8 2, 45 9 4 people

10 a False b True c False d Possible

11 a Mean = £33 920, Median = £22 500, Mode = £22 500 b Mean

12 a Mean = 157.125 kg , Median = 91 kg

b The mean. No, it's too high.

13 a Mean = 74.5 cm , Median = 91 cm

b Yes. It is more appropriate to use the median, as the mean has been distorted by a few short plants.

14 78 kg 15 35.2 cm

16 a 2 b 9

17 a 20.4 m b 12.8 m c 1.66 m

18 55 kg 19 For example: 4, 4, 5, 8, 9

20 For example: 2, 4, 4, 4, 6

21 12 22 $3\frac{2}{3}$

23 a N

b Mean = $N^2 + 2$, Median = N^2 c 2

page 423 **Exercise 4 1**

1 96.25 g 2 51.9 p 3 4.82 cm

4 a Mean = 3.025, Median = 3, Mode = 3

b Mean = 17.75, Median = 17, Mode = 17

5 a Mean = 6.62, Median = 8, Mode = 3

b Mode

6 a 9 b 9 c 15

7 a 5 b 10 c 10

8 $\frac{ax + by + cz}{a + b + c}$

page 425 **Exercise 5** 1

1 a

Number of words	Frequency f	Midpoint x	fx
1–5	6	3	18
6–10	5	8	40
11–15	4	13	52
16–20	2	18	36
21–25	3	23	69
Totals	20	—	215

- b 10.75 c 1–5 words
- 2 a 68.25 b 55–69 marks
- 3 a 3.77 b 0–2 letters
- 4 a 181 cm
- b The raw data is unavailable and an assumption has been made with the midpoint of each interval.

page 426 **Exercise 6** 1

- 1 squares: shaded 33.3%, unshaded 66.6%
triangles: shaded 50%, unshaded 50%

2 a

	Football	Hockey	Swimming	Total
Boys	5	2	1	8
Girls	2	3	2	7
Total	7	5	3	15

- b 8 c 25%

3 a

	Girls	Boys	Total
Can cycle	95	120	215
Cannot cycle	179	82	261
Total	274	202	476

- b 35% c 59%

4 a

	Men	Women	Total
Had accident	75	88	163
Had no accident	507	820	1327
Total	582	908	1490

- b 13% c 10%
- d Men are more likely to have accidents.

page 428 **Exercise 7** 2

- 1 a July b Upwards
- c July, December; Spending on his summer holiday and Christmas
- 2 a 104.5 °F b 27 hours
- c 6.6 degrees d downward
- 3 a 18 °C b 19 °C, 19.4 °C
- d The trend is neither up nor down

page 431 **Exercise 8** 1

1 a

Stem	Leaf
1	5
2	3 9 7 8
3	5 9 6 2 8
4	1 0 7 5 8 2 6
5	2 4 1 9 3
6	5 6

Key: 2 | 3 means 23

- b 51

2 a

Stem	Leaf
2	0 4 5 8
3	1 7 9
4	0 4 6
5	2 5 8 9
6	1 5 7 8
7	3 5

Key: 3 | 1 means 31

b

Stem	Leaf
2	2 8 9
3	0 5 8
4	1 4 6 7 7
5	3 4 9
6	7
7	2

Key: 2 | 2 means 22

- 3 a 50 kg b 15 c 50 kg

4 a 4.5

b 5.3

Stem	Leaf
1	4 8
2	4 4 8
3	1 3 3 7 8
4	0 5 5 6 6 7 9
5	1 2 5 8
6	2 3 7

Key: 3 | 7 means 3.7

page 432 **Exercise 9** 1

1 a Pearce family: Median weight = 54 kg;

Range = 20 kg

Taylor family: Median weight = 63 kg;

Range = 40 kg

b The median weight for the Pearce family is lower than that for the Taylor family and the range for the Pearce family is much less than that for the Taylor family. The weights of the Taylor family are much more spread out.

2 a 13 b 78

c The women's pulse rates were higher on average (median 78 compared with 62). The spread was greater for men (range 53 compared with 45).

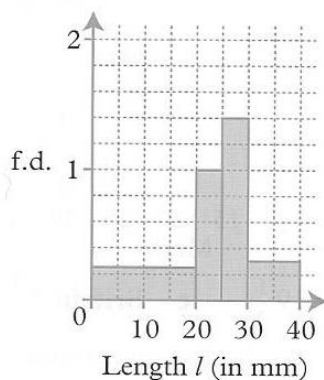
3 a Class 10 M: Median mark = 73; Range = 31
Class 10 S: Median mark = 58; Range = 47

b The median mark for Class 10S is lower than that for Class 10M and the range for Class 10S is greater than that for Class 10M. The marks of Class 10S are more spread out.

page 434 **Exercise 10** 3

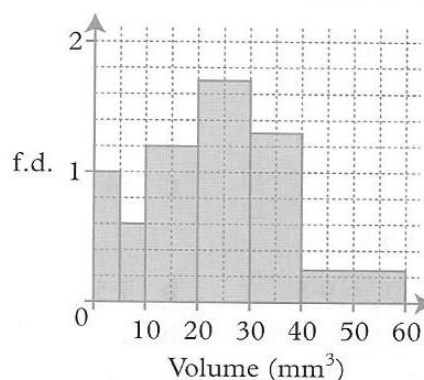
1

Length l (in mm)	Frequency	Frequency density (f.d.)
$0 \leq l < 20$	5	$5 \div 20 = 0.25$
$20 \leq l < 25$	5	$5 \div 5 = 1$
$25 \leq l < 30$	7	$7 \div 5 = 1.4$
$30 \leq l < 40$	3	$3 \div 10 = 0.3$

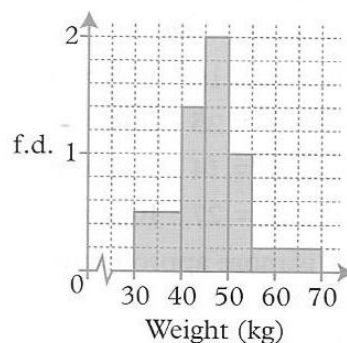


2

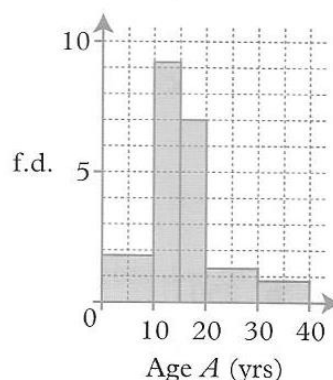
Volume (mm^3)	Frequency	Frequency density
$0 \leq V \leq 5$	5	$5 \div 5 = 1$
$5 \leq V \leq 10$	3	$3 \div 5 = 0.6$
$10 \leq V \leq 20$	12	$12 \div 10 = 1.2$
$20 \leq V \leq 30$	17	$17 \div 10 = 1.7$
$30 \leq V \leq 40$	13	$13 \div 10 = 1.3$
$40 \leq V \leq 60$	5	$5 \div 20 = 0.25$



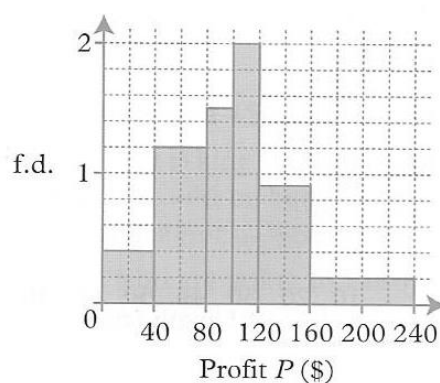
3



4

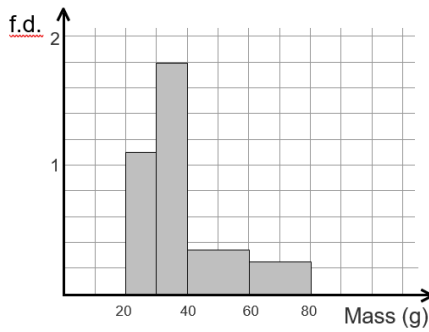


5



(Corrected histogram)

6



page 437 **Exercise 11** 3

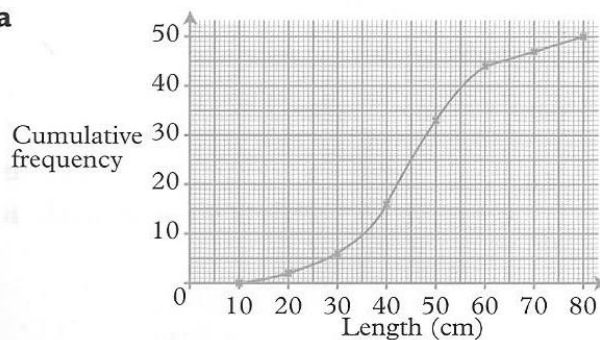
- 1 a i 10 ii 20 b 65
2 55 3 135 4 28 eggs
5 a 6 b 8 c 54

page 439 **Exercise 12** 3

- 1 A a $Q_1 = 4$, $Q_3 = 9.5$ b 5.5
B a $Q_1 = 1.5$, $Q_3 = 5.5$ b 4
C a $Q_1 = 10$, $Q_3 = 21$ b 11
D a $Q_1 = 1.5$, $Q_3 = 6$ b 4.5
2 A a 20 b Range = 19 IQR = 5
B a 27 b Range = 25 IQR = 5
C a 2 b Range = 14 IQR = 6
D a 1, 28 b Range = 27 IQR = 4
c In all, the IQR is more appropriate as there are outliers.
3 A a 28 b 6 c 12
B a 4.8 b 1.5 c 2.8
C a 33 b 12 c 24

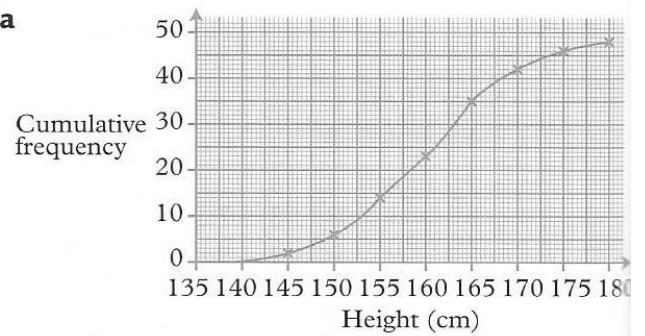
page 443 **Exercise 13** 3

- 1 a 50 b 30, 60 c 30 d 30
2 a 44 b 28, 56 c 28 d 34
3 a 100 b 250
c 2250 hours d 750 hours
4 a



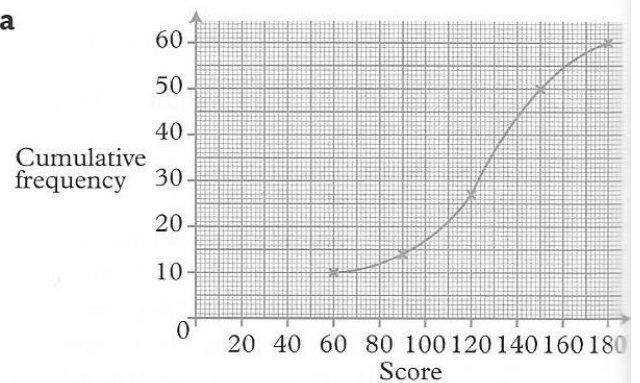
- b i 46 cm ii 17 cm

5 a



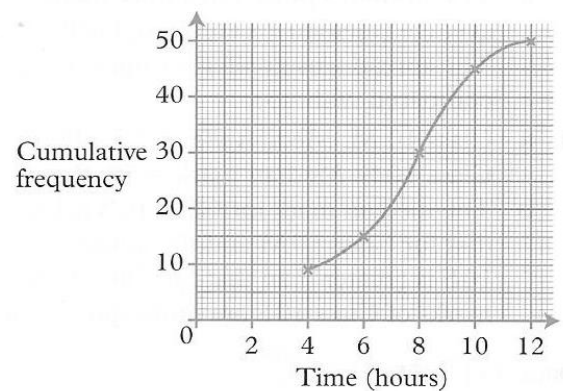
- b i 160.5 cm ii 11.5 cm

6 a



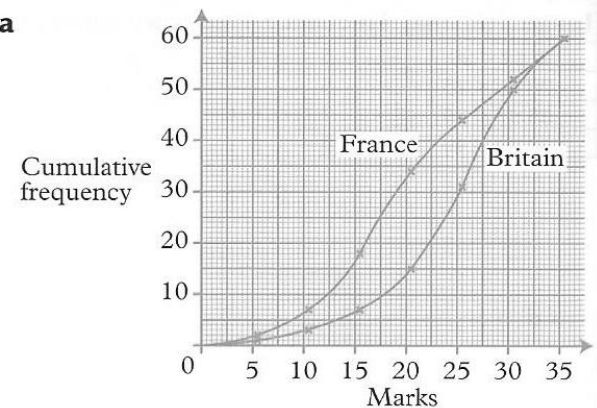
- b i 125 ii 52
c Boris, his interquartile range is smaller

7 a



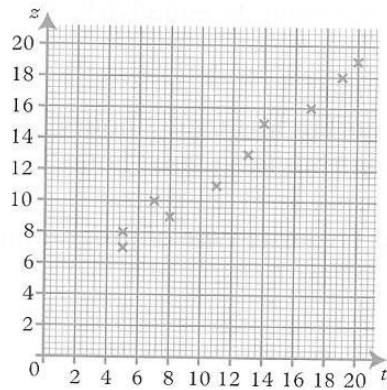
- b i 7.4 hours ii 3.5 hours c 90%

8 a



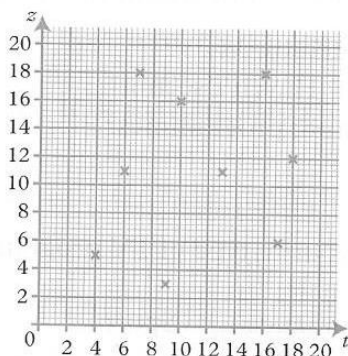
- b Britain 25, France $19\frac{1}{2}$ c Britain $8\frac{1}{2}$
d The British results are higher on average, and less spread out.

2 a



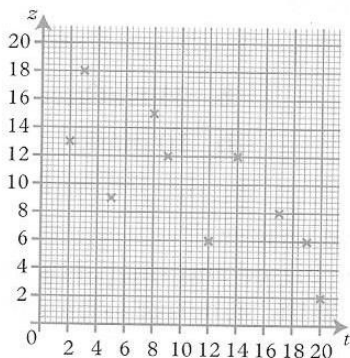
Strong positive correlation

b



No correlation

c



Weak negative correlation

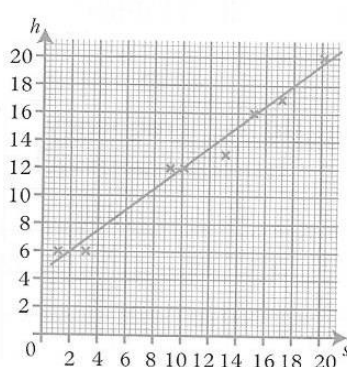
3 a No correlation

b Strong negative correlation

c No correlation

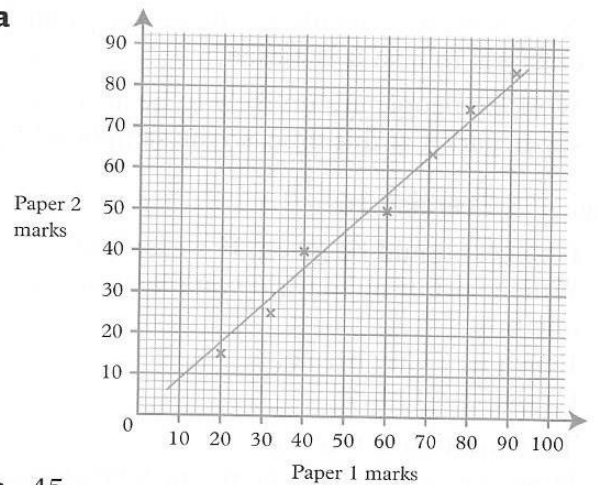
d Weak positive correlation

4 a



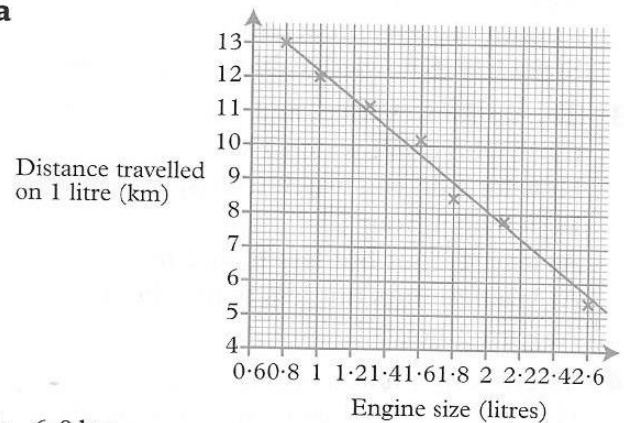
b 9

5 a



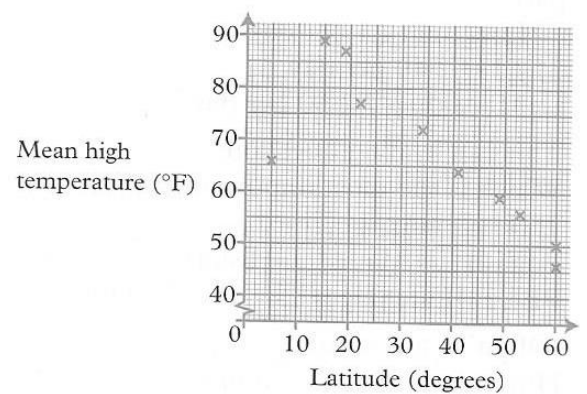
b 45

6 a



b 6.9 km

7 a



b Bogota due to high altitude c 75°F

8 a Positive correlation b Positive correlation

c No correlation d Positive correlation

e No correlation

- 1 She is only asking students who have school meals. It would be better to include students who choose not to have school meals as well.
- 2 People who are going to Europe are more likely to be positive about it. It would be better to choose an unbiased location.

- 3 Not everyone's details will be on the published electoral roll, so it is biased.
- 4 Working people are unlikely to be at the supermarket at this time, so the sample is biased.

page 455 **Exercise 16** 2

- 1 Choices should be given. For example:
Which sort of holiday do you like best? Tick one box.
Beach ☐ City break ☐
Cruise ☐ Other ☐
- 2 The question is too vague.
How would you describe the new head teacher?
Tick all that apply
Friendly ☐ Approachable ☐ Fair ☐
Strict ☐ Knowledgeable ☐ Efficient ☐
- 3 The options overlap, and there is no option for those who don't watch TV.
How long do you watch television each day?
Less than 1 hour ☐
At least 1 hour but less than 2 hours ☐
At least 2 hours but less than 3 hours ☐
At least 3 hours ☐
- 4 There is no middle option.
How much would you pay to use the new car park?
☐ Less than £1 per day
☐ £1–£2.49 per day
☐ More than £2.50 per day
- 5 This is a leading question.
Which is the most important subject at school?
Tick one box.
English ☐ Maths ☐ History ☐ Science ☐
PE ☐ Languages ☐ Art ☐ Other ☐
- 6 'Often' is too vague.
How often do you or your parents go to the cinema?
At least once a week ☐
Not every week, but at least once a month ☐
Less than once a month ☐
- 7 Leading question.
Do we get too much homework?
Yes ☐ No ☐
- 8 They should not ask for personal information like name and age. The first question's options are too vague. Options should be given for the second question.
The third question is a leading question and should be rephrased. The last question only needs yes/no options.

For example:

- How much television do you watch each day?
Less than 1 hour ☐
At least 1 hour but less than 2 hours ☐
At least 2 hours but less than 3 hours ☐
At least 3 hours ☐
- What is your favourite type of programme on TV?
Soaps ☐
Films ☐
Documentaries ☐
Dramas ☐
Others ☐
- Do you like watching MTV?
Yes ☐ No ☐ Haven't seen it ☐
- Do you like nature programmes?
Yes ☐ No ☐

- 9 What is your favourite type of TV programme?
Tick one box.
Comedy ☐ Romance ☐ Sport ☐
Documentary ☐ Other ☐

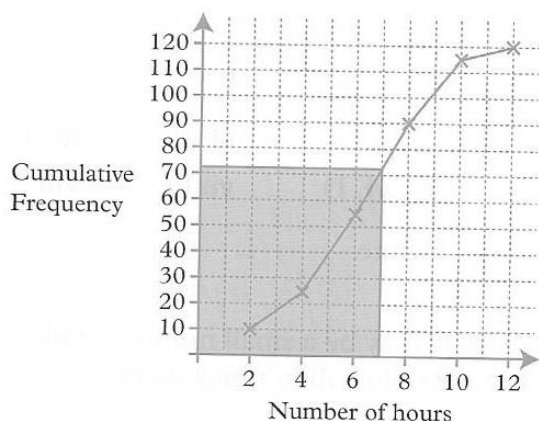
page 457 **Test yourself**

- 1 51.8 km/hr
- 2 a $25 \leq t < 30$ b 25.8 degrees
- 3 a 3 b 10 marks
- 4 30 mm
- 5 a Student's own answer.
b Sample is too biased and small. His friends are likely to be the same age as him and have similar interests.
- 6 a Time period in question not specified, time periods in answer not specified.
b Student's own answer.
c Biased sample.
- 7 a It is a running total of the frequency values.
b i **365** people ii 54 times
- 8 a 6.08 hours

b

No. of hours (h)	Frequency
$0 < h \leq 2$	10
$0 < h \leq 4$	25
$0 < h \leq 6$	55
$0 < h \leq 8$	90
$0 < h \leq 10$	115
$0 < h \leq 12$	120

c

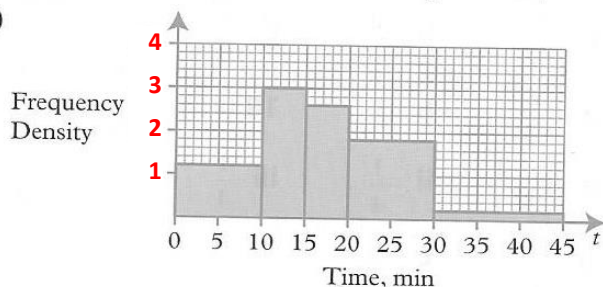


d 72

9 a Box plot drawn with marks given.

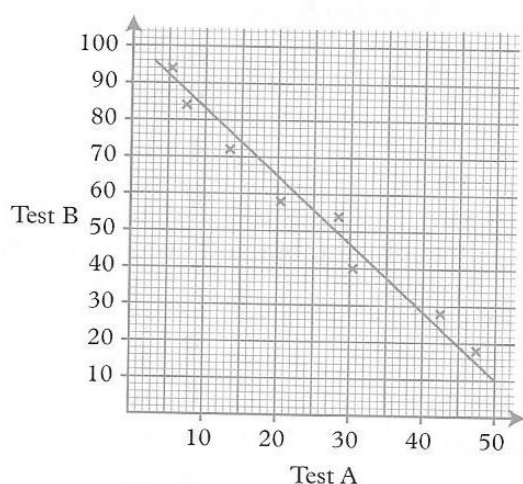
b The boys have a greater range, but a higher median so gave more on average overall. The IQR for both sets is very similar.

10



11 86 farms

12 a c



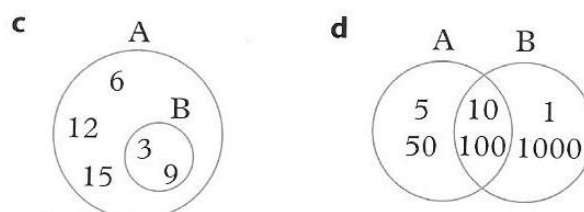
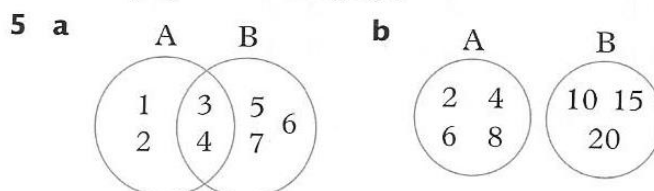
b Strong negative correlation d 68

9 Probability

page 464 **Exercise 1** 1

- 1 a $\{3, 6, 9, 12, \dots\}$ $\{3, 6, 9\}$
b M c $9 \notin M, 6 \in N$

- 2 a Boys' names with the initial J
b Multiples of 5
c Square numbers less than 82
d The initials of the colours of the rainbow
3 a 6, 8, 10, 12, 14 b a, b, c, d
c 1, 8, 27, 64 d A, C, E, H, I, M, S, T
4 true a, b, f false c, d, e



- 6
-
- a) 3, 4
b) 3, 4, 5, 6, 7, 8, 9
c) 1, 2, 3, 4, 5, 6, 7, 8, 9
d) 3
e) 1, 2, 3, 4, 5, 6, 8
f) 3, 4, 8

page 466 **Exercise 2** 1 3

- 1 16 2 a 12 b 3
3 a HH, HT, TH, TT
4 b DD, DC, DR, CD, CC, CR, RD, RC, RR
c 5 d $\frac{5}{9}$
5 a 11 b 6 c 5 d 25
e $\frac{10}{36} = \frac{5}{18}$ f $\frac{1}{36}$
6 a BBB, BBG, BGB, BGG, GBB, GBG, GGB, GGG
b Frequencies are 1, 3, 3, 1.
c A grid has only two axes. A three-child family would need three axes which are difficult to draw on paper in 2-D.
7 a 1 b 3 c $\frac{3}{8}$ d $\frac{1}{8}$
8 1, 5 1, 10 1, 20 2, 5 2, 10 2, 20

9 a AY AZ BY BZ CY CZ DY DZ; 8 ways

b KP KQ KR LP LQ LR MP MQ MR;
9 ways

10 a 20 b 30 c 420 d 525

11 250

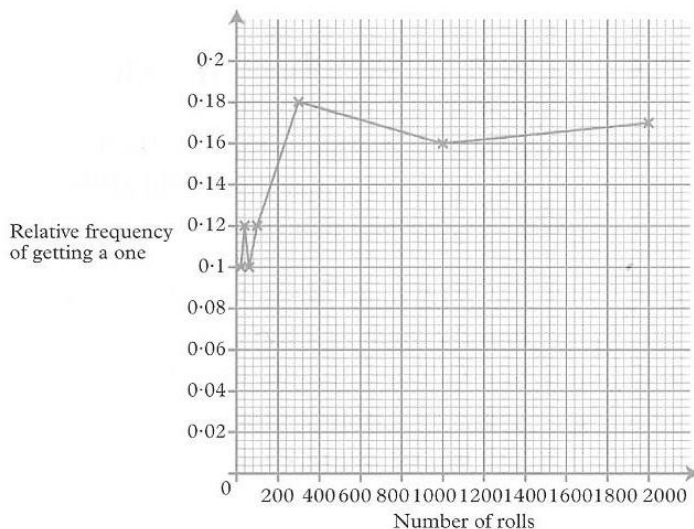
page 469 Exercise 3 1

1 B 2 C 3 A 4 B or C

5 C 6 A 7 B 8 B

9 C 10 D

11



13 Nick, as the relative frequency should be close to 0.1 with his number of spins.

page 471 Exercise 4 1

1 a $\frac{1}{13}$ b $\frac{1}{52}$ c $\frac{1}{4}$

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

3 a $\frac{5}{11}$ b $\frac{2}{11}$ c $\frac{4}{11}$

4 a $\frac{4}{7}$ b $\frac{3}{17}$ c $\frac{11}{17}$

5 a $\frac{2}{9}$ b $\frac{2}{9}$ c $\frac{1}{9}$ d 0 e $\frac{5}{9}$

6 a $\frac{1}{13}$ b $\frac{2}{13}$ c $\frac{1}{52}$ d $\frac{5}{52}$

7 a $\frac{3}{13}$ b $\frac{5}{13}$ c $\frac{8}{13}$

8 Megan

9 a $\frac{1}{10}$ b $\frac{3}{10}$ c $\frac{3}{10}$

10 i H ii A iii B iv C

v E vi D vii G viii F

11 6 blue, 3 white

12 a 1

b There may be a small number of blue balls, and Asif just didn't pick them.

13 a $\frac{1}{7}$ b $\frac{4}{7}$ c $\frac{6}{7}$

14 a $\frac{1}{6}$ b $\frac{1}{3}$ c $\frac{1}{6}$

15 a i $\frac{5}{13}$ ii $\frac{6}{13}$ b i $\frac{5}{12}$ ii $\frac{1}{12}$

16 a $\frac{1}{12}$ b $\frac{1}{40}$ c $\frac{1}{4}$

17 a $\frac{x}{12}$ b 3 18 0.14

19 a i $\frac{1}{4}$ ii $\frac{1}{4}$ iii $\frac{1}{4}$

b $\frac{1}{4}$ c $\frac{2}{9}$

page 476 Exercise 5 1

1 a 67 b 200

2 a 25 b No

3 50 4 40

5 a $\frac{3}{8}$ b 25

c Possibly not, but you need more trials to be certain.

6 a $\frac{1}{2}$ b $\frac{1}{4}$

7 a 15 b 105

8 a 20 b 5
c 50 d 40

9 a 0.2146 b 1073

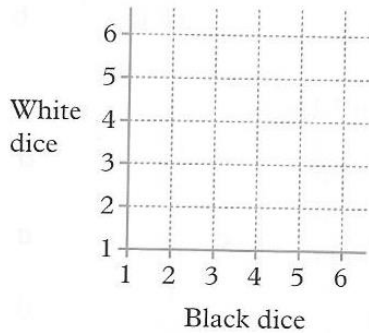
page 478 Exercise 6 1

1 a HHH, HHT, HTH, THH, HTT, THT, TTH, TTT

b $\frac{1}{8}$

2 HHHH, HHHT, HHTH, HTHH, THHH, HHTT, HTHT, THHT, HTTH, THTH, TTHH, HTTT, THTT, TTHT, TTTH, TTTT (16)

3 a



b 4

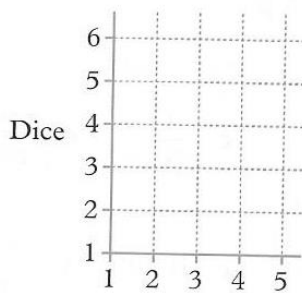
c $\frac{1}{9}$

4 a $\frac{1}{4}$

b $\frac{1}{4}$

5 WX, WY, WZ, XW, XY, XZ, YW, YX, YZ, ZW, ZX, ZY; $\frac{1}{6}$

6 a



b $\frac{1}{2}$

7 a $\frac{1}{12}$

b $\frac{1}{36}$

c $\frac{5}{18}$

d $\frac{1}{6}$

8 a $\frac{1}{12}$

b $\frac{5}{36}$

c $\frac{2}{3}$

d $\frac{1}{12}$

e $\frac{1}{36}$

9 $\frac{2}{3}$

10 a 64

b $\frac{1}{64}$

11 Yes

12 No, it is slightly biased in favour of Y.

13 Lose 20p

14 a $\frac{1}{144}$

b $\frac{1}{18}$

page 483 **Exercise 7** 1

1 $\frac{4}{5}$

2 a $\frac{1}{13}$

b $\frac{12}{13}$

c $\frac{3}{13}$

d $\frac{10}{13}$

3 $\frac{35}{36}$

4 0.76

5 0.494

6 a $\frac{1}{4}$

b $\frac{3}{4}$

c $\frac{3}{8}$

d $\frac{5}{8}$

e 0

f 1

7 a $\frac{5}{11}$

b $\frac{7}{22}$

c $\frac{17}{22}$

d $\frac{15}{22}$

8 $\frac{1}{18}$

9 a 0.3

b 0.9

10 $\frac{1}{3}$

11 $\frac{1}{24}$

12 a i 0.24

ii 0.89

b 575

13 a i Exclusive

ii Not Exclusive

b $\frac{11}{15}$

14 a i Exclusive

ii Exclusive

iii Not Exclusive

b $\frac{3}{4}$

15 a 0.8

b 0.7

c The events are not mutually exclusive.

16 The events are not mutually exclusive.

page 487 **Exercise 8** 2

1 a $p(A) = \frac{1}{13}$, $p(B) = \frac{1}{6}$

b $\frac{1}{78}$

2 a $\frac{1}{2}$

b $\frac{1}{2}$

c $\frac{1}{4}$

3 $\frac{1}{10}$

4 a $\frac{1}{78}$

b $\frac{1}{104}$

c $\frac{1}{24}$

5 a $\frac{1}{16}$

b $\frac{1}{169}$

c $\frac{9}{169}$

6 a $\frac{1}{16}$

b $\frac{25}{144}$

7 a $\frac{1}{121}$

b $\frac{9}{121}$

8 $\frac{8}{1125}$

9 a $\frac{1}{288}$

b $\frac{1}{72}$

10 a $\frac{1}{9}$

b $\frac{4}{27}$

11 $\frac{1}{24}$

12 $\frac{1}{128}$

13 $\frac{1}{144}$

14 a $\left(\frac{1}{6}\right)^{20} = 2.7 \times 10^{-16}$ b $\left(\frac{5}{6}\right)^n$ c $1 - \left(\frac{5}{6}\right)^n$

page 491 **Exercise 9** 2

1 a $\frac{1}{8}$ b $\frac{3}{8}$ 2 a $\frac{1}{4}$ b $\frac{1}{4}$
 3 a $\frac{49}{100}$ b $\frac{9}{100}$ 4 a $\frac{9}{64}$ b $\frac{15}{64}$
 5 a $\frac{1}{4}$ b $\frac{3}{25}$ c $\frac{1}{25}$
 6 a $\frac{7}{15}$ b $\frac{1}{15}$
 7 a $\frac{1}{12}$ b $\frac{1}{6}$ c $\frac{1}{3}$ d $\frac{2}{9}$
 8 a $\frac{1}{216}$ b $\frac{125}{216}$ c $\frac{25}{72}$ d $\frac{91}{216}$
 9 a $\frac{1}{64}$ b $\frac{5}{32}$ c $\frac{27}{64}$
 10 a $\frac{1}{6}$ b $\frac{1}{30}$ c $\frac{1}{30}$ d $\frac{29}{30}$
 11 a $\frac{9}{16}$ b $\frac{1}{16}$ 12 a 6 b $\frac{1}{3}$
 13 a $\frac{4}{9}$ b $\frac{1}{24}$ 14 a $\frac{3}{20}$ b $\frac{9}{20}$
 15 a $\frac{6}{6840}$ b $\frac{60}{6840}$ c $\frac{120}{116280}$

page 494 **Exercise 10** 2

1 a $\frac{90}{999000}$ b $\frac{979110}{999000}$ c $\frac{19800}{999000}$
 2 a $\frac{3}{20}$ b $\frac{7}{20}$ c $\frac{1}{2}$
 3 a 5 b $\frac{1}{64}$
 4 a $\frac{1}{220}$ b $\frac{1}{22}$ c $\frac{3}{11}$ d 5
 5 a $\frac{3}{5}$ b $\frac{1}{3}$ c $\frac{2}{15}$
 d $\frac{2}{21}$ e $\frac{1}{7}$
 6 a 0.00781 b 0.511
 7 a $\frac{21}{506}$ b $\frac{455}{2024}$ c $\frac{945}{2024}$
 8 a $\frac{x}{x+y}$ b $\frac{x(x-1)}{(x+y)(x+y-1)}$
 c $\frac{2xy}{(x+y)(x+y-1)}$ d $\frac{y(y-1)}{(x+y)(x+y-1)}$

9 a $\frac{x}{z}$ b $\frac{x(x-1)}{z(z-1)}$ c $\frac{2x(z-x)}{z(z-1)}$
 10 a $\frac{1}{125}$ b $\frac{1}{125}$ c $\frac{1}{10000}$ d $\frac{3}{500}$
 11 a $\frac{1}{49}$ b $\frac{1}{7}$ 12 a $\frac{1}{52}$ b 1

page 497 **Exercise 11** 3

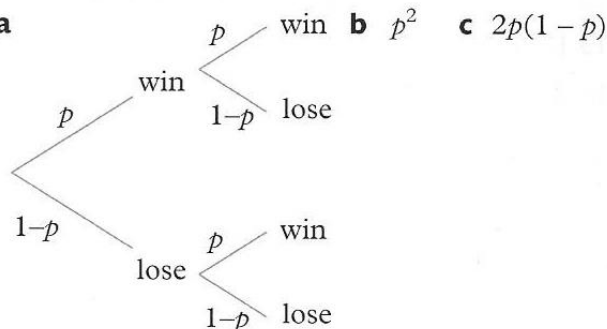
1 a $\frac{23}{50}$ b $\frac{11}{50}$ c $\frac{13}{25}$ d $\frac{13}{24}$
 2 a $\frac{2}{15}$ b $\frac{4}{45}$ c $\frac{1}{10}$ d $\frac{2}{3}$
 3 a $\frac{1}{24}$ b $\frac{2}{3}$ c $\frac{1}{10}$ d $\frac{6}{7}$
 4 a $\frac{1}{5}$ b $\frac{13}{20}$ c $\frac{9}{13}$ d $\frac{2}{5}$
 5 a $\frac{11}{25}$ b $\frac{8}{25}$ c $\frac{8}{11}$ d $\frac{1}{7}$
 6 a $\frac{18}{25}$ b $\frac{3}{10}$ c $\frac{5}{12}$ d $\frac{6}{7}$

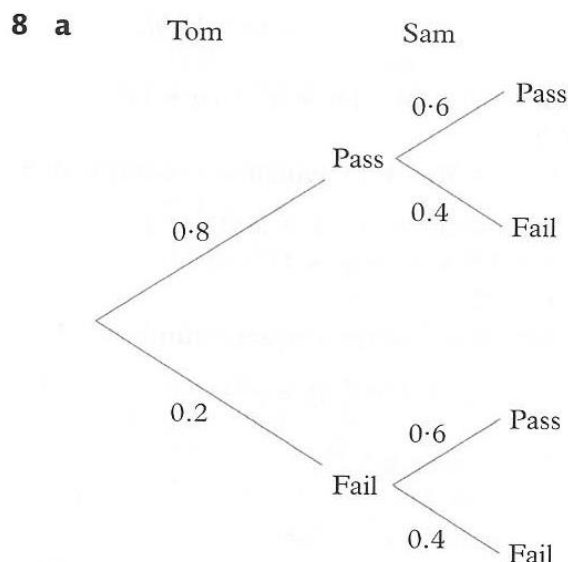
page 500 **Exercise 12** 3

1 $\frac{3}{10}$ 2 $\frac{9}{140}$
 3 a $\frac{1}{5}$ b $\frac{18}{25}$ c $\frac{1}{20}$ d $\frac{2}{25}$
 e $\frac{77}{100}$
 4 a 0.07 b 0.64 c 0.29 5 $\frac{4}{35}$
 6 a $\frac{19}{25}$ b 38 7 27

page 502 **Test yourself**

1 0.35 2 a 0.3 b 175
 3 a 252 students b 0.252
 4 a i $\frac{7}{20}$ ii A different experiment usually produces different results
 b 250 5 a 36 b 0.47
 6 a 0.26 b 45
 7 a





b 0.48 **c** 0.44

9 a i $\frac{2}{9}$ **ii** $\frac{1}{3}$ **iii** 0 **iv** $\frac{2}{3}$

b 120 **10** $\frac{3}{8}$ or 0.375

10 Problem solving and proof

The results are given here as a check for teachers or students working on their own.

10.1.1 Opposite corners

The difference in an $n \times n$ square with 3 columns is $(3n - 3)^2$.

10.1.2 Hiring a car

Hav-a-car is cheapest up to 774 miles. Between 774 and 1538 miles, Snowdon rent-a-car is cheapest. Gibson is cheapest over 1538 miles.

10.1.3 Half-time score

12 different scores were possible at half-time. The general rule is $(a + 1)(b + 1)$ for a final score $a - b$.

10.1.4 Squares inside squares

Area is always $a^2 + b^2$.

10.1.5 Maximum box

The corner squares should be $\frac{1}{6}$ th the size of the square sheet. For a rectangle $a \times 2a$, cut out $\approx$.

10.1.6 What shape tin?

Smallest surface area is 393.8 cm^2 when $r = 4.57 \text{ cm}$. In general, height = $2 \times$ radius for smallest surface area.

10.1.7 Painting cubes

27 cubes: 8 have 3 blue faces, 12 have 2 blue faces, 6 have 1 blue face, 1 does not have a blue face.
 n^3 cubes: 8 have 3 blue faces, $12(n - 2)$ have 2 blue faces, $6(n - 2)^2$ have 1 blue face, $(n - 2)^3$ do not have a blue face.

10.1.8 Discs

a For n blacks and n whites,

$$\text{no. of moves} = \frac{n(n+1)}{2}$$

b no. of moves = $\frac{n(n+2)}{2}$

c For n of each colour, no. of moves = $\frac{3}{2}n(n+1)$

10.1.9 Diagonals

880 squares

10.1.10 Chess board

30 squares on a 4×4 board
 204 squares on an 8×8 board

$$n^2 + (n-1)^2 + \dots + 2^2 + 1^2 = \frac{1}{6}n(n+1)(2n+1)$$

squares on an $n \times n$ board

10.1.11 Find the connection

They all tend to a constant number.

Cube root of x , seventh root of x , $\frac{1}{\sqrt[3]{x}}$, $(\sqrt[3]{x})^2$.

10.1.12 Spotted shapes

$$A = i + \frac{1}{2}p - 1 \text{ (Pick's theorem)}$$

page 513 **Exercise 1**

- | | |
|--------------------------|-----------------------------------|
| 1 False, $n = 2$ | 2 False, $x = \frac{1}{2}$ |
| 3 False, $n = 0$ | 4 False, $n = -3$ |
| 5 False, 1, 2, 2 | 6 False, $x = \frac{1}{2}$ |
| 7 False, a square | 8 False, $\sqrt{2}$ |
| 9 Not proven | |

10 False, $333\ 333\ 331 \div 17 = 19\ 607\ 843$

11 False, $n = -\frac{1}{2}$ 12 Not proven

13 $r = \frac{1}{24}(n^4 - 6n^3 + 23n^2 - 18n + 24)$

page 515 Exercise 2

- 1 a If today is Monday, then tomorrow is Tuesday.
b If it is raining, then there are clouds in the sky.
c If Abraham Lincoln was born in 1809, then Abraham Lincoln is dead.
- 2 a True b True c True d False
e True f False g True h True
i False j True

page 517 Exercise 3

- 1 Let $b = 2m$ for an integer m
so $ab = a \times 2m = 2 \times am$
so ab is even
- 2 Let $a = 2n + 1$ and $b = 2m + 1$ for integers n, m
then $ab = (2n + 1)(2m + 1)$
 $= 4nm + 2n + 2m + 1$
 $= 2(2nm + n + m) + 1$
which is odd
- 3 Let the numbers be $2n + 1$ and $2m + 1$.
Then $2n + 1 + 2m + 1 = 2(n + m + 1)$
which is even.
- 4 Let the even number be $2m$.
Then $(2m)^2 = 4m^2$, which is divisible by 4.
- 5 The n th line is $(n + 1)(n + 3) - n(n + 4)$
 $= n^2 + 4n + 3 - n^2 - 4n$
 $= 3$
- 6 Let the numbers be $x - 1, x, x + 1$ then
 $(x - 1)(x + 1) = x^2 - 1$.
- 7 One of the fair consecutive numbers will be a multiple of 4.
Therefore, the product will be a multiple of 4.
- 8 Let the numbers be x and $x + 1$.
Then $x^2 + (x + 1)^2 = x^2 + x^2 + 2x + 1$
 $= 2(x^2 + x) + 1$
As $2(x^2 + x)$ is an even number,
 $2(x^2 + x) + 1$ must be odd.

9 Let the numbers be $(n - 2), (n - 1), n, (n + 1)$ and $(n + 2)$.
Then $(n - 2)^2 + (n - 1)^2 + n^2 + (n + 1)^2 + (n + 2)^2$
 $= 5n^2 + 10 = 5(n^2 + 2)$, which is a multiple of 5.

10 Let the numbers be $x - 1, x$ and $x + 1$.
Then $(x - 1)^2 + x^2 + (x + 1)^2 - 2$
 $= 3x^2 + 2 - 2$
 $= 3x^2$, which is 3 times a square number.

11 Area (2) $= c^2 + 4 \times \frac{1}{2}ab = c^2 + 2ab$

So area (1) = area (2)
 $(a + b)^2 = c^2 + 2ab$
 $\therefore a^2 + b^2 + 2ab = c^2 + 2ab$
 $\therefore a^2 + b^2 = c^2$

12 Dividing by $(b - a)$ is not allowed as $b - a = 0$.

page 520 Exercise 4

- 1 Let $\angle CAB = x$
Then $\angle ACB = x$ (isosceles triangle)
 $\therefore \angle ABC = 180 - 2x$ (angles in a triangle)
 $\therefore \angle CBD = 180 - \angle ABC$ (angles on a straight line)
 $= 180 - (180 - 2x)$
 $= 2x$
So $\angle CBD = 2 \times \angle CAB$
- 2 $\angle PRS = \angle PQS$ (isosceles triangle)
 $\angle PSR = \angle PSQ$ (both 90°)
 $\therefore \angle RPS = \angle SPQ$ (two angles in triangles RPS and PSQ are the same so the third angles must also be the same)
 $\therefore$ PS bisects $\angle QPR$
- 3 $\angle ACD = \angle ABD$ (both subtended by the chord AD)
 $\angle CDB = \angle BAD$ (both subtended by the chord BC)
 $\angle CXA = \angle BXD$ (vertically opposite angles)
So $\triangle ACX$ is similar to $\triangle DBX$.
 $\therefore \frac{BX}{CX} = \frac{DX}{AX}$ (ratio of corresponding sides are equal)
 $\therefore AX \times BX = CX \times DX$
- 4 Let $\angle CAT = x$
Then $\angle ACT = 90 - x$ (angles in a triangle, tangent meets diameter at 90°)
 $\therefore \angle ATD = \angle DET = 90 - x$ (alternate angle theorem)
So $\angle ADT = 180 - x - (90 - x)$
 $= 90^\circ$ (angles in a triangle)

Similarly $\angle TEB = 90^\circ$

So $\angle DEB = \angle DET + \angle TEB = 180^\circ - x$

Therefore $\angle BAD + \angle DEB = x + 180^\circ - x$
 $= 180^\circ$

Similarly $\angle ADE + \angle ABE = 180^\circ$

So ADEB is a cyclic quadrilateral.

- 5 Use the alternate angle theorem to show that two angles in a triangle are x and $90^\circ - x$, so third angle is $180^\circ - (x + 90^\circ - x) = 90^\circ$.

- 6 $\angle CTA = \angle CTB$ (same angle)
 $\angle TCA = \angle ABC$ (alternate angle theorem)
 $\therefore \angle CAT = \angle TCB$ (third angle in triangle)
So TCA and TBC are similar.

Therefore $\frac{TC}{TB} = \frac{TA}{TC}$ (ratio of corresponding sides are equal)

So $TC^2 = TA \times TB$

- 7 Let $\angle ACD = x$
Then $\angle CAD = 90^\circ - x$ (angles in a triangle)
 $\therefore \angle ABC = 90^\circ - x$ (alternate angle theorem)
 $\angle CAB = 90^\circ$ (angle in a semicircle)
So $\angle ACB = 180 - 90 - (90 - x)$
 $= x$ (angles in a triangle)
So AC bisects $\angle BCD$.

page 521 Test yourself

- 1 $n + (n + 1) + (n + 2) = 3n + 3 = 3(n + 1)$
= a multiple of 3
- 2 e.g. when $x = 5$, $y = 25 - 5 + 5 = 25$
(not prime)
Other counter-examples are possible.
- 3 a 1.30 or -2.30
b When $x = 10$, $y = 100 + 10 + 11 = 121$
which is not a prime as it is divisible by 11.
Other counter-examples are possible.
- 4 a $5n$
b i $5n + 5(n + 1) = 5n + 5n + 5 = 10n + 5 = 5(2n + 1)$ which is $5 \times$ an odd number, and therefore odd.
ii $5n \times 5(n + 1) = 25n(n + 1)$.
If n is odd, then this equals
 $25 \times \text{odd} \times \text{even} = 25 \text{ even} = \text{an even}$.
If n is even, then this equals
 $25 \times \text{even} \times \text{odd} = 25 \text{ even} = \text{an even}$.
 $\therefore$ the product is always even.
- 5 a i If n is odd, then $n(n + 1) = \text{an odd} \times \text{an even} = \text{an even number}$.
If n is even, then $n(n + 1) = \text{an even} \times \text{an odd} = \text{an even number}$.

- ii $2n$ is a multiple of 2 and therefore even.

$\therefore 2n + 1 = \text{an even number} + 1$
= an odd number

b $(2n + 1)^2 = 4n^2 + 4n + 1$

- c The square of any odd number can be written as $(2n + 1)^2$.

$$\begin{aligned}(2n + 1)^2 &= 4(n^2 + n) + 1 \\ &= 4n(n + 1) + 1 \\ &= 4 \times \text{an even number} + 1 \\ &= \text{an even number} + 1 \\ &= \text{an odd number}\end{aligned}$$

6 $(n + 1)^2 - (n - 1)^2$
 $= n^2 + 2n + 1 - (n^2 - 2n + 1)$
 $= n^2 + 2n + 1 - n^2 + 2n - 1$
 $= 4n$
= a multiple of 4

7 $AB = BC$; $AM = MC$

$\angle BAM = \angle BCM$

Using the SAS rule, the two triangles are congruent.

- 8 a 3, 7, 31 Yes, he is correct.

b $2^7 - 1 = 127$ which is prime

c $n = 4$

9 a $y - 1, y + 1$

b $P = y^3 - y$

15 a $7 \times 8 - 4 \times 11 = 12$

$8 \times 9 - 5 \times 12 = 12$

11 Revision

page 525 Revision exercise 1

1 £25.60, £6.70, 4, £55.30

2 a 30, 37 b 12, 10 c 7, 10 d 8, 4

e 26, 33

3 £8 4 £262

5 a 1810 seconds b 72.4 seconds

6 0.8 cm

7 a £13 b £148 c £170

8 a 5.89 b 6 c 7

9 a -11 b 23 c -10

d -20 e 6 f -14

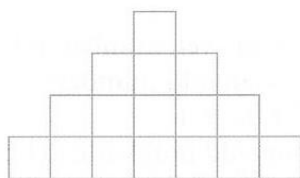
10 a 3 b 5 c -6 d -7

11 a $x = 9$ b $x = 11$ c $x = 3$ d $x = 7$

12 a and c

page 526 **Revision exercise 2**

1 a



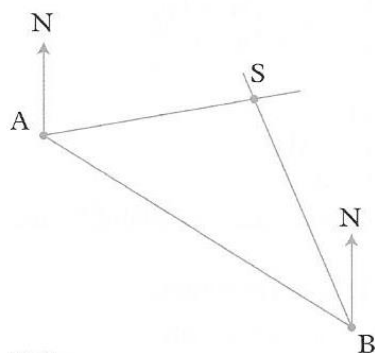
- b 1, 4, 9, 16
c Square numbers
d 49

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

3 a $\frac{3}{8}$ b $\frac{5}{8}$

4 a $\frac{2}{11}$ b $\frac{5}{11}$ c $\frac{9}{11}$

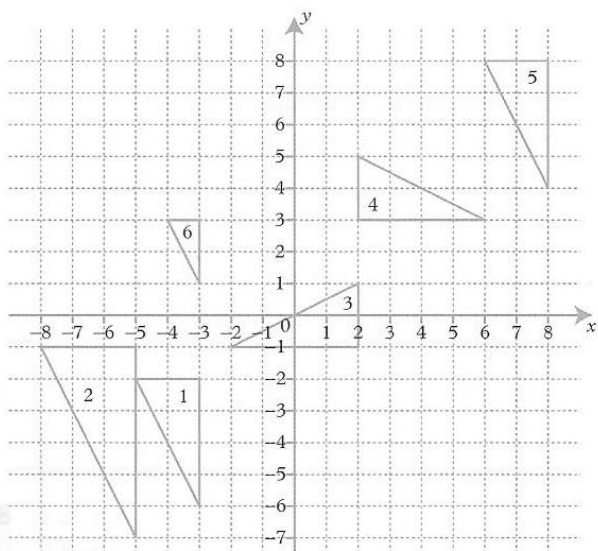
5 a



b 86 km

- 6 a Reflection in $y = 0$ b Reflection in $x = -1$
c Reflection in $y = x$
d Rotation 90° clockwise, centre $(0, 0)$
e Reflection in $y = -1$
f Rotation 180° , centre $(0, -1)$

7



- a Enlargement scale factor $1\frac{1}{2}$, centre $(1, -4)$
b Rotation 90° clockwise, centre $(0, -4)$

c Reflection in $y = -x$

d Translation $\begin{pmatrix} 11 \\ 10 \end{pmatrix}$

e Enlargement scale factor $\frac{1}{2}$, centre $(-3, 8)$

f Rotation 90° anticlockwise, centre $(\frac{1}{2}, 6\frac{1}{2})$

g Enlargement scale factor 3, centre $(-2, 5)$

8 26 cm^2

page 527 **Revision exercise 3**

1 a $t + t + t = 3t$

b $a^2 \times a^2 = a^4$

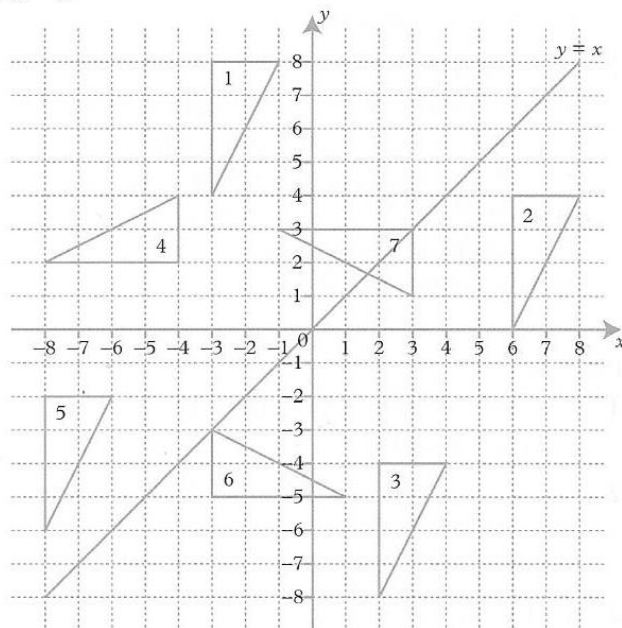
c $2n \times n = 2n^2$

2 a 9

b 50

c $(7 \times 11) - 6 = 72 - 1$

3 a - b



c $(6, 0), (2, -8), (-8, 2), (1, -5), (-1, 3)$

4 17.7 cm

5 a £26 b 29 minutes

6 a $= 45^\circ$ b $= 67.5^\circ$

7 a £44 000 b 198 c £220 d £43 560

8 a 4 b 19

9 a i Consett ii Durham iii Consett

b i 55 km ii 40 km

c i 80 km/h ii 55 km/h

iii 70 km/h iv 80 km/h

d $1\frac{3}{4}$ hours

10 a $1\frac{2}{3}$

b 20 cm

- 11 A** Cross-channel swimmer
B Car ferry from Calais
C Hovercraft from Dover
D Train from Dover
E Marker buoy outside harbour
F Car ferry from Dover

12 a 560 kg **b** 57 kg

page 529 **Revision exercise 4**

- 1 A** $y = 6$ **B** $y = \frac{1}{2}x - 3$
C $y = 10 - x$ **D** $y = 3x$
2 a 5 **b** $\frac{4}{7}$
3 6
4 a 220° **b** 295°
5 a 14 **b** 18 **c** 28
6 253 **7** £5250 **8** 0.375
9 a $\frac{9}{20}$ **b** $\frac{11}{24}$
10 iii
11 a 1 : 50 000 **b** 1 : 4 000 000
12 a $s = rt + 3t$ **b** $r = \frac{s-3t}{t}$
13 10 **14** $y \leq 3x, y \geq 2, x + y \leq 6$

page 529 **Revision exercise 5**

- 1** 5%
2 21%
3 6
4 25
5 a 8 **b** 140 **c** 33
d 42 **e** 6 **f** -6
6 $\frac{1}{6}$ **7 a** $9\pi \text{ cm}^2$ **b** 9
8 $33\frac{1}{3} \text{ mph}$ **9** 9
10 a 5.45 **b** 5 **c** 5
11 6 cm **12 a** $6x + 15 < 200$ **b** 29

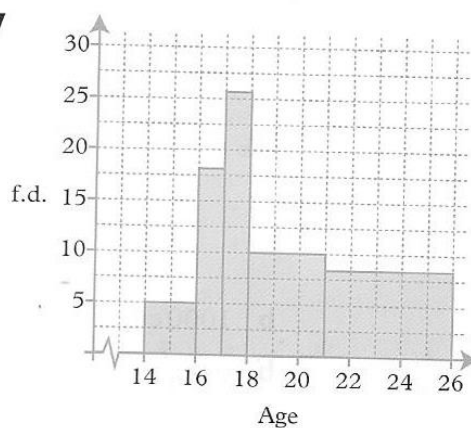
page 530 **Revision exercise 6**

- 1 a** 20.8% **b** £240
2 A $4y = 3x - 16$ **B** $2y = x - 8$
C $2y + x = 8$ **D** $4y + 3x = 16$
3 a 0.00 5 m/s **b** 1.6 s
c 172 800 m or 172.8 km
4 $c = 5, d = -2$

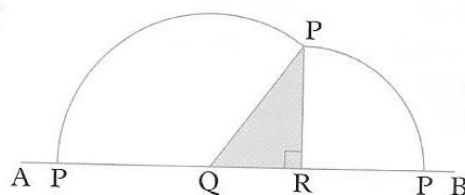
- 5 a** Reflection in $x = \frac{1}{2}$
b Reflection in $y = -x$
c Rotation 180° , centre (1, 1)
6 152° **7** $45^\circ, 225^\circ$
8 a $\frac{3}{5}$ **b** $w = \frac{k - ky}{y}$
9 a 50 **b** 50

page 531 **Revision exercise 7**

- 1** $x < \frac{3}{4}$ **2** 1.5×10^{11}
3 a $(x + 3)(x + 5)$ **b** $(x + 3)(x - 2)$
c $5x(x - 6)$
4 20 cm^2
5 a $\frac{1}{28}$ **b** $\frac{15}{28}$ **c** $\frac{3}{7}$
6 a 30 **b** 75
7



- 8** $x \geq 0, x + y \leq 7, y \geq x - 2$
9 a 600 **b** 9000 **c** 3 **d** 60
10 a 40° **b** 100°
11



page 532 **Revision exercise 8**

- 1 a** $x = 5$ or -3 **b** $x = 6$ or 2
2 -4
3 They arrive at the same time.
4 250 cm^3
5 a $3\frac{1}{3} \text{ cm}$ **b** 1620 cm^3
6 a $a = 50^\circ$ **b** $b = 128^\circ$
c $c = 50^\circ, d = 40^\circ$ **d** $y = 40^\circ, x = 10^\circ$

$$7 \frac{1}{12}$$

$$8 \frac{35}{48}$$

$$9 \text{ a } \frac{1}{9}$$

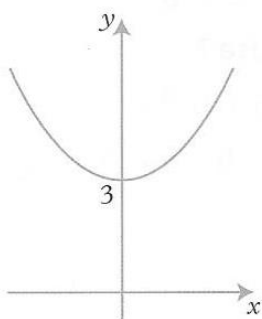
$$\text{b } \frac{1}{12}$$

$$\text{c } 0$$

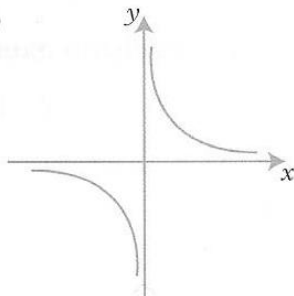
$$10 \text{ i } \frac{11}{20}b$$

page 533 **Revision exercise 9**

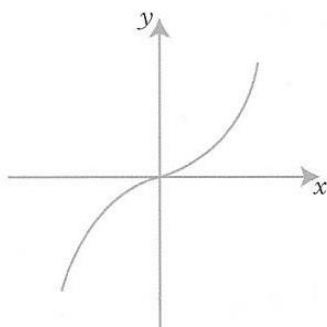
1 a



b



c



$$2 \text{ a } 1 \text{ m}^2$$

$$\text{b } 1000 \text{ cm}^3$$

$$3 \text{ a } y = \frac{1}{2}, -\frac{1}{2}$$

$$\text{b } y = \frac{7}{11}$$

$$4 \frac{5}{16}$$

$$5 \angle DAE = \angle BAE \text{ (as AE bisects angle A)}$$

$$\angle AED = \angle BAE \text{ (alternate angles)}$$

So triangle ADE is isosceles.

Thus $DE = AD$ and $AD = BC$ as ABCD is a parallelogram.

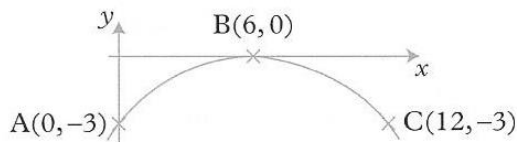
So $DE = BC$

$$6 \text{ a } 1\frac{5}{6}$$

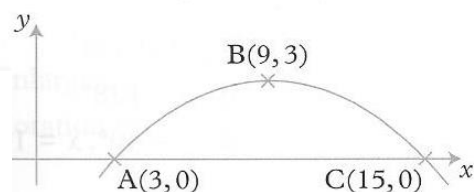
$$\text{b } 0.09$$

$$7 \text{ a } z = x - 5y \quad \text{b } m = \frac{11}{k+3} \quad \text{c } z = \frac{T^2}{C^2}$$

8 a



b



$$9 x = 13$$

$$10 \text{ a } a - c \quad \text{b } \frac{1}{2}a + c$$

$$\text{c } \frac{1}{2}a - \frac{1}{2}c \quad \text{NM is parallel to CA, and half as long.}$$

$$11 \text{ a } x = 3$$

$$\text{b } x = 0 \text{ or } 5$$

$$\text{c } x = 0$$

$$12 x = 0.65 \text{ or } 3.85$$

page 534 **Revision exercise 10**

$$1 201 \text{ cm}^2, 32.2 \text{ cm}^2$$

$$2 \text{ a } 123 \text{ p per litre}$$

$$\text{b } 760 \text{ miles}$$

$$3 \text{ a } 7.21 \text{ cm}$$

$$\text{b } 9.22 \text{ cm}$$

$$\text{c } 7.33 \text{ cm}$$

$$4 x = \pm 1.9$$

$$5 \text{ a } 2.088$$

$$\text{b } 3.043$$

$$6 7.62 \text{ cm}$$

$$7 \text{ a } 34.56 \text{ m}^3$$

$$\text{b } 14.1 \text{ m}^3$$

$$8 \text{ a } -14.88$$

$$\text{b } 58.44$$

$$\text{c } \frac{22}{35}$$

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

$$9 41.7\%$$

$$10 \text{ a } 198 \text{ cm}^3$$

$$\text{b } 1.36 \text{ cm}^3$$

$$\text{c } 145$$

page 535 **Revision exercise 11**

$$1 20.75 \text{ litres}$$

$$2 \text{ a } 12.2 \text{ cm}$$

$$\text{b } 61.1 \text{ cm}^2$$

$$3 2.3 \times 10^9$$

$$4 33.1\%$$

$$5 9.95 \text{ cm}$$

$$6 \text{ Maximum} = 123.25 \text{ cm}^2, \\ \text{Minimum} = 101.25$$

$$7 0.72\%$$

$$8 \text{ a } 0.5601$$

$$\text{b } 3.215$$

$$\text{c } 0.6161$$

$$\text{d } 0.4743$$

$$9 \text{ a } 84$$

$$\text{b } 19.2$$

$$10 0.335 \text{ m}$$

$$11 x = 1.24$$

$$12 \text{ a } 1.755$$

$$\text{b } 60.3^\circ$$

page 536 **Revision exercise 12**

$$1 \text{ The } 1 \text{ lb jar}$$

$$2 \text{ a } 290^\circ$$

$$\text{b } 60^\circ, 300^\circ$$

$$3 \text{ a } 0.340$$

$$\text{b } 4.08 \times 10^{-6}$$

$$\text{c } 64.9$$

$$\text{d } 0.119$$

$$4 \text{ a } 45.6^\circ$$

$$\text{b } 58.0^\circ$$

$$\text{c } 3.89 \text{ cm}$$

$$\text{d } 33.8 \text{ m}$$

5 3.63 m

6 Fig 1 3.43 cm² Fig 2 4.57 cm²

7 273 cm³

8 a 14.1 cm

b 35.3°

9 a $\frac{x}{x+5}$

b $\frac{x^2}{(x+5)^2}$

10 68 p

11 1.552 m

12 4.12 cm

13 a 0

b 16

c -8

4 a $x = -1.25$ or 2.92

b $x = 0.76$ or 5.24

5 4.74

6 5.39 cm

7 Mean = 13.6, Median = 11.5

8 45.2 km, 33.6 km

9 a 6.63 cm

b 41.8°

10 5.14 cm²

11 AB = 41.2 cm, AD = 9.93 cm

12 8.06 cm

13 89°

page 538 **Revision exercise 13**

1 2.1×10^{24} tonnes

2 17 kg

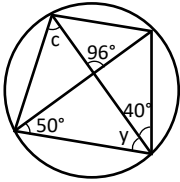
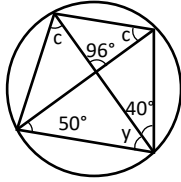
3 a $x = 14.1$ cm, 48.3 cm square

b 1930 cm²

page 539 **Revision exercise 14**

8, 9, 16, 20, 23, 29, 36, 41, 42

ERRORS IN TEXT

Page	Exercise	Question	Should be	Not
25	Ex 18	24	$\frac{543 + 472}{18.1 + 10.9}$	$\frac{543 \times 472}{18.1 + 10.9}$
		25	$\frac{112.2 + 75.9}{6.9 + 5.1}$	$\frac{112.2 \times 75.9}{6.9 + 5.1}$
89	Test yourself	6	0.34	0.34
131	26	6	for $-2 \leq x \leq 4$	for $22 \leq x \leq 4$
		12	for $-1 \leq x \leq 4$	for $21 \leq x \leq 4$
130	Ex 25	2f	$1 + \sqrt{3} + 3 + 3\sqrt{3} + \dots$	$1 + \sqrt{3} + 3\sqrt{3} + 9 + \dots$
352	Ex 23	6		
395	Ex 17	1i	$4x - x^2 - 3 < 0$	$4x - x^2 - 1 < 0$