

Answers

Chapter 1 Number skills

Are you ready?

- 1 a 2 b 10 c -14
 2 a -8 b 3 c -10
 3 a 7.8 b 6.74 c 10.043
 4 a 24 b 3.29 c 56.782 18
 5 a 7.94 b 6.23 c 182
 6 $2\frac{3}{5}$ 7 $\frac{37}{7}$
 8 a $1\frac{1}{10}$ b $\frac{11}{18}$ c $1\frac{1}{8}$
 9 a $\frac{1}{6}$ b $\frac{6}{11}$ c $2\frac{1}{2}$
 d $1\frac{1}{2}$ e 7 f $4\frac{2}{5}$
 10 a 0.48 b 0.05 c 0.189
 11 a 30 b 27

Exercise 1A — Order of operations using integers

- 1 a 16 b 0 c 9 d 9 e 12
 f 18 g 480 h 0 i 4 j 30
 k 12 l 18 m 26 n 68 o 12
 p 80 q 4 r 48 s 2 t 3
 2 a C b D c A
 3 a 12 b 10 c 8 d 6 e 0
 f 44 g 2 h 78 i 92 j 4
 k 0 l 3 m 14 n 0 o 340
 p 0
 4 3 5 \$235 6 \$245
 7 \$250, $100 + 2 \times (100 - 25)$
 8 a 5 b -7 c -26 d -1 e -11
 f -13 g 10 h -3 i 4 j 36
 k -60 l -1 m -3 n 24 o 30
 p -15
 9 a -2 b -11 c -11 d 13 e -3
 f 2 g 1 h 6 i -9 j -3
 k -4
 10 a B b E c C
 11 a 6 b -21 c -2 d -5 e -36
 f -48 g -16 h -2 i -11 j -40
 k 6 l -8 m 17 n -23 o -9
 p 2 q 42 r 1 s 38 t 18
 12 a B b E c D d B e A
 13 a + b \times c + d - e +, -
 f \times , + g \times , + h -, - i -, \times
 j \times , +, \times or \times , - k \div , - l +, + m -, +
 n -, \times or +, - o -, \times , +
 p -, -, \div or +, \times , -
 14 95 metres 15 22°C 16 16°C 17 30°C
 18 a A, B, D b C c C, D

Exercise 1B — Estimation and rounding

- 1 a i 5.9 ii 5.89 iii 5.893
 b i 67.8 ii 67.81 iii 67.806
 c i 712.1 ii 712.14 iii 712.138
 d i 81.1 ii 81.05 iii 81.054
 e i 504.9 ii 504.90 iii 504.896

- 2 a 26 b 317 c 1028 d 20
 3 a 3047.3 b 24.7 c 8.3 d 20.0
 4 a i 5.7 ii 5.74 iii 5.742 iv 5.7425
 b i 4.3 ii 4.31 iii 4.310 iv 4.3097
 c i 0.3 ii 0.29 iii 0.286 iv 0.2862
 d i 1.1 ii 1.07 iii 1.067 iv 1.0673
 e i 4.6 ii 4.59 iii 4.586 iv 4.5861
 5 a i 600 000 ii 570 000 iii 574 000 iv 574 200
 b i 400 000 ii 430 000 iii 431 000 iv 431 000
 c i 30 000 ii 29 000 iii 28 600 iv 28 620
 d i 1 000 000 ii 1 100 000 iii 1 070 000
 iv 1 067 000
 e i 500 000 ii 460 000 iii 459 000
 iv 458 600
 6 a 26 b 320 c 1000 d 20
 7 a 0.0852 b 0.000 580 c 0.000 008 07
 d 0.006 77 e 0.000 027 0 f 0.000 352
 8 a 3 b 800 c 800 d 10
 e 400 f 100 g 1200 h 270
 i 100 j 500 k 110 l 20
 m 100 000 n 696 o 60 000
 9 a D b D c D d B
 10 \$9000

10 Quick Questions 1

- 1 -18 2 6
 3 4 4 15
 5 -21 6 10
 7 \times , \div , +, or +, \div , \times 8 1.7466
 9 0.006 060 10 90

Maths Quest challenge (page 15)

- 1 10 km/h
 2 11 of digit 0, 21 of digit 1, 20 of all of the other digits

Exercise 1C — Decimals

- 1 a 9.774 b 2.377 c 39.424 d 23 e 23.1
 f 0.6 g -7.2 h 22.976 i 360 j 10
 k 44.95 l 13.2
 2 a 15.22 b 4.57 c 24.96 d 33.18 e 7.26
 3 a 0.4, 0.66, 0.71 b 0.23, 2.3, 23
 c 0.7, 1.04, 1.32 d 1.02, 1.1, 1.22
 e 0.06, 0.5, 0.56 f 0.323, 0.35, 0.4
 4 a 0.24, 0.204, 0.2004 b 0.11, 0.081, 0.062
 c 0.77, 0.707, 0.7 d 0.09, 0.082, 0.0802
 e 1.2304, 1.23, 1.204 f 0.39, 0.3592, 0.359
 5 a C b E c B d A
 6 a $\frac{9}{10}$ b $\frac{3}{5}$ c $\frac{4}{25}$ d $\frac{27}{100}$ e $\frac{39}{50}$
 f $\frac{3}{20}$ g $\frac{2}{25}$ h $1\frac{1}{2}$ i $2\frac{21}{25}$ j $\frac{1}{8}$
 k $\frac{121}{250}$ l $\frac{963}{1000}$ m $\frac{31}{40}$ n $\frac{1}{16}$ o $\frac{71}{80}$
 7 a 72% b 31% c 89% d 57%
 e 90% f 6% g 78.2% h 61.75%
 i 0.94% j 135% k 160.2% l 1100%
 m 230% n 575% o 248.5%

8 B 9 B 10 D

11 \$80.50

12 a \$50 b \$46.75

Maths Quest challenge (page 19)

1 36 apples 2 125 m² 3 90 s

Exercise 1D — Fractions

1 a $\frac{2}{3}$ b $\frac{4}{5}$ c $\frac{1}{2}$ d $\frac{8}{9}$ e $\frac{9}{10}$

f $\frac{5}{7}$ g $\frac{3}{8}$ h $\frac{7}{11}$ i $\frac{7}{12}$ j $\frac{1}{3}$

k $\frac{3}{4}$ l $\frac{3}{20}$ m $\frac{4}{5}$ n $\frac{1}{4}$ o $\frac{1}{3}$

2 a $4\frac{2}{5}$ b $4\frac{3}{7}$ c $12\frac{1}{4}$ d $6\frac{1}{6}$ e $2\frac{1}{3}$

f $4\frac{1}{4}$ g $2\frac{3}{4}$ h $5\frac{1}{3}$ i $9\frac{4}{5}$ j $7\frac{5}{6}$

3 a $\frac{15}{4}$ b $\frac{24}{5}$ c $\frac{28}{3}$ d $\frac{35}{6}$ e $\frac{39}{10}$

f $\frac{41}{7}$ g $\frac{31}{11}$ h $\frac{13}{8}$ i $\frac{113}{20}$ j $\frac{65}{17}$

4 a $\frac{17}{20}$ b $\frac{1}{4}$ c $\frac{3}{14}$ d $\frac{16}{25}$ e $1\frac{4}{35}$

f $\frac{29}{60}$ g $\frac{11}{20}$ h $1\frac{9}{16}$ i $\frac{151}{360}$ j $5\frac{7}{12}$

k $\frac{1}{2}$ l $4\frac{25}{48}$ m $1\frac{13}{14}$ n $6\frac{7}{25}$ o 0

p $3\frac{1}{3}$

5 a 45 b 21 c 30 d 54 e 13

f 52 g 105 h 14 i 176 j 90

6 a $\frac{1}{4}, \frac{3}{8}, \frac{1}{2}$ b $\frac{3}{10}, \frac{1}{3}, \frac{7}{20}$

c $\frac{3}{20}, \frac{1}{6}, \frac{1}{5}$ d $\frac{1}{2}, \frac{13}{20}, \frac{2}{3}, \frac{7}{10}$

e $\frac{7}{20}, \frac{19}{50}, \frac{2}{5}, \frac{11}{25}$ f $\frac{11}{16}, 1\frac{1}{4}, 1\frac{7}{12}, 1\frac{5}{6}$

g $\frac{3}{15}, \frac{7}{30}, \frac{1}{3}, \frac{2}{5}$ h $\frac{5}{19}, \frac{5}{18}, \frac{5}{17}$

i $-\frac{1}{5}, -\frac{1}{8}, \frac{1}{4}$ j $-\frac{79}{100}, -\frac{31}{40}, -\frac{19}{25}$

k $-\frac{1}{7}, -\frac{1}{9}, \frac{1}{10}, \frac{1}{8}$ l $-\frac{3}{4}, -\frac{2}{3}, \frac{2}{3}, \frac{7}{10}, \frac{4}{5}$

7 a 0.75 b 0.8 c 0.45 d 0.56

e 0.775 f 0.07 g 0.3125 h 0.0375

i 0.3 j 0.705 k 0.156 25 l 1.5

Each of the answers obtained is a terminating decimal.

8 a 0. $\overline{3}$ b 0. $\overline{18}$ c 0. $\overline{2}$

d 0.8 $\overline{3}$ e 0.285714 f 0.08 $\overline{3}$

g 0.230769 h 0.0 $\overline{6}$

Each of the answers obtained is an infinite decimal.

9 a 25% b 20% c $37\frac{1}{2}\%$ d $43\frac{3}{4}\%$ e 79%

f 72% g $73\frac{3}{4}\%$ h 55% i $83\frac{1}{3}\%$ j $77\frac{7}{9}\%$

k $71\frac{3}{7}\%$ l $36\frac{4}{11}\%$

10 a D b A c E d B e C

11 a Year 9 sold 50; Year 10 sold 10.

b 40 c $\frac{2}{5}$

12 $\frac{1}{4}$

Exercise 1E — Percentages

1 a 0.62 b 0.41 c 0.38 d 0.93 e 0.1
f 0.02 g 0.367 h 0.2125 i 2.5 j 3.157
k 8 l 0.006

2 a $\frac{97}{100}$ b $\frac{21}{50}$ c $\frac{2}{5}$ d $\frac{7}{10}$ e $\frac{11}{20}$

f $\frac{1}{2}$ g $\frac{1}{4}$ h $\frac{3}{10}$ i $\frac{5}{8}$ j $\frac{1}{3}$

k $\frac{19}{40}$ l $\frac{1}{12}$ m $\frac{9}{11}$ n $\frac{2}{7}$ o $\frac{4}{9}$

p $\frac{1}{6}$

3 a 5.68 b 208 c 884 d 7.02 e 22.41

f 42 g 13.06 h 23.375 i 9.1 j 3.28

k 35.25 l 100

4 a 75% b 27% c 30% d 64%

e 62.5% f 2.5% g 43.75% h 64%

i 72% j 50.4% k 25.8 $\frac{3}{4}\%$ l 78.5%

5 a A b D c E d C e A

6 a 1300 b 1600 c 4600 d 400 e 9

f 4.5 g 250 h 204 i 900 j 120

7 a 51.75 b 8236 c 78 d 122.4

e 162.18 f 690.1 g 1430 h 3.175

i 119

8 a 38.25 b 49.4 c 72 d 1279.34

e 4571 f 96.72 g 1.068 h 368 i 80

9 a A b C c B

10 \$200 000

11 \$63.75

10 Quick Questions 2

1 -9

2 $\frac{1}{28}$

3 $\frac{9}{20}$

4 0.003 950

5 0.67

6 85%

7 $\frac{31}{50}$

8 567.1631

9 $\frac{41}{7}$

10 \$59.33

Exercise 1F — Index notation, square roots and higher order roots

1 a 128 b 243 c 1 000 000 d 256

e 125 f 2.89 g 39.0625 h 29.791

i 9.3025 j 0.512

2 a $\frac{16}{25}$ b $\frac{8}{27}$ c $\frac{1}{64}$ d $\frac{81}{10000}$ e $\frac{49}{144}$

f $\frac{32768}{59049}$ g $\frac{1}{128}$ h $\frac{27}{64}$ i $\frac{1296}{2401}$ j $\frac{243}{3125}$

3 a 21 b 0.3 c 9 d 1.2 e 46

f 0.23 g 26 h 11.5 i 0.24 j 2.7

4 a 21.56 b 8.12 c 48.52 d 0.99 e 4.46

f 92.87 g 1.32 h 7.54 i 4.63 j 2.37

5 a 2.4 b 1.4 c 2.9 d 3

6 a 1.614 b 9.543 c 2.721 d 3.670

7 a $\frac{1}{9}$ b $\frac{3}{4}$ c $\frac{11}{13}$ d $\frac{2}{11}$ e $\frac{17}{27}$

f $\frac{6}{31}$ g $\frac{5}{12}$ h $\frac{7}{15}$

8 a 141 b 27.949 c 0.707 788 8 d 20.25

9 a 2.828 427 125 irrational

b $\frac{1}{2}$ or 0.5 rational

- c $\frac{5}{12}$ or 0.41 $\dot{6}$ rational
 d 0.816 496 580 9 irrational
 e 0.4 rational
 f 1.059 479 691 irrational
 g $\frac{3}{4}$ or 0.75 rational
 h 0.449 644 313 irrational

- 10 a D b A
 11 35 600
 12 778 000 000 km

Exercise 1G — Further estimation and calculator use

- 1 a 17.664 b 8.433 c -181.284 d -3.175
 e 6.794 f 3.933 g 19.458 h 0.946
 i 0.397 j 34.291 k -0.448 l 0.086
 m -3.846 n 4.345 o 1.131
 2 a 0.055 56 b 1.994 c -57.09 d 2.188
 e 1.104 f 27.98 g -0.017 30 h 82.53
 i 2.421
 3 a C b A

Exercise 1H — Ratios

- 1 a 2:3 b 1:7 c 1:3 d 2:5 e 4:3
 f 4:15 g 40:31 h 36:11 i 8:25 j 100:33
 2 a 6:1 b 13:15 c 4:1 d 5:1 e 1:2
 f 20:3 g 1:6 h 5:3 i 5:1 j 11:5
 k 43:20 l 1:200
 3 a 3:4 b 8:7 c 2:3 d 28:25 e 9:2
 f 2:7 g 10:3 h 33:16 i 23:15 j 16:65
 4 D
 5 a 1:4 b 6:5 c 100:39 d 23:2 e 1:12
 f 63:125 g 400:21 h 20:1 i 1:15 j 54:5
 6 D
 7 a 120 kg, 150 kg b 50 m, 550 m
 c 86 L, 129 L d 1875 mm, 3125 mm
 e 240 g, 180 g f 3.2 tonnes, 0.4 tonnes
 g \$1000, \$1500, \$1500 h 50 km, 75 km, 125 km
 i 100 mL, 150 mL, 450 mL
 j 33 h, 9 h, 6 h
 8 Maths 2 and Science 6
 9 Brother 25, sister 35
 10 a 6, 12, 18 b 40, 80, 120
 c 9.60, 19.20, 28.80
 11 \$1350, \$1650
 12 67.5°, 90°, 90°, 112.5°; Trapezium
 13 350 g; 500 g; 10 g
 14 a 175:6428 b 37

Exercise 1I — Applications

- 1 a -7.3°C b 10.6°C c 19° d 9°C e -14°C
 2 a \$190 b +\$103.04
 3 a \$25.88 b \$14.40 c \$1.45 d 9 h
 e \$786.30 f \$100.23 g 3944 mL
 4 209
 5 a $\frac{2}{3}$ of \$39 b 1045 c 8 d \$24 e 320 g
 6 \$457.19
 7 a 3740 b i 8% ii 2356
 c Roald by 2 $\frac{1}{2}$ % d \$19 000

- 8 1 608 000 000 000 000 000
 9 a B b B c B d D
 10 a 12.5 m b 80 mm × 72 mm
 11 a 7:5:4
 b Jane: \$14 000, Annette \$10 000, Bernadette \$8000

Summary

- 1 brackets 2 point
 3 significant 4 numerator, terminating, recurring
 5 decimal 6 divide, percentage
 7 amount 8 100
 9 add 10 ratio
 11 highest common factor
 12 quantity 13 real
 14 irrational

Chapter review

- 1 a 4 b 38 c 3 d 22
 2 a 51 b 2 c 6 d 20
 3 ×, ÷, -
 4 C and D 5 10 - 23 × -2
 6 a 5689.71 b 5700
 7 a 2160 b 2156.6
 8 B and C
 9 Any number between 15.395 and 15.405.
 10 Any decimal greater than 0.6 and less than 0.6.
 11 a 36.615 b -2.95
 12 a $\frac{7}{8}$ b $\frac{6}{25}$ c $\frac{11}{20}$ d $\frac{73}{200}$ e $\frac{31}{125}$
 f $\frac{13}{100}$ g $\frac{3}{4}$ h $\frac{23}{40}$ i $\frac{93}{250}$ j $\frac{2}{5}$
 13 a $\frac{5}{8}$ b $\frac{4}{5}$
 14 a 71% b 240% c 93.75% d 16 $\frac{2}{3}$ %
 15 E
 16 a 0.375 b 0.05 c 0.16 d 0.857142
 17 $\frac{6}{7}$
 18 a 24 b 383.5 c 373.8
 19 a 0.12 b 0.346 c 0.875 d 8.25
 20 a $\frac{13}{25}$ b 1 $\frac{3}{10}$ c $\frac{2}{7}$
 21 182.4 22 1500
 23 a 57%, $\frac{29}{50}$, 0.6 b 23 $\frac{1}{2}$ %, $\frac{6}{25}$, 0.245
 24 a 0.83, 82%, $\frac{4}{5}$ b $\frac{5}{12}$, 0.416, 41%
 25 45 26 A 27 150%
 28 31.5
 29 a 36 b 2.05 c 1.1
 30 a 267.968 75 b 875 000
 31 a i 4.273 ii 4.27 b i 0.380 ii 0.380
 32 20
 33 a C b A c B
 34 Miss Alan \$5600, Mr Bradley \$4200,
 Mrs Cato \$9800, Ms Dawn \$8400
 35 C 36 B
 37 40 litres 38 219 030 litres
 39 a 567 km b \$115.50

Chapter 2 Pythagoras' theorem

Are you ready?

- 1 a i AC = 4.5 cm ii $\angle ABC = 90^\circ$
 b i DE = 6.5 cm ii $\angle DFE = 130^\circ$
 2 a 36 b 64 c 25

- 3 Approximately 57 mm
 4 a 7 b 5.1 c 11.7
 5 a 3.43 b 89.80 c 288.00
 6 a 2.5 cm b 700 mm c 0.001 25 km
 7 13.7 cm 8 8 cm²

Exercise 2A — Right-angled triangles

1

	a	b	c	d	e	f
a	19	24	27	16	31	41
b	35	32	30	40	25	19
c	40	40	40	43	40	45
a ²	361	576	729	256	961	1681
b ²	1225	1024	900	1600	625	361
a ² + b ²	1586	1600	1629	1856	1586	2042
c ²	1600	1600	1600	1849	1600	2025

- 2 $a^2 + b^2 \approx c^2$
 3 $a^2 + b^2 = c^2$
 4 $a^2 + b^2 \neq c^2$
 5 The angle sum of a triangle is 180°. If a triangle contained two right angles, the third angle would be 0°, which would mean it was a straight line rather than a triangle.

History of mathematics

- 1 The island of Samos
 2 $c^2 = a^2 + b^2$
 3 Sets of three numbers that obey Pythagoras' theorem
 4 Plato

Exercise 2B — Using Pythagoras' theorem

- 1 a $x = 5$ b $x = 13$ c $x = 25$
 d $x = 21.3$ e $x = 1163.3$ f $x = 6.3$
 2 a 7.86 b 33.27 c 980.95
 d 12.68 e 2.85 f 175.14
 3 12.65 cm
 4 a 14.14 cm b 24.04 mm c 4.53 cm
 5 a 12.81 cm b 737.83 cm c 17.26 cm
 6 18.03 cm
 7 19.23 cm
 8 4.66 m
 9 39 m
 10 4.34 km
 11 38.2 m
 12 130 mm
 13 a 55.71 cm b 29.71 mm c 57.27 m
 d 3098.08 mm e 6.53 m f 5.74 km
 g 10.16 m h 3.16 km
 14 a C b C
 15 54.67 mm
 16 36.37 cm
 17 0.51 m
 18 6.43 km
 19 21.46 diagonals, so would need to complete 22
 20 5889.82 m

Exercise 2C — Finding a shorter side

- 1 a 6 b 9.6 c 7.8
 d 250.8 e 3.6 f 54.5
 2 a 36.36 b 1.62 c 15.37
 d 0.61 e 2133.19 f 453.90

- 3 23.04 cm
 4 a 97.47 cm b 334.94 cm c 6822.90 cm²
 5 17.32 cm
 6 65.82 cm; 2501.16 cm²
 7 2.60 m
 8 1.32 m
 9 127.89 m
 10 Yes
 11 20.61 m
 12 a 386.13 mm b 62.09 cm c 2.33 km
 d 16.15 cm e 541.70 cm f 2615.61 m
 g 478.97 mm h 369.87 km
 13 a 176.16 cm b 147.40 cm c 2.62 km
 d 432.12 m e 165.88 m f 6811.55 m
 14 a B b E
 15 a 28 cm b 588 cm²
 16 552.86 cm²
 17 8.65 m
 18 1600 mm
 19 7.07 cm
 20 a 6.06 b 4.24 c 0.87
 21 \$81.60
 22 185 cm

10 Quick Questions 1

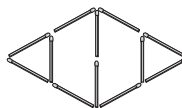
- 1 a True b False c False
 2 5.39 cm 3 11.6
 4 B 5 3.16 m
 6 4.33 m 7 6.7 cm
 8 42.21 cm² 9 10.6 km
 10 9.7 cm

Exercise 2D — Composite shapes

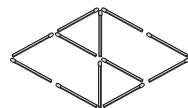
- 1 8.06 cm
 2 a $x = 7.62$ b $x = 60$ c $x = 20.87$
 3 a $x = 4$, $y = 9.17$ b $x = 6.93$, $y = 5.80$
 c $x = 13$, $y = 15.20$ d $x = 19.55$
 4 a C b B c C d D
 5 12 mm; 480 mm²
 6 20 m
 7 917.88 m
 8 a 4 km b 5 km c 24 m
 9 2.45 m
 10 11.35 m
 11 10.16 m³
 12 3.67 km
 13 26.65 m
 14 a 2606 mm b 3007 mm
 15 18.44
 16 $a = \sqrt{2}$, $b = \sqrt{3}$, $c = \sqrt{4} = 2$, $d = \sqrt{5}$

Maths Quest challenge (page 76)

- 1 36 hours
 2 Possible answers:



OR



Exercise 2E — Pythagorean triads

- 1 Yes: a, b, d, e No: c, f
 2 Answers will vary. Possible answers:
 a 6, 8, 10; 9, 12, 15; 12, 16, 20
 b 10, 24, 26; 15, 36, 39; 20, 48, 52

- 3 a 40, 41 b 60, 61 c 84, 85 d 420, 421
 4 The two larger numbers are consecutive numbers.
 5 a 12, 35, 37 b 33, 56, 65 c 48, 55, 73
 d 85, 132, 157 e 115, 252, 277 f 60, 221, 229
 6 a Yes b Yes

10 Quick Questions 2

- 1 7.6 cm 2 13.0 m
 3 B 4 2.32 m
 5 4.408 m^2 6 False
 7 Yes 8 No
 9 15, 112, 113 10 39, 80, 89

Exercise 2F — Pythagoras in 3-D

- 1 a 17.32 b 12.25 c 15.12
 2 12.21, 12.85
 3 4.84 m, 1.77 m
 4 11.31, 5.66
 5 31.62 cm
 6 6 cm
 7 12.65 cm
 8 23 mm
 9 No: maximum stick can only be 115 cm long.
 10 3.41 cm
 11 a i 283.02 m ii 240.21 m iii 150.33 m
 b 141.86 m
 12 14.72 cm
 13 11.40 cm
 14 42.27 cm
 15 1.3 m, 5.98 m^2
 16 $\sqrt{3}x$ or $1.732x$

Summary

- 1 hypotenuse 2 right angle
 3 Pythagoras' 4 length
 5 units 6 convert
 7 diagram 8 right-angled triangles
 9 Pythagorean triads 10 $M = \frac{S^2 - 1}{2}$
 11 expressions 12 solve
 13 pyramids 14 original

Chapter review

- 1 $c^2 = a^2 + b^2$
 2 a 11.06 cm b 12.40 cm
 c 4.30 m or 429.70 cm
 3 0.9 m
 4 183.58 cm
 5 373.36 cm
 6 a 113.06 cm b 83.46 mm
 c 5.55 cm or 55.50 mm
 7 19.9 metres
 8 1558.85 cm^2
 9 a 9.48 cm b 4.45 mm c 0.65 m
 10 a 12.69 b $l = 11.53$ $k = 10.34$
 11 a 64.81 cm b 84.07 m
 12 592.71 m
 13 59.24 m
 14 a Yes b No c Yes
 15 8.25 mm
 16 22.72 cm

Chapter 3 Introductory algebra

Are you ready?

- 1 a $6 + 4$ b 2×5 c $7 - 3$
 2 a D b E c A
 d B e C
 3 a $3a, -4a, a$ b $5x, x, \frac{1}{2}x$
 c $7qp, 7pq$ d $ac, 2ac$
 4 a 13y b $3n + 4m$
 c $7x + 4$ d $9k + 2p$
 5 a 12x b $21ab$
 c $-5kp$ d $6m^2n$
 6 a 3x b 15
 c 4 d $-7xy$
 7 a 18 b -15 c -3
 d 9 e 25 f 80
 g 60 h 2

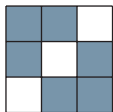
Exercise 3A — Using pronumerals

- 1 a 3 b 7 c -2 d -8 e 1
 f -1 g $\frac{1}{3}$ h $\frac{1}{2}$ i $-\frac{1}{4}$ j $-\frac{1}{9}$
 2 a 6 b 7 c 3 d -2 e 3
 f -2 g -7 h -11 i $-\frac{2}{3}$ j $\frac{1}{4}$
 k 1 l 0
 3 a i 3 ii 5 iii 8 iv $5x^2$
 b i 3 ii -9 iii -6 iv $-9m^2$
 c i 4 ii 5 iii 5 iv $-7x^2$
 d i 4 ii 9 iii 4 iv $-9b^2$
 e i 5 ii 11 iii -4 iv $-7q$
 f i 5 ii -9 iii 5 iv $-9p$
 g i 4 ii 4 iii -2 iv $-3ac$
 h i 5 ii 5 iii 9 iv $-3u$
 i i 5 ii -1 iii 8 iv $-m$
 j i 5 ii 7 iii 14 iv $-3cd^2$
 4 a $p + 2$ b $q - 7$ c $3p + 2$ d $9q - 7$
 e $10 - 4p$ f $5 - 2p$ g $p + q$ h $p - q$
 i $3p + q$ j $p - 2q$ k pq l $4pq$
 m $2p + 3q$ n $2q - 3p$ o $\frac{p}{2q}$ p $\frac{3q}{p}$
 5 a B b D c A d B
 6 a 11 b $x + 5$ c $y + 5$
 7 a 3.5 km b $(x + 2) \text{ km}$
 8 a 4 b $2.5 + t$ c $2.5 - y$
 9 a $10n$, where n = number of shirts
 b $N + 30$, where N = Nick's dollars
 c $7g - 4$, where g = goals scored
 10 a i 94 ii $6x + y$ b i 66 ii $6p + q$
 c i 28 ii $6x + y - 6p - q$
 11 xy dollars 12 $\frac{x}{y}$ dollars worth of chips
 13 a $\frac{x}{n}$ b $\frac{x}{2n}$
 14 a $(30 - d) \text{ cm}$ b $\frac{30 - d}{4} \text{ cm}$
 c $\frac{3(30 - d)}{4} \text{ cm}$
 15 a $\frac{x}{4}$ b $\frac{x}{6}$ c $\frac{x}{4} - \frac{x}{6}$

- 16 a** $\frac{24-c}{7}$ hours **b** $(c + \frac{24-c}{7})$ hours
- 17 a** 1 **b** 8.30 pm and 9.30 pm **c** 5 **d** 24
- e** 7.30 pm and 8.00 pm
- f** None of Marty's friends left and then returned, and also nobody arrived who hadn't been invited.
- g** Check with your teacher.

Maths Quest challenge (page 100)

- 1** Possible answer:



- 2 332 pages
3 6 years ago

Exercise 3B — Simplifying algebraic expressions

- | | | | | | | | | | | |
|----------|----------|--------------------------|----------|------------------|---------------------------|-------------------|----------|--------------------------|----------|---------------------------|
| 1 | a | $9ab, -ab$ | b | $4x$ | c | $2x^2, -x^2$ | d | $-x^2y^5, -3x^2y^5$ | e | $4y^5z^4x^2, -2x^2z^4y^5$ |
| | c | $-3za, -az$ | | d | $2x^2, -x^2$ | | f | $-x^2y^5, -3x^2y^5$ | | g |
| | e | $-2x^2y$ | | f | $-x^2y^5, -3x^2y^5$ | | g | $p^3x^2w^5, -5x^2p^3w^5$ | | h |
| | g | $p^3x^2w^5, -5x^2p^3w^5$ | | h | $4y^5z^4x^2, -2x^2z^4y^5$ | | i | | | j |
| 2 | a | $7x$ | b | $11y$ | c | $19m$ | d | $11q$ | e | $8r$ |
| | f | $5x$ | g | $8a$ | h | $8y$ | i | $13x$ | j | $16p$ |
| | k | $9q^2$ | l | $3x^2$ | m | $8x^2 - 3y$ | | | | |
| | n | $2m^2 + 2n$ | | o | $7x^2 + x$ | | | | | |
| | p | $9h^2 + h + 9$ | q | $-2g^2 + g - 12$ | r | $-5m^2 + m + 15$ | | | | |
| | s | $12a^2 + b + 4b^2$ | t | $3m + 7n^2$ | u | $12xy + 2y^2$ | | | | |
| | v | $2ab + 5a^2b$ | w | $16x^2y - 3xy$ | x | $m^2n + 11n$ | | | | |
| | y | $-3xy + 9x^2$ | z | $8m^2n + 5mn^2$ | | | | | | |
| 3 | a | B | b | D | c | A | d | D | | |
| 4 | a | $6mn$ | b | $20xy$ | c | $8pq$ | d | $-10xy$ | | |
| | e | $-12xy$ | f | $15mn$ | g | $10a^2$ | h | $20y^2$ | | |
| | i | $5p^2$ | j | $7m^2$ | k | $6mnp$ | l | $-6ab^2$ | | |
| | m | $10m^2n$ | n | $-18a^2b$ | o | $30x^3y^2$ | p | $-12p^2q^3$ | | |
| | q | $-56c^3d$ | r | $30a^4b^7$ | | | | | | |
| 5 | a | $3x$ | b | $3m$ | c | $2y$ | d | $4m$ | e | $4m$ |
| | f | $2x$ | g | $-7x$ | h | $-4m$ | i | $\frac{m}{2}$ | j | $\frac{x}{3}$ |
| | k | $\frac{4m}{9}$ | l | $\frac{4x}{3}$ | m | $\frac{1}{5m}$ | n | $\frac{1}{2a}$ | o | $2yz$ |
| | p | $\frac{35ab}{2}$ | q | $\frac{xy}{4}$ | r | $-\frac{7yz}{11}$ | | | | |
| 6 | a | $40x^2y^2$ | b | $56ax^2y^2$ | c | $12x^3y^2$ | | | | |
| | d | $\frac{x^2}{2y}$ | e | $-\frac{5a}{4b}$ | f | 2 | | | | |
| | g | $40a^3b^2$ | h | $-8a^3b^3$ | i | $16a^4$ | | | | |

Maths Quest challenge (page 104)

- 1 Let D = dark coloured counter, L = light coloured counter, S = empty space so starting position is DDSLL.
- Solution is: DDL~~S~~L, D~~S~~LDL, S~~D~~LDL, L~~D~~SDL, L~~D~~LS, L~~D~~LS~~D~~, L~~S~~LDD, L~~L~~SDD
- 2 Possible solution is DDDLSLL, D~~D~~SLDLL, D~~S~~DLDLL, D~~L~~DS~~D~~LL, D~~L~~DL~~S~~L, D~~L~~DL~~D~~LS, D~~L~~DL~~S~~D, D~~L~~SL~~D~~LD, S~~D~~LD~~L~~LD, L~~S~~DL~~D~~LD, L~~L~~DS~~D~~LD, L~~L~~DL~~S~~D, L~~L~~DL~~S~~DD, L~~L~~SL~~D~~DD, L~~L~~L~~S~~DD.

Exercise 3C — Algebraic fractions

- | | | | | | |
|----------|--|--|-------------------------------------|---------------------------|---------------------------|
| 1 | a $\frac{7x}{12}$ | b $\frac{y}{6}$ | c $-\frac{m}{8}$ | d $\frac{x}{4}$ | e $\frac{9m}{14}$ |
| | f $\frac{2t}{15}$ | g $\frac{13a}{10}$ | h $-\frac{p}{6}$ | i $\frac{17q}{15}$ | j $\frac{x}{6}$ |
| | k $\frac{17x+7}{15}$ | | l $\frac{24a-17}{30}$ | | |
| 2 | a $-\frac{1}{2p}$ | b $\frac{11}{10x}$ | c $-\frac{11}{4m}$ | d $\frac{7}{20b}$ | e $\frac{25}{18c}$ |
| | f $\frac{22}{15y}$ | | g $\frac{4p+1}{(p-1)(p+4)}$ | | |
| | h $\frac{10m+46}{(m+7)(m+3)}$ | | i $\frac{5x+19}{(x-1)(x+2)}$ | | |
| 3 | a $\frac{12x}{(x-2)(x-3)(x+1)}$ | b $\frac{3x-22}{(x+5)(x-2)(x-4)}$ | | | |
| 4 | a 3 | b 2 | c $\frac{1}{4}$ | d $\frac{1}{5}$ | e 3 |
| | f $\frac{1}{3}$ | g $\frac{m}{12}$ | h $\frac{n}{6}$ | i 14 | j $\frac{1}{9}$ |
| | k $\frac{8}{y}$ | l $\frac{5x}{3}$ | m $\frac{4}{21}$ | n $\frac{2}{45}$ | o $\frac{1}{4}$ |
| 5 | a 3 | b 2 | c $\frac{1}{3}$ | d $\frac{1}{4}$ | e 3 |
| | f $\frac{1}{3}$ | g 4 | h $\frac{10}{3}$ | i $\frac{3}{2}$ | j $\frac{7b}{4}$ |
| | k $\frac{3m}{5}$ | l $\frac{8b}{3}$ | m $\frac{3q}{5}$ | n $\frac{1}{2}$ | o $\frac{x}{5}$ |

10 Quick Questions

- | | | |
|--------------------------|------------------|---|
| 1 $5m + 4n$ | 2 $6 - x$ | 3 $(60 - p)$ cm |
| 4 $4y^2 - 2y + 2$ | 5 $8mn$ | 6 $\frac{x}{8}$ |
| 7 $\frac{7x}{10}$ | 8 $6yz$ | 9 $\frac{23}{20b}$ 10 $\frac{7z}{12}$ |

History of mathematics

- 1 Heron invented machines and toys such as fountains, syphons and steam engines which were operated by water, steam or compressed air.
- 2 It works out the area of a triangle using the side lengths of the triangle.
- 3 He was the head of the observatory at Ujjain in India.
- 4 It works out the maximum area of a quadrilateral using the side lengths.
- 5 Heron's formula is the same as Brahmagupta's with one of the side lengths set to 0.

Exercise 3D — Substitution and formulas

- | | | | | | | |
|---|---|-----------|---|-------|-----------|-------|
| 1 | a | 7 | | b | -40 | |
| | c | 7 | | | | |
| 2 | a | 32 volts | | b | 250 volts | |
| | c | 240 volts | | d | 245 volts | |
| 3 | a | 15 | b | 10 | c | 18 |
| | d | 45 | e | 30 | f | 10.72 |
| | g | 21 | h | 22.4 | i | 50 |
| | j | 171 | k | 4 | l | -30 |
| | m | 32.75 | n | 38.33 | o | 34.54 |

- 4 a i 12 cm^2 ii 5 cm^2 iii 1.5 cm^2
 b i 15 ii $6\frac{2}{3}$ iii 0
 c i 5 ii 13 iii 10
 d i 63 cm^3 ii 580 cm^3 iii 8.28 cm^3
 e i 10 ii 15 iii 20
 f i 19.44 ii 32.4 iii 10
 g i 461.58 ii 69 360.09 iii 78.11
 h i 1670.48 ii 150.72 iii 226.33

Summary

- term
- coefficient
- pronumeral
- equation
- like
- $10x - y$
- worded question
- like terms
- lowest common denominator
- denominators, cancelling
- multiplication, reciprocal
- substitute

Chapter review

- 1 a i 4 ii -8 iii -5 iv $-8xy^2$
 b i $y + 8$ ii $x - y$ iii $x + y$ iv $7xy$
 v $5y - 2x$
- 2 a xy dollars b i $(24 - k) \text{ m}$ ii $\frac{24 - k}{3} \text{ m}$
- 3 a $17p$ b $10m^2$
 c $y^2 + 2y$ d $10ab + 3b^2$
 e $-3s^2t$ f $4x + 9xy$
 g $16c^2d - 2cd$ h $5x^2y - 6$
 i $n^2 - 2p^2q + 6$ j $15ab - 3a^2b^2$
- 4 a $12ab$ b $-5y^2$ c $2ab^2$ d $6p^2q$ e $8x^2y^2$
 f $5a$ g $\frac{x}{3}$ h $\frac{1}{7m}$ i $\frac{9}{2b}$ j $\frac{1}{5}$
- 5 a $\frac{7x}{10}$ b $\frac{x}{12}$ c $\frac{x}{8}$ d $\frac{31}{24m}$ e 2
 f $\frac{1}{4}$ g $\frac{1}{4}$ h $\frac{2}{5}$ i $\frac{2}{3}$ j 2
 k $\frac{1}{6}$ l $\frac{3}{7}$ m $\frac{x}{6}$ n $\frac{5}{2b}$
- 6 a 23 b 134
- 7 a 307.72 cm^3 b 5377.26 cm^3

Chapter 4 Indices

Are you ready?

- 1 a Base is 3, power is 4
 b Base is 2, power is 5
 c Base is 15, power is 7
- 2 a 16 b 125 c 4096
- 3 a 3 b 11 c 17
- 4 a 8 b 10 c 5
- 5 a 2 b 5 c 9
- 6 a 4 b 6 c 1
- 7 a 5 b 10 c 6
 d 4 e 2 f 5
- 8 a 4.7958 b 10.0995 c 6.3246
 d 3.9149 e 2.2240 f 4.9324

Exercise 4A — Index notation

- 1 a Base = 4, power = 7 b Base = 3, power = 8
 c Base = 5, power = 0 d Base = 7, power = 12
 e Base = 123, power = 3 f Base = 2, power = 141
 g Base = p , power = 3 h Base = e , power = 7
 i Base = k , power = 10 j Base = q , power = 4
- 2 a 3^6 b 7^4 c e^4 d 5^5 e $4a^7$
 f $7y^3$ g d^1 h $(\frac{3}{4})^5$ i $(-8)^6$
- 3 a 3×3 b $4 \times 4 \times 4 \times 4 \times 4$
 c $9 \times 9 \times 9$ d $8 \times 8 \times 8 \times 8$
 e $p \times p \times p \times p \times p \times p \times p$ f $b \times b \times b$
 g $k \times k \times k \times k \times k \times k$ h $a \times a \times a \times a$
 i $-9 \times -9 \times -9 \times -9 \times -9 \times -9 \times -9$
 j $-11 \times -11 \times -11 \times -11$
 k $\frac{7}{11} \times \frac{7}{11} \times \frac{7}{11} \times \frac{7}{11} \times \frac{7}{11} \times \frac{7}{11} \times \frac{7}{11} \times \frac{7}{11}$
 l $29 \times d \times d \times d \times e \times e \times e \times e \times e$
 m $3 \times e \times e \times e \times e \times e \times e \times f \times f$
 n $4 \times p \times p \times p \times p \times p$
 o $7 \times t \times t \times p \times p \times p \times p \times p$
 p $12 \times q \times q \times q \times r \times r \times r \times t$
 q $12 \times a \times a \times b \times b \times b \times b \times c \times c \times c$
- 4 a 16 b 2187 c 1000 d 512
 e 256 f 125 g 1296 h 1
- 5 a B b E
- 6 a $6a^2b^3$ b $4p^3r^4$ c $15e^4y^2$ d $30c^3z$
 e $7d^2f^5g^2$ f $18h^2i^3j^3$ g $35ek^3m^2$ h $40n^5p^2q$
 i $(\frac{3x}{8})^3(\frac{11}{7y})^2$ j $(\frac{2}{5x})^5(\frac{3y}{13})^2$
- 7 a $2^2 \times 3$ b $2^3 \times 3^2$ c 3×5^2
 d $2^4 \times 3 \times 5$ e $2^7 \times 5$ f $2^3 \times 5^2 \times 7^2$
- 8 The second option is better.

Exercise 4B — Multiplication using indices

- 1 a $3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$
 b $e \times e \times e \times e \times e \times e \times e \times e \times e = e^8$
 c $f \times f \times f \times f \times f \times f \times f \times f \times f \times f = f^{10}$
 d $9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 = 9^{10}$
 e $e \times e \times e \times e \times e \times e \times e \times e \times e \times e = e^{10}$
 f $u \times u \times u \times u \times u \times u \times u \times u \times u \times u = u^{10}$
- 2 a 2^9 b 3^{17} c 6^{10} d 10^6 e 4^9
 f g^{14} g h^3 h a^{11} i p^{15} j q^{47}
 k h^{23} l k^{32}
- 3 a 2^{12} b 3^{18} c 9^{17} d 10^{11} e 12^6
 f a^{12} g p^{22} h e^{23} i g^{28} j e^{38}
 k $3b^{13}$ l $5d^{16}$
- 4 a A b B
- 5 a $20p^{11}$ b $6x^8$ c $56y^{10}$ d $21p^8$
 e $84t^6$ f $30q^{15}$
- 6 a $6a^6e^7$ b $8p^6h^{12}$ c $80m^9$ d $6g^3h^6$
 e $30p^6q^9$ f $48u^9w^7$ g $27d^{11}y^{17}$ h $42b^{14}c^9$
 i $24r^{16}s^{18}$ j $60h^{38}v^{20}$

Maths Quest challenge (page 133)

- 1 \$10 240
 2 525, 526, 527
 3 $3\frac{1}{2}$ minutes

Exercise 4C — Division using indices

- 1 a b^3 b w^4 c $q^0 = 1$
 2 a 5 b 7^7 c s^4 d z^5 e i^3
 f 6 g 10^4 h c^4 i i^{33} j h^{77}
 k b^{70} l f^{900}
 3 a $3x^2$ b $6y^2$ c $8w^7$ d $3q^4$ e $8f^9$
 f $10h^{90}$ g $4j^{10}$ h $5p^{10}$ i $8g^3$ j $\frac{3b^6}{2}$
 k $\frac{9m^4}{2}$ l $\frac{5n^{90}}{2}$
 4 a E b A
 5 a $3p^4$ b $6r^4$ c $9a^3$ d $3b^6$ e $20r^4$
 f $9q$
 6 a $\frac{3p^5}{2}$ b $\frac{8b^5}{3}$ c $\frac{5m^{10}n^6}{6}$ d $\frac{9x^8y}{4}$
 e $\frac{4hk^3}{3}$ f $3j^5f^3$ g $\frac{4p^2rs}{3}$ h $\frac{9a^5b^3c}{2}$
 i $\frac{20f^6g^2h^4}{3}$
 7 a $16d^5$ b $5a^9b^3$ c $\frac{7k^2l^3}{24}$

Exercise 4D — Zero index

- 1 a 1 b 1 c 1 d 1
 2 a 1 b -1 c 1 d 1
 e 3 f 5 g 1 h 8
 3 a $4r^3$ b 5 c 13 d $\frac{5}{3}$
 e 3 f $2b^2$ g $\frac{d^2}{2}$ h 1
 4 a 1 b 1 c 1 d 4
 e 4 f 10
 5 a 1 b -1 c 3 d 1
 e 0 f -15 g 9 h $-12 - 7p$
 6 a 1 b $\frac{3}{2}$ c $\frac{2}{3}$ d $\frac{3a^2}{2}$
 e $\frac{2r^5}{3}$ f $\frac{g}{2}$ g $\frac{r^6}{3}$ h $\frac{2d^9f^4}{3}$
 7 a B b D c D d A e E
 8 a 1 b 2 c 2 d 2
 e 2 f $\frac{h^2}{2}$ g $\frac{q^4}{5}$ h $\frac{n^3}{5}$
 i v^2 j $2x^6$

Maths Quest challenge (page 141)

1 33

2

5	14	15	8
4	18	11	9
17	7	6	12
16	3	10	13

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

10 Quick Questions 1

- 1 a Base = b b power = 7
 2 z^5 3 $2^3 \times 5$
 4 27 5 262.144
 6 1639 7 g^8
 8 p^{10} 9 1
 10 q

Exercise 4E — Raising a power to another power

- 1 a e^6 b f^{80} c p^{100}
 d r^{144} e a^8b^{12} f p^5q^{15}
 g $g^{30}h^{20}$ h $81w^{36}q^8$ i $49e^{10}r^4q^8$
 2 a p^8q^6 b $r^{15}w^9$ c $b^{10}n^{18}$
 d $j^{18}g^{12}$ e q^4r^{20} f $h^{24}j^{16}$
 g $f^{16}a^{21}$ h $t^{10}u^8$ i $i^{15}j^{12}$
 3 a 2^{20} b t^{33} c a^{21} d b^{24}
 e e^{66} f g^{39} g $324a^{20}$
 h $216d^{27}$ i $40\,000r^{54}$
 4 B 5 B 6 E
 7 a a^6 b m^4 c n^3 d b^8
 e f^{17} f g^6 g p^9 h y^2
 i c^{20} j f^7 k k^{14} l p^{16}
 8 a $\frac{9b^8}{d^6}$ b $\frac{25h^{20}}{4j^4}$ c $\frac{8k^{15}}{27t^{24}}$ d $\frac{49p^{18}}{64q^{44}}$
 e $\frac{125y^{21}}{27z^{39}}$ f $\frac{256a^{12}}{2401c^{20}}$ g $\frac{-64k^6}{343m^{18}}$ h $\frac{16g^{28}}{81h^{44}}$
 9 a i 1 ii -1 iii -1 iv 1
 b $(-1)^{\text{even}} = 1$ $(-1)^{\text{odd}} = -1$

Exercise 4F — Negative indices

- 1 a $\frac{1}{4}$ b $\frac{1}{6}$ c $\frac{1}{m}$ d $\frac{1}{p}$
 2 a 5^{-1} b 8^{-1} c a^{-1} d q^{-1}
 3 a $\frac{1}{x}$ b $\frac{1}{a}$ c $\frac{1}{b}$ d $\frac{1}{w}$
 4 a $\frac{1}{25}$ b $\frac{1}{8}$ c $\frac{1}{g^4}$ d $\frac{1}{k^6}$
 5 a 7^{-2} b y^{-5} c z^{-4} d v^{-3}
 6 a $\frac{1}{x^3}$ b $\frac{1}{y^4}$ c $\frac{1}{z^6}$ d $\frac{1}{q^7}$
 e $\frac{1}{m^4}$ f $\frac{3}{m^2}$ g $\frac{5q}{p}$ h $\frac{1}{6m}$
 7 a $\frac{1}{a}$ b $\frac{36}{p^5}$ c $\frac{21g^6}{h^3}$ d $\frac{20}{p}$
 e s f $\frac{7p^4}{q^4}$ g $3r^6$ h $\frac{15a}{b^4}$

Maths Quest challenge (page 146)

1 8

2 6

3 2

Exercise 4G — Square roots and cube roots

- 1 a 2 b 4 c 10 d 7 e 9 f 12
 2 a b b c c d d a^2
 3 a $2t$ b $3b$ c $10f$ d $9g^2$
 e $5h^2$ f $4y^2$
 4 a 2 b 1 c 4 d 35
 e 5 f 2.1544 g 2.4662 h 2.7144

- 5 a e b t c b d y^2
 6 a $2p$ b $4x$ c $5at$ d $10p^2$
 e $6y^2$ f $15z^2t$ g $3ed^2$ h $7f^2g^2$
 7 a B b D c A

10 Quick Questions 2

- 1 q^9 2 p^2
 3 5 4 a^{40}
 5 $2s^6t^3$ 6 $\frac{1}{p}$
 7 $8q^{-4}$ 8 10
 9 3 10 $2g^2$

Exercise 4H — Scientific notation (standard form)

- 1 a 3.15×10^2 b 4.3×10^3 c 6.7×10^{12}
 d 4.5×10^0 e 2.3×10 f 9.0×10^{16}
 g 6.78×10^4 h 1.22×10^{-2} i 7.89×10^{-3}
 j 2.3456×10^{-1} k 7.8×10^{-4} l 5.0×10^{-6}
 2 a 3500 b 670 c 9010
 d 86 500 e 700 000 f 78
 g 0.012 35 h 0.008 996 54 i 0.4323
 j 0.000 07 k 0.000 432 l 0.000 008 765
 3 a 1.53×10^9 b 1.035×10^5
 c 4.68×10^8 d 1.05×10^{30}
 e 5.22×10^4 f $3.513\ 123 \times 10^{16}$
 g 4.0815×10^{10} h 2.1736×10^{13}
 i 2.72×10^{12} j 4.08×10^7
 k 1.495×10^{42} l 1.5615×10^6
 4 a 9.0×10 b 2.077×10 c 2.0×10^4
 d 4.0×10^2 e 2.6×10^5 f 5.0×10^2
 g 1.73×10^{13} h $2.241\ 04 \times 10^2$ i 1.27×10
 j 1.9×10^4 k 2.41×10 l 8.0×10^{13}
 5 a 1.62×10^{19} b 1.3293×10^{13}
 c $1.606\ 406 \times 10^{37}$ d $1.760\ 54 \times 10^{22}$
 e 8.1862×10^8 f $9.633\ 12 \times 10^{18}$
 g $2.093\ 75 \times 10^2$ h $2.127\ 65 \times 10^2$
 i 2.0×10^{-10} j 4.0×10^{-2}
 k 1.302857×10^{10} l 4.3×10^{13}
 6 a A b C
 7 a $6\ 000\ 000 \times 10^{-9}$, 0.06, 0.6, 6, 0.006×10^4 ,
 $600\ 000 \times 10^{-3}$
 b $5\ 000\ 000 \times 10^{-19} \times 10^{10}$, 0.05, $499\ 999\ 999 \times 10^{-9}$,
 0.5, 5, 40, 4.9×10^5 , 0.005×10^9
 8 a 10^6 or 1 million b 10^9 or 1 billion
 c Yes, 10^{12} or 1 trillion d 10^{-6} or 1 millionth
 9 1.0×10^7
 10 1.2×10^7
 11 a 2.544×10^6 km b 9.2856×10^8 km
 12 8.849×10^3 hours

Summary

- 1 power 2 index form 3 calculator
 4 add 5 subtract 6 base
 7 raising 8 variations 9 fractional, $\frac{1}{a^n}$
 10 multiply 11 cube 12 square root, $a^{\frac{1}{2}}$
 13 cube root, $a^{\frac{1}{3}}$ 14 Scientific notation
 15 negative

Chapter review

- 1 a 4 b 5 c a d x
 2 a 3 b 12 c 89 d 0
 3 a 5^4 b 7^7 c 8^5 d h^3j^5
 e $(\frac{1}{6})^5$ f $(-9)^9$
 4 a 25 b 16 c 32
 d 1000 e 81 f $429\ 981\ 696$
 5 a 16 b 35 c 49 d 4
 6 The second option is better.
 7 a $2^2 \times 5^2$ b 11^2 c $2^3 \times 13$
 d $3^2 \times 5^2$ e $2^2 \times 3 \times 7^2$ f $2^5 \times 3^2 \times 5 \times 7$
 8 a b^{10} b m^{11} c k^8 d f^{14}
 e h^{10} f $6q^{17}$ g $35w^{29}$ h $12e^5p^8$
 i $105a^{16}b^{17}$
 9 a a^3 b t^4 c r^7 d p^3
 e f^5 f y^{90} g m^{10} h g^7
 i x j d^6 k t^5 l p^5
 m $4k^4$ n $11b^7c^5$ o $\frac{9e^6}{32d^2}$
 10 a 1 b 1 c 1 d 1
 e 1 f a g 3 h 3
 i 199 j a^7 k v^{10} l pr
 m a^9b^4 n j^8m^3 o $4e^2 - 36$ p -8
 q $15 - 12x$ r -3 s 54
 11 a b^8 b a^{24} c k^{70} d j^{200}
 e $a^{15}b^6$ f $m^{14}n^{24}$ g s^3t^{18} h $q^{10}p^{300}$
 12 C
 13 a $\frac{1}{a}$ b $\frac{1}{k^4}$ c $\frac{2}{m^4}$ d $\frac{42}{y^5}$
 14 a x^{-1} b $2y^{-4}$ c z^{-3}
 d $135p^{-3}q^{-3}$
 15 a 10 b 6 c a d b
 e $7f^2$ f 3 g 10 h x
 i $2d$ j $4f^2g$
 16 a 4.5×10^4 b 2.3×10^2 c 7.5×10^8
 d 3.7×10^{-3}
 17 a 3400 b 789 000 c 345 600 000
 d 0.0043
 18 C
 19 A
 20 1.4×10^{12}
 21 4.167×10^8
 22 9.16×10^7 km
 23 1.2441×10^9 km

Chapter 5 Expanding

Are you ready?

- 1 a $3a, -4a, a$ b $5x, x, \frac{1}{2}x$
 c $7qp, 7pq$ d $ac, 2ac$
 2 a $13y$ b $3n + 4m$
 c $7x + 4$ d $9k + 2p$
 3 a $12x$ b $21ab$
 c $-5kp$ d $6m^2n$
 4 a $2x + 6$ b $3y - 3k$
 c $-5m - 10$ d $-7a + 28$
 5 a $\frac{17}{30}$ b $\frac{1}{4}$ c $1\frac{26}{45}$
 6 a $6 + 4$ b 2×5 c $7 - 3$
 7 a D b E c A
 d B e C

Exercise 5A — Expanding single brackets

- 1 a $3x + 6$ b $4x + 12$ c $5m + 20$
d $2p + 10$ e $4x + 4$ f $7x - 7$
g $-4y - 24$ h $-5a - 5$ i $-3p + 6$
j $-x + 1$ k $-x - 3$ l $-x + 2$
m $6b - 12$ n $24m - 16$ o $-30m + 24$
p $-27p + 15$
- 2 a $x^2 + 2x$ b $y^2 + 3y$ c $a^2 + 5a$
d $c^2 + 4c$ e $4x + x^2$ f $5y + y^2$
g $7m - m^2$ h $8q - q^2$ i $2xy + 4x$
j $5pq + 20p$ k $-3xy - 12y$ l $-10pq - 90p$
m $-3b + ab$ n $-35m + 7mn$ o $-30a + 18a^2$
p $-28x + 16x^2$
- 3 a $2p - 2$ b $5x - 17$ c $-7p - 17$
d $-12p + 3$ e $6x^2 - 20x$ f $2m^2 + 7m$
g $3px + 6x - 5$ h $4y^2 - 4y + 7$ i $-4p^2 + 13p$
j $4x - 13y$ k $2m^2 - 8m - 4$
l $-3p^2 + 10pq - 1$ m $-30a + 10ab$
n $7cd - 12c^2 - 5c$ o $-2p - 17$
p $3 - 3m$

Exercise 5B — Expanding two brackets

- 1 a $8x + y$ b $10p + 8q$ c $18a + 29b$
d $19c + 22d$ e $2m - 11n$ f $6x - 11y$
g $9x + 5y$ h $-14p - 8q$ i $-4a + 3b$
j $4x - y$ k $5p - 10q$ l $-8c + 9d$
m $13x - 19y$ n $-7p + 11q$ o $-5a + 3b$
p $8c + d$
- 2 a $2ab + 2a - 3b$ b $2xy + 4x - 2y$
c $2cd + 3c$ d $2pq - 2p$
e $5cd - 11c$ f $5ab - 21a - 3b$
g $5m$ h $6cd - 36c$
i $6m^2 + 6m - 10$ j $9cd - 8c$
k $-15a^2 + 2b^2 - 9ab$ l $-8c^2 + 3d^2 + 22cd$
m $12m^2 - 20m - 4$ n $2p^2 + 7p - 6$
o $-7x^2 + 41x - 6$ p $-10y^2 - 6y - 12$
- 3 a B b A c D

Maths Quest challenge (page 166)

- 1 $21x + 23y, 34x + 37y, 55x + 60y$
- 2 Hint: Let n represent the number of the month and d represent the day of the month. Form an algebraic expression from the instructions given. Show how this becomes $100n + d$.

Exercise 5C — Expanding pairs of brackets

- 1 a $a^2 + 5a + 6$ b $x^2 + 7x + 12$ c $y^2 + 5y + 6$
d $m^2 + 9m + 20$ e $b^2 + 3b + 2$ f $p^2 + 5p + 4$
g $a^2 + a - 6$ h $x^2 + x - 20$ i $m^2 - m - 12$
j $y^2 + 2y - 15$ k $y^2 - 4y - 12$ l $x^2 - 2x - 3$
m $x^2 - 7x + 12$ n $p^2 - 5p + 6$ o $x^2 - 4x + 3$
- 2 a $2a^2 + 7a + 6$ b $3m^2 + 7m + 2$
c $6x^2 + 10x + 4$ d $4c^2 - 31c + 42$
e $35 - 17t + 2t^2$ f $9 - 11x + 2x^2$
g $10 + 11t - 6t^2$ h $14 - 31x + 15x^2$
i $25x^2 - 20x + 4$
- 3 a $xz + x + yz + y$ b $pr + 3p + qr + 3q$
c $2xz + 8x + yz + 4y$ d $3pr + 3p + qr + q$
e $a^2 + 3ab + 2b^2$ f $2c^2 - 5cd - 3d^2$
g $2x^2 - xy - 3y^2$ h $4p^2 + pq - 3q^2$

- i $3yx + 3yz + zx + z^2$ j $ab + ac + 2b^2 + 2bc$
k $3p - 9pr - 2q + 6qr$ l $7cd - 35c - 2d^2 + 10d$
m $12x^2 - 7xy + y^2$ n $2p^2 - rp - 2pq + qr$
o $15k + 5 - 6jk - 2j$
- 4 a A b C c C

10 Quick Questions 1

- 1 $5x + 15$ 2 $3z - 7z^2$
3 $5p - 19q$ 4 $11a + 12b$
5 $2mn + m - 4n$ 6 D
7 $a^2 + 5a + 4$ 8 $6p^2 - 45p + 21$
9 $16k + 8 - 12jk - 6j$ 10 True

Exercise 5D — Expansion patterns

- 1 a $x^2 - 4$ b $y^2 - 9$ c $m^2 - 25$
d $a^2 - 49$ e $x^2 - 36$ f $p^2 - 144$
g $a^2 - 100$ h $m^2 - 121$ i $p^2 - q^2$
- 2 a $4x^2 - 9$ b $9y^2 - 1$ c $25d^2 - 4$
d $49c^2 - 9$ e $4 - 9p^2$ f $1 - 81x^2$
g $25 - 144a^2$ h $9 - 100y^2$ i $4b^2 - 25c^2$
- 3 a $x^2 + 4x + 4$ b $a^2 + 6y + 9$
c $b^2 + 14b + 49$ d $c^2 + 18c + 81$
e $m^2 + 24m + 144$ f $n^2 + 20n + 100$
g $x^2 - 12x + 36$ h $y^2 - 10y + 25$
i $81 - 18c + c^2$ j $64 + 16e + e^2$
k $x^2 + 2xy + y^2$ l $u^2 - 2uv + v^2$
- 4 a $4a^2 + 12a + 9$ b $9x^2 + 6x + 1$
c $4m^2 - 20m + 25$ d $16x^2 - 24x + 9$
e $25a^2 - 10a + 1$ f $49p^2 + 56p + 16$
g $81x^2 + 36x + 4$ h $16c^2 - 48c + 36$
i $9 + 12a + 4a^2$ j $25 + 30p + 9p^2$
k $4 - 20x + 25x^2$ l $49 - 42a + 9a^2$
m $81x^2 - 72xy + 16y^2$ n $64x^2 - 48xy + 9y^2$
o $81x^2 - 36xy + 4y^2$ p $49x^2 - 56xy + 16y^2$

Exercise 5E — More complicated expansions

- 1 $2x^2 + 13x + 21$ 2 $2x^2 + 13x + 20$
3 $2x^2 + 14x + 26$ 4 $2x^2 + 10x + 11$
5 $2p^2 - 3p - 21$ 6 $2a^2 - 5a + 4$
7 $2p^2 - p - 24$ 8 $2x^2 + 19x - 36$
9 $2y^2 + 2y - 7$ 10 $2d^2 + 8d - 2$
11 $2x^2 + 10$ 12 $2y^2$
13 $2x^2 - 4x + 19$ 14 $2y^2 - 4y - 7$
15 $2p^2 + 3p + 23$ 16 $2m^2 + 3m + 31$
17 $x + 5$ 18 $4x + 8$
19 $-2x - 6$ 20 $3m + 2$
21 $-3b - 22$ 22 $-15y - 2$
23 $8p - 10$ 24 $16x + 2$
25 $-16c - 40$ 26 $-14f - 34$
27 $4m + 17$ 28 $-7a + 30$
29 $-6p - 7$ 30 $3x - 21$

Exercise 5F — Simplifying algebraic fractions — addition and subtraction

- 1 a $\frac{3x+5}{4}$ b $\frac{4m+7}{6}$ c $\frac{7x+26}{12}$
d $\frac{5x+1}{6}$ e $\frac{7y-1}{10}$ f $\frac{11a+26}{30}$
g $\frac{3p-4}{10}$ h $\frac{8x-17}{15}$ i $\frac{17x+5}{15}$

- j $\frac{12m+17}{10}$ k $\frac{4p+1}{6}$ l $\frac{10x-11}{6}$
 m $\frac{10x+1}{4}$ n $\frac{14x-13}{6}$ o $\frac{5x-3}{4}$
 2 a $\frac{m+5}{12}$ b $\frac{9x+38}{14}$ c $\frac{p-15}{6}$
 d $\frac{8y-14}{15}$ e $\frac{5x+17}{6}$ f $\frac{7a+3}{10}$
 g $\frac{-m-7}{8}$ h $\frac{-2p+11}{15}$ i $\frac{-x-1}{12}$
 j $\frac{-4y+29}{21}$ k $\frac{x-5}{4}$ l $\frac{10p+1}{9}$
 m $\frac{17y+14}{12}$ n $\frac{24a-23}{30}$ o $\frac{3x-4}{15}$
 3 a D b B c A d C
 4 a $\frac{3m+3}{m(m+3)}$ b $\frac{7x+6}{x(x+2)}$ c $\frac{9a+28}{a(a+4)}$
 d $\frac{14b+27}{b(b+3)}$ e $\frac{5c-3}{c(c-1)}$ f $\frac{9m-12}{m(m-3)}$
 g $\frac{9p-16}{p(p-8)}$ h $\frac{6p-20}{p(p-5)}$ i $\frac{6a-12}{a(a-6)}$
 j $\frac{10q-4}{q(q-1)}$ k $\frac{3a+4}{(a+1)(a+2)}$
 l $\frac{3b+7}{(b+3)(b+2)}$ m $\frac{4x+11}{(x+2)(x+3)}$
 n $\frac{6m+14}{(m+1)(m+3)}$ o $\frac{14p-9}{(p-1)(p+4)}$
 5 a $\frac{3m+7}{2m(m+1)}$ b $\frac{2x+18}{2x(x+3)}$ c $\frac{5x+45}{4x(x+5)}$
 d $\frac{2m-10}{m(m+5)}$ e $\frac{4m-9}{m(m+3)}$ f $\frac{3p+6}{p(p-3)}$
 g $\frac{3a+21}{a(a-7)}$ h $\frac{7b-27}{b(b-3)}$ i $\frac{3r-35}{r(r-5)}$
 j $\frac{-x+16}{3x(x+2)}$ k $\frac{3x+13}{(x+1)(x+3)}$
 l $\frac{4p-2}{(p+2)(p+1)}$ m $\frac{2m-10}{(m+7)(m+3)}$
 n $\frac{2p}{(p+3)(p+1)}$ o $\frac{3x+21}{(x-1)(x+2)}$
 6 a $\frac{5x+9}{(x+1)(x+2)(x+3)}$ b $\frac{6x+22}{(x+3)(x+1)(x+4)}$
 c $\frac{7x-5}{(x-1)(x+2)(x-3)}$ d $\frac{9x+15}{(x+4)(x-3)(x+1)}$
 e $\frac{8x+11}{(x+7)(x-4)(x-2)}$ f $\frac{11x+3}{(x-2)(x-3)(x+1)}$
 g $\frac{9x-15}{(x-6)(x-4)(x-1)}$ h $\frac{5x+6}{(x+2)(x-3)(x+1)}$
 i $\frac{3x+8}{(x+1)(x+3)(x+2)}$ j $\frac{4x+10}{(x+4)(x+1)(x+3)}$
 k $\frac{3x-9}{(x-6)(x+2)(x-1)}$ l $\frac{x-18}{(x+7)(x+2)(x-3)}$
 m $\frac{x-3}{(x+5)(x-6)(x+1)}$ n $\frac{7x-82}{(x+1)(x+4)(x-2)}$
 o $\frac{5x-9}{(x+2)(x-6)(x-3)}$ p $\frac{4x-26}{(x+5)(x-2)(x-4)}$
 7 a B b A c E d C

10 Quick Questions 2

- 1 $-4x+20$ 2 $22x-4y$
 3 $x^2+14x+45$ 4 $\square=4$
 5 $36+12q+q^2$ 6 $2x^2+7x+5$
 7 $7x-39$ 8 True
 9 $\frac{36z-2}{(3z-2)(4z+1)}$ 10 $\frac{8}{(x+6)(x+4)(x-3)}$

Maths Quest challenge (page 183)

- 1 8.11 am
 2 2.9×10^9 or 2 900 000 000
 3 53%

Exercise 5G — Applications

- 1 a i 12x ii 60 iii $9x^2$ iv 225
 b i $4x+8$ ii 28 iii x^2+4x+4 iv 49
 c i $16x-4$ ii 76 iii $16x^2-8x+1$ iv 361
 d i 10x ii 50 iii $4x^2$ iv 100
 e i $10x+2$ ii 52 iii $6x^2+2x$ iv 160
 f i $12x-2$ ii 58 iii $5x^2-13x-6$ iv 54
 g i $20x+18$ ii 118 iii $21x^2+42x$ iv 735
 2 a 1250 m^2 b $(1250+150x+4x^2) \text{ m}^2$
 c $(150x+4x^2) \text{ m}^2$ d 366.16 m^2
 3 a $20-2x$ b $15-2y$ c $300-40y-30x+4xy$
 d Check with your teacher.
 4 a 40 cm^2
 b i $(8+v) \text{ cm}$ ii $(5+v) \text{ cm}$
 iii $(v^2+13v+40) \text{ cm}^2$ iv 70 cm^2
 c i $(8-d) \text{ cm}$ ii $(5-d) \text{ cm}$
 iii $(40-13d+d^2) \text{ cm}^2$ iv 18 cm^2
 d i $8x \text{ cm}$ ii $(5+x) \text{ cm}$
 iii $(8x^2+40x) \text{ cm}^2$ iv 400 cm^2
 5 a $20x \text{ m}$ b $25x^2 \text{ m}^2$
 c i $(5x-2) \text{ m}$ ii $(5x-3) \text{ m}$
 iii $(25x^2-25x+6) \text{ m}^2$ iv 756 m^2
 6 a $6x \text{ cm}$ b $2x^2 \text{ cm}^2$
 c i $(2x+y) \text{ cm}$ ii $(x-y) \text{ cm}$
 iii $(2x^2-xy-y^2) \text{ cm}^2$ iv 11 cm^2
 7 a $4x \text{ cm}$ b $x^2 \text{ cm}$
 c i $(x+y) \text{ cm}$ ii $(4x+4y) \text{ cm}$
 iii 56 cm iv $(x^2+2xy+y^2) \text{ cm}^2$
 d 60.84 cm^2
 8 a $(14p+4) \text{ m}$ b $(12p^2+6p) \text{ m}^2$
 c $(6p+2) \text{ m}$ d $5p \text{ m}$
 e $(22p+4) \text{ m}$ f $(30p^2+10p) \text{ m}^2$
 g $(18p^2+4p) \text{ m}^2$ h 80 m^2

Summary

- 1 inside
 2 collect like terms
 3 $10x+6$
 4 multiply
 5 first, outer, inner, last
 6 difference of two squares
 7 $49-x^2$, a^2-b^2
 8 perfect squares
 9 common denominator
 10 lowest, $x(x-2)$
 11 denominator
 12 word problems
 13 problem

Chapter review

- 1 a $5x + 15$ b $-y - 5$ c $-3x + 2x^2$
d $-8m^2 - 4m$
- 2 a $3x + 3$ b $-10m - 1$ c $4m^2 - 9m - 5$
d $4p - 6$
- 3 a $9a + 8b$ b $-5x - 18y$ c $-mn + 9m$
d $4x^2 - 10x + 3$
- 4 a $x^2 + 9x + 20$ b $m^2 - m - 2$ c $3m^2 - 17m + 10$
d $2a^2 - 5ab - 3b^2$
- 5 a $x^2 - 16$ b $81 - m^2$ c $x^2 - y^2$ d $1 - 4a^2$
- 6 a $x^2 + 10x + 25$ b $m^2 - 6m + 9$
c $16x^2 + 8x + 1$ d $4 - 12y + 9y^2$
- 7 a $2x^2 + 8x + 8$ b $2m^2 + 11m - 5$
c $6x + 15$ d $-7b + 37$
- 8 a $2x^2 + 10x + 13$ b $2x - 5$ c $16x$
- 9 a $\frac{7x+9}{10}$ b $\frac{7m-5}{8}$ c $\frac{5a+36}{14}$ d $\frac{3y+19}{12}$
- 10 a $\frac{3m+8}{m(m+4)}$ b $\frac{8m-7}{(m+1)(m-2)}$
c $\frac{4x+14}{3x(x+2)}$ d $\frac{8y-10}{(2y+1)(3y-2)}$
e $\frac{5x+16}{(x+1)(x+2)(x+4)}$ f $\frac{5x+13}{(3x-1)(x+2)(2x+3)}$
- 11 a $8x$ b $3x^2$
c i $3x + y$ ii $8x + 2y$ iii 780 cm
iv $3x^2 + xy$ v $27\,000 \text{ cm}^2$

Chapter 6 Factorising

Are you ready?

- 1 a 3 b 4 c 5 d 6 e $9x$ f $5a$
- 2 a $4(m+2)$ b $2x(x-3)$ c $3a(4b+3)$
- 3 a 8 b 9 c 12 d 2.5
- 4 a 13 b 1.1 c 0.2 d 19
- 5 a 3 and 4 b -2 and -3 c -6 and 1 d 10 and -1
- 6 a $\frac{1}{3}$ b $\frac{2}{9}$ c $\frac{7}{20}$ d $\frac{4}{9}$
- 7 a $\frac{1}{2}$ b $\frac{9}{16}$ c $\frac{2}{3}$ d 1
- 8 a $\frac{x+2}{2}$ b $x - 5$ c 2
- 9 a 3 b $\frac{2}{3}$ c $\frac{1}{2}$

Exercise 6A — The highest common factor

- 1 a $-36, -18, -12, -9, -6, -4, -3, -2, -1, 1, 2, 3, 4, 6, 9, 12, 18, 36$
b $-17, -1, 1, 17$
c $-51, -17, -3, -1, 1, 3, 17, 51$
d $-14, -7, -2, -1, 1, 2, 7, 14$
e $-8, -4, -2, -1, 1, 2, 4, 8$
f $-100, -50, -25, -20, -10, -5, -4, -2, -1, 1, 2, 4, 5, 10, 20, 25, 50, 100$
g $-42, -21, -14, -7, -6, -3, -2, -1, 1, 2, 3, 6, 7, 14, 21, 42$
h $-32, -16, -8, -4, -2, -1, 1, 2, 4, 8, 16, 32$
i $-32, -16, -8, -4, -2, -1, 1, 2, 4, 8, 16, 32$
j $-9, -3, -1, 1, 3, 9$
k $-64, -32, -16, -8, -4, -2, -1, 1, 2, 4, 8, 16, 32, 64$
l $-81, -27, -9, -3, -1, 1, 3, 9, 27, 81$

- m $-29, -1, 1, 29$
n $-92, -46, -23, -4, -2, -1, 1, 2, 4, 23, 46, 92$
o $-48, -24, -16, -12, -8, -6, -4, -3, -2, -1, 1, 2, 3, 4, 6, 8, 12, 16, 24, 48$
- p $-12, -6, -4, -3, -2, -1, 1, 2, 3, 4, 6, 12$
- 2 a 4 b 3 c 5 d 8 e 3
f 25 g 1 h $6a$ i $7x$ j $30q$
k 10 l $3x$ m 3 n 5 o x^2 p 2
- 3 C
- 4 a $4(x+3y)$ b $5(m+3n)$
c $7(a+2b)$ d $7(m-3n)$
e $-8(a-3b)$ f $4(2x-y)$
g $-2(6p+q)$ h $6(p+2pq+3q)$
i $8(4x+y+2z)$ j $4(4m-n+6p)$
k $8(9x-y+8pq)$ l $3(5x^2-y)$
m $5(p^2-4q)$ n $5(x+1)$
o $8(7q+p^2)$ p $7(p-6x^2y)$
q $4(4p^2+5q+1)$ r $12(1+3a^2b-2b^2)$
- 5 a $3(3a+7b)$ b $2(2c+9d^2)$
c $4(3p^2+5q^2)$ d $7(5-2m^2n)$
e $5(5y^2-3x)$ f $4(4a^2+5b)$
g $6(7m^2+2n)$ h $9(7p^2+9-3y)$
i $11(11a^2-5b+10c)$ j $2(5-11x^2y^3+7xy)$
k $9(2a^2bc-3ab-10c)$ l $12(12p+3q^2-7pq)$
m $7(9a^2b^2-7+8ab^2)$ n $11(2+9p^3q^2-4p^2r)$
o $6(6-4ab^2+3b^2c)$
- 6 a $-(x-5)$ b $-(a-7)$
c $-(b-9)$ d $-2(m+3)$
e $-6(p+2)$ f $-4(a+2)$
g $-3(n^2-5m)$ h $-7(x^2y^2-3)$
i $-7(y^2+7z)$ j $-6(2p^2+3q)$
k $-7(9m-8)$ l $-2(6m^3+25x^3)$
m $-3(3a^2b-10)$ n $-3(5p+4q)$
o $-2(9x^2-2y^2)$ p $-3(ab-6m+7)$
q $-5(2+5p^2+9q)$ r $-9(10m^2-3n-6p^3)$
- 7 a $a(a+5)$ b $m(m+3)$
c $x(x-6)$ d $q(14-q)$
e $m(18+5m)$ f $p(6+7p)$
g $n(7n-2)$ h $a(a-b+5)$
i $p(7-pq+q)$ j $y(x+9-3y)$
k $c(5+3cd-d)$ l $ab(3+a+4b)$
m $xy(2x+1+5y)$ n $pq(5pq-4+3p)$
o $xy(6xy-5+x)$
- 8 a $5x(x+3)$ b $2y(5y+1)$
c $4p(3p+1)$ d $6m(4m-1)$
e $4a(8a-1)$ f $-2m(m-4)$
g $-5x(x-5)$ h $-7y(y-2)$
i $-3a(a-3)$ j $-2p(6p+1)$
k $-5b(3b+1)$ l $-13y(2y+1)$
m $2m(2-9m)$ n $-6t(1-6t)$
o $-8p(1+3p)$

Maths Quest challenge (page 197)

- 1 a p (Two chances to win.)
b p or q (Two chances to win.)
- 2 Possible solutions are: 5, 13, 17. (Some of the solutions take the form $4n+1$. Try a number, n , that will make $4n+1$ a prime number.)

Exercise 6B — More factorising using the highest common factor

- 1 a $(a+b)(2+3c)$ b $(m+n)(4+p)$
c $(2m+1)(7x-y)$ d $(3b+2)(4a-b)$

- e $(x+2y)(z-3)$ f $(6-q)(12p-5)$
 g $(x-y)(3p^2+2q)$ h $(b-3)(4a^2+3b)$
 i $(q+2p)(p^2-5)$ j $(5m+1)(6+n^2)$
 2 a $(y+2)(x+2)$ b $(b+3)(a+3)$
 c $(x-4)(y+3)$ d $(2y+1)(x+3)$
 e $(3b+1)(a+4)$ f $(b-2)(a+5)$
 g $(m-2n)(1+a)$ h $(5+3p)(1+3a)$
 i $(3m-1)(5n-2)$ j $(10p-1)(q-2)$
 k $(3x-1)(2-y)$ l $(4p-1)(4-3q)$
 m $(2y+1)(5x-2)$ n $(2a+3)(3b-2)$
 o $(b-2c)(5a-3)$ p $(x+3y)(4-z)$
 q $(p+2q)(5r-3)$ r $(a-5b)(c-2)$

10 Quick Questions 1

- 1 -36, -18, -12, -9, -6, -4, -3, -2, -1, 1, 2, 3, 4, 6, 9,
12, 18, 36
 2 3
 3 $4a$
 4 $9y(3x-5)$
 5 $5y(5y-17x+7x^2y)$
 6 $9ac(-3b+4-2ab)$
 7 $(x-2y)(9+b)$
 8 $(x+2)(7-2y)$
 9 $(b+2)(3ac+1)$
 10 $(3xy-2)(4+x)$

Exercise 6C — Factorising using the difference of two squares rule

- 1 a $(x+5)(x-5)$ b $(x+9)(x-9)$
 c $(a+4)(a-4)$ d $(c+8)(c-8)$
 e $(y+12)(y-12)$ f $(4+x)(4-x)$
 g $(5+p)(5-p)$ h $(11+a)(11-a)$
 i $(6+y)(6-y)$ j $(2b+5)(2b-5)$
 k $(3a+4)(3a-4)$ l $(5d+1)(5d-1)$
 2 a $(x+y)(x-y)$ b $(a+b)(a-b)$
 c $(p+q)(p-q)$ d $(c+d)(c-d)$
 e $(3x+y)(3x-y)$ f $(4p+q)(4p-q)$
 g $(5m+n)(5m-n)$ h $(9x+y)(9x-y)$
 i $(p+6q)(p-6q)$ j $(m+2n)(m-2n)$
 k $(a+7b)(a-7b)$ l $(y+10z)(y-10z)$
 m $(6m+5n)(6m-5n)$ n $(4q+3p)(4q-3p)$
 o $(2m+7n)(2m-7n)$
 3 a $(x+13)(x+5)$ b $(p+13)(p+3)$
 c $(p-2+q)(p-2-q)$ d $(c-6+d)(c-6-d)$
 e $(x+7+y)(x+7-y)$ f $(p+5+q)(p+5-q)$
 g $(r-9+s)(r-9-s)$ h $(a-1+b)(a-1-b)$
 i $(x+1+y)(x+1-y)$ j $(a+3+b)(a+3-b)$
 k $(a-2)(a-4)$ l $(b+5)(b-7)$
 4 a $2(m+4)(m-4)$ b $5(y+3)(y-3)$
 c $6(p+2)(p-2)$ d $4(m+5)(m-5)$
 e $2(12+x)(12-x)$ f $5(4+a)(4-a)$
 g $9(2x+y)(2x-y)$ h $9(y+3z)(y-3z)$
 i $4(m+3n)(m-3n)$ j $25(2x+y)(2x-y)$
 k $4(6p+q)(6p-q)$ l $2(4y+x)(4y-x)$
 m $3(m+3n)(m-3n)$ n $4(x+5)(x-1)$
 o $3(m+3)(m-1)$ p $7(y-1)(y-5)$
 q $2(y+1)(y-9)$ r $3(b+9)(b+1)$
 5 a C b A c D d A e C
 6 a $\pi r^2 m^2$ b $(r+1)m$ c $\pi(r+1)^2 m^2$
 d $(\pi(r+1)^2 - \pi r^2) m^2$ e $\pi(2r+1) m^2$ f $35 m^2$
 g $47 m^2$

Maths Quest challenge (page 204)

- 1 a $16 \times 2 = 32$ b $100 \times 70 = 7000$
 c $1000 \times 530 = 530\,000$
 2 11 and 13
 3 22 and 24

Exercise 6D — Quadratic trinomials

- 1 $(x+3)(x+1)$ 2 $(x+1)(x+11)$
 3 $(a+5)(a+1)$ 4 $(b-1)(b-7)$
 5 $(x-2)(x-3)$ 6 $(y-3)(y-4)$
 7 $(c+5)(c-4)$ 8 $(x+7)(x-3)$
 9 $(x+10)(x-1)$ 10 $(p+4)(p-7)$
 11 $(q-9)(q+3)$ 12 $(x+2)(x-8)$
 13 $(y+1)(y+9)$ 14 $(x-4)(x-8)$
 15 $(c+4)(c-9)$ 16 $(m-7)(m+2)$
 17 $(x+5)(x-11)$ 18 $(m-12)(m-2)$
 19 $(x+7)(x+5)$ 20 $(x-9)(x-8)$
 21 $(x+5)^2$ 22 $(p+2)^2$
 23 $(a+4)^2$ 24 $(y-3)^2$
 25 $(x-8)^2$ 26 $(x-5)^2$
 27 $(m-6)(m-1)$ 28 $(x-9)(x-3)$
 29 $(k-11)(k+2)$ 30 $(x-1)(x+12)$
 31 $(x-6)(x-7)$ 32 $(a-2)(a+3)$
 33 $(a-4)(a+1)$ 34 $(x-5)(x+2)$
 35 $(x-2)(x+4)$ 36 $(x-6)(x+1)$
 37 $(x-1)(x+5)$ 38 $(b-7)(b+5)$
 39 $(c-16)(c+1)$ 40 $(x-18)(x+2)$
 41 $(x-5)(x+6)$ 42 $(d+7)(d-2)$
 43 $(f-8)(f+5)$ 44 $(m-1)(m+6)$
 45 $(q-2)(q+9)$ 46 $(x-3)(x+8)$
 47 $(x-2)(x+1)$ 48 $(y-4)(y+7)$
 49 $(a-2)(a+9)$ 50 $(x-3)(x+4)$

10 Quick Questions 2

- 1 6 2 $4x^2(3-8xy)$
 3 $(x-2y)(8-3q)$ 4 $(x+9)(x-9)$
 5 $(x+6+y)(x+6-y)$ 6 $(7x+10y)(7x-10y)$
 7 $(y+1)(y-8)$ 8 $(y-3)(y+4)$
 9 $(c+3)(c+5)$ 10 $(x-2)(x-8)$

Exercise 6E — More quadratic trinomials

- 1 a $2(x+2)(x+3)$ b $3(x+4)(x+1)$
 c $7(x+2)(x+4)$ d $6(x+5)(x+4)$
 e $2(x-2)(x-4)$ f $3(x-3)(x-1)$
 g $5(x-7)(x-2)$ h $6(x-4)(x-3)$
 i $4(x+2)(x-3)$ j $3(x+5)(x-2)$
 k $2(x+7)(x-3)$ l $7(x+9)(x-4)$
 m $3(x+3)(x-6)$ n $8(x+6)(x-1)$
 o $5(x+6)(x-2)$
 2 a $(x+3)(2x+1)$ b $(x+2)(2x+3)$
 c $(x+2)(3x+1)$ d $(x+3)(3x+1)$
 e $(x+2)(5x+1)$ f $(3x+2)(2x+3)$
 g $(x-3)(2x-1)$ h $(x-1)(3x+2)$
 i $(x+1)(5x-2)$ j $(x-2)(7x-3)$
 k $(2x-3)(5x+2)$ l $(x+4)(2x-3)$
 m $(x-3)(7x-5)$ n $(x-2)(11x-6)$
 o $(x-4)(2x+9)$ p $(2x+5)(2x-1)$
 q $(x-2)(2x+9)$ r $(x-1)(7x+4)$
 3 a B b C c A d C e D

Maths Quest challenge (page 213)

- 1 152 pages (9 digits for 9 one-digit numbered pages + 180 digits for 90 two-digit numbered pages + 159 digits for 53 three-digit numbered pages)
- 2 6 mm

Exercise 6F — Mixed factorising practice

- 1 $2(m + 4n)$
- 3 $(b - 3)(a + 2)$
- 5 $(m + 2)(m + 1)$
- 7 $3(a - 3b)$
- 9 $-(m + 3)$
- 11 $(x + 7)(x - 3)$
- 13 $(2m + 1)(m - 3)$
- 15 $(x - 6)(x - 3)$
- 17 $(5m - 2)(m + 7)$
- 19 $(x - 6)(x + 5)$
- 21 $(m + 2)(2m - 1)$
- 23 $(x - 1)(3x + 2)$
- 25 $p(8 + 9p)$
- 27 $2(x + 3)(x - 2)$
- 29 $-x(5xy + 1)$
- 31 $5(2p^2 - 5q)$
- 33 $(x + 8)(x - 2)$
- 35 $3(a + 4b)(a - 4b)$
- 37 $(2a + b)(c - 3)$
- 39 $(m - 2)(2m - 5)$
- 2 $-(m - 6)$
- 4 $(p + 4)(p - 4)$
- 6 $2(m + 3)(m - 3)$
- 8 $(x + 5)(x + 1)$
- 10 $4(2m^2 + 1 - 4q)$
- 12 $(a - 3)(2b - c)$
- 14 $3a(6a - 1)$
- 16 $(x + 3)(x + 1)$
- 18 $(m - 4)(m - 5)$
- 20 $(1 + x)(1 - x)$
- 22 $(2a + 1)^2$
- 24 $7(1 - 2a^2)$
- 26 $(n + 1)(2m + 3)$
- 28 $(p + 6q)(p - 6q)$
- 30 $(m + 4)^2$
- 32 $5(x - 4)(x - 2)$
- 34 $2(x + 5)(x - 2)$
- 36 $-6(3m + 2n^2)$
- 38 $(a - 1)(a - 13)$
- 40 $(10a^2 + 11)(11b - 1)$

Exercise 6G — Simplifying algebraic fractions — multiplication and division

- 1 a $\frac{1}{2}$
- d 3
- g $\frac{1}{4}$
- j $x + 2$
- 2 a $\frac{x}{3}$
- d 3
- g $\frac{s-6}{3s}$
- j $\frac{a-3}{a-5}$
- 3 a $a + 1$
- d $p - 3$
- g $3(x + 6)$
- j $\frac{3(x-5)}{5}$
- m $\frac{2}{3}$
- b $\frac{2}{3}$
- e 1
- h 2
- k $\frac{b+3}{b+5}$
- b 2
- e 1
- h $a - 3$
- k $\frac{m-2}{m+5}$
- b $\frac{a+2}{3}$
- e $\frac{x+2}{2}$
- h $3(x - 8)$
- k $\frac{1}{x+5}$
- n $\frac{3}{4}$
- c 1
- f 3
- i $\frac{5(p-3)}{p-2}$
- l $\frac{x+1}{x-6}$
- c $\frac{1}{2}$
- f $\frac{p+2}{p-2}$
- i $\frac{4}{m+2}$
- l $\frac{p+2}{p-4}$
- c $a - 1$
- f $\frac{x-4}{2}$
- i $\frac{2(x-2)}{3}$
- l $-\frac{1}{x-4}$
- o $\frac{5}{6}$

p 3

- 4 a $x + 3$
- d $a + 10$
- g $\frac{9}{y-9}$
- j $\frac{3}{2m-1}$
- m $\frac{3x+1}{9-x}$
- p $\frac{2(2-a)}{3+2a}$
- 5 a $x + 2$
- d $b - 7$
- g $x + 7$
- j $\frac{p+1}{p+5}$
- m $\frac{y+2}{y+6}$
- 6 a 10
- d 3
- g $\frac{6x+1}{8(x+7)}$
- j $\frac{x+2}{x-4}$
- b $p - 5$
- e $\frac{7}{5-x}$
- h $\frac{4}{m-4}$
- k $\frac{1-2a}{a+3}$
- n $\frac{7-2b}{b+5}$
- b $x + 3$
- e $a - 9$
- h $m + 8$
- k $\frac{x+3}{x-1}$
- n $\frac{x-2}{x+2}$
- b 3
- e $\frac{3}{4}$
- h $\frac{m+4}{m+7}$
- k $\frac{y-3}{y+1}$
- c $y - 4$
- f $\frac{5}{5-b}$
- i $\frac{7}{1-2x}$
- l $\frac{2b+1}{5-8b}$
- o $\frac{3(m+2)}{4m-1}$
- c $x - 4$
- f $p - 11$
- i $\frac{a-3}{a+4}$
- l $\frac{m-1}{m+6}$
- o $\frac{x-5}{x-2}$
- p $\frac{x+6}{x-3}$
- c 4
- f $\frac{12(a+2)}{a+3}$
- i $\frac{x+5}{x+3}$
- l $\frac{x-6}{x+3}$

Summary

- 1 factorising
- 3 two
- 5 common
- 7 difference of two squares
- 9 factor
- 11 denominator
- 13 tip
- 2 product
- 4 remainder
- 6 highest common factor
- 8 $(a + b)(a - b)$
- 10 grouping
- 12 numerators

Chapter review

- 1 a $6(x + 2)$
- c $6x^2(1 + 2xy)$
- e $4(2a^2 - b)$
- g $8x(2x - 3y)$
- i $-2(x + 2)$
- k $b(b - 3 + 4c)$
- 2 a $(5 - 4a)(x + y)$
- c $(7a - 6c)(b + 5c)$
- e $5x(3 + 5y)(d + 2e)$
- g $(2 + a)(x + y)$
- i $2(x - 1)(3y + 2)$
- k $(p - r)(q + 1)$
- 3 a $(x + 8)(x - 8)$
- c $(11 + z)(11 - z)$
- e $(7b + 1)(7b - 1)$
- g $(2f + 3g)(2f - 3g)$
- i $(1 + 10m)(1 - 10m)$
- k $(p + 4)(p - 6)$
- 4 a $(c + 1)(c + 4)$
- c $(x - 2)(x - 2)$
- e $(q + 7)(q - 6)$
- b $6x(1 + 2y)$
- d $2(4x + 2p + pq)$
- f $11x(2y + 3a - 5p)$
- h $5b(10a + 5c - 3bc)$
- j $-3x(2y - 1)$
- l $3pq(2p + 3p^2q - 5q)$
- b $(6x + 5)(b - 4c)$
- d $19x(d - 2e)$
- f $(6x^2 - 1)(5y - 2)$
- h $(x + 2y)(4 - a)$
- j $(x - 2)(x + a)$
- l $(p - q)(x - y)$
- b $(9 + y)(9 - y)$
- d $(a + 12)(a - 12)$
- f $(c + d)(c - d)$
- h $(9h + 2k)(9h - 2k)$
- j $(n + 1 + m)(n + 1 - m)$
- l $(r - 1 + 2s)(r - 1 - 2s)$
- b $(x - 7)(x + 1)$
- d $(p - 2)(p + 12)$
- f $(x - 6)(x + 4)$

g $(y-6)(y-4)$	h $(x+1)(x+2)$
i $(c-13)(c+2)$	j $(m-2)(m-5)$
k $(x+9)(x-3)$	l $(m+22)(m+2)$
5 a $2(a+6)(a+2)$	b $3(b-6)(b-2)$
c $4(c-6)(c+2)$	d $2(d-2)(d+3)$
e $5(e-11)(e+11)$	f $6(x+7)(x-3)$
g $(x+1)(2x+1)$	h $(x-1)(3x+2)$
i $(2x+3)(3x+2)$	j $(x-1)(2x-5)$
k $(2x-1)(4x+3)$	l $(x-4)(6x+7)$
6 a $3(a+3b)$	b $(x+4)(x-4)$
c $(p+3)(11+q)$	d $(m+3)(m-1)$
e $(a+2)(b+9)$	f $2(t+2)(t-2)$
g $(4e+5)(4e-5)$	h $(h-3)(h-4)$
i $(x-2)(x+3)$	j $b(b+7c+5)$
k $(x+2)(x-6)$	l $(a-1)(2a+5)$
7 a $(x-2)$	b $\frac{2p-1}{3}$
	c $\frac{1}{2y-5}$
d $\frac{-4}{d+3}$	e $\frac{1}{2}$
	f $\frac{3}{2}$
g $\frac{x+5}{2}$	h $\frac{4}{y+2}$
	i $\frac{p-1}{p^2+1}$
j $\frac{x-3}{4-x}$	k $x-3$
	l $\frac{m+3}{m+4}$
8 a $x+4$	b x^2
	c 2
d $\frac{4(x+1)}{x-1}$	e $\frac{x-7}{x-2}$
	f $\frac{x+6}{x-1}$

Chapter 7 Solving linear equations

Are you ready?

1 a $x=6$	b $y=13$
c $k=15$	d $x=-51$
2 a Yes	b No
c No	d Yes
3 a $x=3$	b $a=6$
c $m=0$	d $y=-1$
4 a $6x-12$	b $-2y-2$
c $8a+12$	d $-10p+35$
5 a $x+2=9$	b $8x=40$
c $x-11=3$	d $\frac{x}{6}=2$
6 a No	b No
c Yes	d Yes
7 a $w=4$	b $l=13$

Exercise 7A — Solving linear equations

1 a, b, e, f, h, k, m, p		
2 a $x=210$	b $x=52$	c $x=230$
d $x=23$	e $x=142$	f $x=96$
g $x=37$	h $x=20$	i $x=50$
j $x=138$	k $x=442$	l $x=243$
m $y=-15$	n $y=1.8$	o $y=12.8$
p $y=2\frac{1}{3}$	q $y=24$	r $y=-\frac{1}{18}$
s $y=21.5$	t $y=172.5$	u $y=-8.32$
3 a $x=5$	b $x=-2$	c $x=0.2$
d $x=1$	e $x=1$	f $x=2$
g $x=5\frac{1}{3}$	h $x=-1\frac{2}{3}$	i $x=24.5$

j $x=1.2$	k $x=22.25$	l $x=\frac{383}{600}$
4 a $x=1$	b $x=-2$	c $x=3$
d $x=-6$	e $x=-1$	f $x=\frac{1}{2}$
g $x=1\frac{2}{3}$	h $x=-2.32$	i $x=3$
j $x=-\frac{5}{6}$	k $x=1\frac{1}{4}$	l $x=3\frac{1}{13}$
5 a $y=-1$	b $y=1$	c $y=0$
d $y=5$	e $y=-8.6$	f $y=-0.9$
g $y=8.9$	h $y=19$	i $y=-26$
j $y=-1$	k $y=-1$	l $y=-1$
6 a $x=12$	b $x=-3$	c $x=4$
d $x=-15$	e $x=16$	f $x=-66$
g $x=9$	h $x=-1\frac{1}{5}$	i $x=9\frac{1}{3}$
j $x=-2\frac{1}{4}$	k $x=-7$	l $x=\frac{2}{3}$
7 a $z=16$	b $z=31$	c $z=-4$
d $z=6$	e $z=-9$	f $z=-6$
g $z=-1.9$	h $z=6.88$	i $z=140$
j $z=0.6$	k $z=-35.4$	l $z=8$
8 a $x=1$	b $x=13$	c $x=-2$
d $x=-8$	e $x=-4$	f $x=30\frac{1}{2}$
g $x=-6$	h $x=-\frac{7}{10}$	i $x=10.35$
j $x=-0.046$	k $x=22$	l $x=-5$
9 a $x=4$	b $x=\frac{3}{7}$	c $x=-1\frac{1}{7}$
d $x=-6\frac{2}{3}$	e $x=\frac{4}{45}$	f $x=8$
g $x=-6$	h $x=7.5$	i $x=5.1$
j $x=-6$	k $x=-5\frac{13}{15}$	l $x=-61\frac{3}{7}$
10 a E	b D	c C
11 a $a=-1$	b $b=10$	c $c=12.1$
d $d=4$	e $e=5$	f $f=12$
g $g=15.97$	h $h=31$	i $i=\frac{13}{226}$
j $j=\frac{1}{6}$	k $k=-8$	l $l=10.3$

10 Quick Questions 1

1 $x=-3$	2 $x=5\frac{1}{6}$
3 $x=-12$	4 $x=2.7$
5 $x=2\frac{4}{5}$ or 2.8	6 $x=-42$
7 $x=5\frac{1}{4}$ or 5.25	8 $\frac{19}{14}$ or $1\frac{5}{14}$
9 $x=7$	10 $x=0$

History of mathematics

- 1** Bug **2** COBOL **3** Rear admiral

Exercise 7B — Solving equations with pronumerals on both sides

1 a $y=-1$	b $y=1$	c $y=-3$
d $y=-5$	e $y=-45$	f $y=\frac{8}{27}$
g $y=-2$	h $y=20$	i $y=1$
j $y=-1\frac{1}{5}$	k $y=4$	l $y=-2$
2 a C	b A	
3 a $x=1$	b $x=-2$	c $x=3$
d $x=4$	e $x=9$	f $x=3$
g $x=-2$	h $x=4$	i $x=-4$
j $x=\frac{1}{2}$	k $x=0$	l $x=-\frac{3}{4}$

- 4 a $x = -6$ b $x = 7$ c $x = 2$
 d $x = -2$ e $x = 13$ f $x = -7$
 g $x = \frac{1}{6}$ h $x = -\frac{2}{17}$ i $x = 1$
 5 a D b C

Maths Quest challenge (page 237)

- 1 $\frac{2}{3}$ kg or approx. 667 g
 2 4

Exercise 7C — Solving linear equations with brackets

- 1 a $x = 6$ b $x = -3$ c $x = 0$
 d $x = 56$ e $x = 1$ f $x = 0$
 g $x = -1$ h $x = -2$ i $x = 6$
 j $x = 0$ k $x = -0.8$ l $x = 6$
 2 a $b = 1\frac{1}{6}$ b $m = 4\frac{1}{2}$ c $a = -1\frac{1}{2}$
 d $m = -1\frac{1}{3}$ e $p = \frac{3}{5}$ f $m = 2\frac{2}{3}$
 g $a = -1\frac{1}{2}$ h $p = 1\frac{1}{2}$ i $a = 3\frac{1}{3}$
 j $m = -2\frac{1}{2}$ k $a = -\frac{1}{6}$ l $m = -\frac{1}{4}$
 3 a $x = 16\frac{1}{9}$ b $x = 2$ c $a = 5$
 d $b = 7$ e $y = 7$ f $x = -3\frac{1}{3}$
 g $m = 4$ h $y = 1$ i $a = 5$
 j $p = -2$ k $m = 3$ l $p = 1$
 4 a $y = -7.5$ b $y = -4.667$ c $y = -26.25$
 d $y = 8.571$ e $y = -2.9$ f $y = 3.243$
 g $y = 3.667$ h $y = 2.75$ i $y = 1.976$
 j $y = -2$ k $y = -3.167$ l $y = 1.98$
 5 a D b C
 6 a $x = 5$ b $x = -3$ c $x = -8$
 d $x = -7\frac{1}{2}$ e $x = 4$ f $x = \frac{10}{11}$
 g $x = -18$ h $x = 3\frac{2}{3}$ i $x = \frac{2}{3}$
 j $x = -1\frac{3}{7}$ k $x = 0$ l $x = -15$

Maths Quest challenge (page 239)

- 1 27 2 6

Exercise 7D — Solving problems with linear equations

- 1 a $x + 3 = 5$ b $x - 9 = 7$ c $7x = 24$
 d $\frac{x}{5} = 11$ e $\frac{x}{2} = -9$ f $5x = -7$
 g $14 - x = -3$ h $3x + 5 = 8$ i $2x - 12 = 15$
 j $\frac{3x}{2} = 5$
 2 a C b D c B d B
 3 0
 4 60 years
 5 a 12.15 km
 b He will have to walk 0.85 km (850 m).
 6 23 passengers
 7 a $0.06x$ b $(1 - x)$ c $0.03(1 - x)$
 d $0.06x + 0.03(1 - x) = 0.05$
 e 0.667 or 66.7%
 8 947
 9 a Post quick distributor, cost = \$700
 b 333 flyers, cost = \$366.67

- 10 24 km
 11 $21\frac{123}{137} \approx 21.9$ km
 12 6, 7, 8, 9, or 10 books
 13 a $10 + 1.5(x - 3) + 1(x - 6)$
 b Check with your teacher.
 c Mississippi.com is \$4.50 more expensive.
 d 14 books

10 Quick Questions 2

- 1 $x = -92$ 2 $x = \frac{5}{11}$
 3 $x = -3$ 4 $x = 28$
 5 $x = -4$ 6 $x = -16$
 7 $x = 3\frac{5}{9}$ 8 0.156
 9 46 10 118

Exercise 7E — Solving linear inequations

- 1 a $x > 2$ b $a > -1$ c $y \geq 7$
 d $m \geq 4$ e $p < 1$ f $x < 7$
 g $m \leq 9$ h $a \leq 7$ i $x > 3$
 j $m \geq 2$ k $q \geq -4$ l $a > -8$
 2 a $m > 3$ b $p \leq 2$ c $a < 4$
 d $x \geq 5$ e $p > -5$ f $x \leq -7$
 g $m \geq -0.5$ h $b > -0.5$ i $m > 18$
 j $x < 8$ k $a \leq -14$ l $m \geq 25$
 3 a $m < 4.5$ b $x \geq 3$ c $p > 4$
 d $n \leq 2$ e $b < 5$ f $y > 2$
 g $m \leq -1$ h $a \geq -5$ i $b < -4\frac{1}{3}$
 j $c \leq -1$ k $p > -2$ l $a \geq -7$
 4 a $m > 3$ b $a \geq 2$ c $a < -1$
 d $a \leq -3$ e $x > 6$ f $x \leq 2$
 g $b < 4$ h $a > 5$ i $m < 2$
 j $m \leq 3$ k $b \leq -1\frac{5}{11}$ l $m \geq 1$
 5 a $x \leq 7$ b $x \geq -18$ c $x < -10$
 d $x > 10\frac{1}{2}$ e $x \geq 5$ f $x < -1\frac{4}{5}$
 6 a $m < -2$ b $p \geq -3$ c $a \leq 5$
 d $p \geq -5$ e $y \leq -3$ f $x > 7$
 g $p < 0$ h $a \geq \frac{1}{5}$ i $x > -3$
 j $a \leq -11$ k $b \leq 3$ l $x < -3$
 m $k > 8$ n $x > -18\frac{1}{2}$ o $a \leq 40$
 7 B
 8 a $x < -1$ b $m \leq -3$ c $x > 17$
 d $a > \frac{5}{8}$ e $m \geq 1\frac{1}{3}$ f $m \geq -12$
 9 a $k > 2$ b $a > -5$ c $m \leq 1\frac{2}{3}$
 d $x > 5$ e $y \geq 7$ f $d < -2$
 g $p \geq -\frac{6}{7}$ h $x \geq -5$ i $m < -2$
 j $a < 9$ k $p \geq 3$ l $x > -4\frac{1}{2}$

Exercise 7F — Rearranging formulas

- 1 a $x = \frac{y}{a}$ b $x = \frac{y-b}{a}$ c $x = \frac{y+b}{2a}$
 d $x = \frac{y+7}{2}$ e $x = \frac{8-6y}{5}$ f $x = \frac{1}{y-2}$

g $x = \frac{y+1}{y-2}$ **h** $x = \frac{4y+1}{5}$ **i** $x = -5y - 12$
j $x = 12a$ **k** $x = \frac{5a-9}{19}$ **l** $x = \frac{14a+13}{93}$
2 a $P = \frac{g+3}{4}$ **b** $c = \frac{5f}{9}$ **c** $c = \frac{5(f-32)}{9}$
d $I = \frac{V}{R}$ **e** $t = \frac{v-u}{a}$ **f** $c = \frac{b^2-d}{4a}$
g $y = hm + k$ **h** $y = m(x-b) + a$
i $a = y - m(x-b)$ **j** $x = \frac{y-a+mb}{m}$ **k** $r = \frac{C}{2\pi}$
l $x = \frac{f-by}{a}$ **m** $a = \frac{2(s-ut)}{t^2}$ **n** $G = \frac{Fr^2}{Mm}$

3 500 km

4 $\frac{10}{\pi} \approx 3.18$ cm

Summary

- 1** equals sign, one
3 by itself
5 cross-multiply
7 expand
9 reversed
11 formula, other pronumerals
2 left-hand side
4 reverse order
6 single
8 portion
10 subject

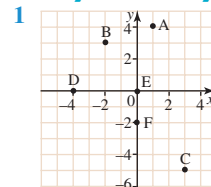
Chapter review

- 1 b, c, f, g, i**
2 a $y = 13$ **b** $y = 19$ **c** $y = 22\frac{1}{2}$
d $y = -1$ **e** $a = -12.8$ **f** $a = 0.9$
g $a = 2.8$ **h** $a = -0.6$ **i** $b = -2.52$
j $b = 3.1$ **k** $b = -3.45$ **l** $b = 0.749$
3 a $x = 2$ **b** $x = -2$ **c** $x = 4$
d $x = -21$ **e** $x = 3\frac{3}{4}$ **f** $x = 18\frac{1}{5}$
g $x = -2$ **h** $x = 15$ **i** $x = 19$
j $x = 13$ **k** $x = -6\frac{1}{3}$ **l** $x = 1\frac{1}{5}$
m $x = 6\frac{2}{3}$ **n** $x = -8$ **o** $x = -11.13$
4 a $x = -2$ **b** $x = -1$ **c** $x = \frac{1}{2}$
d $x = 3$ **e** $x = 3$ **f** $x = 5$
g $x = 2$ **h** $x = -1$ **i** $x = 7$
5 a $x = 3\frac{1}{5}$ **b** $x = 2\frac{5}{7}$ **c** $x = 1\frac{1}{4}$
d $x = -1\frac{5}{12}$ **e** $x = -12\frac{1}{2}$ **f** $x = -8\frac{1}{2}$
6 a $8h + 21 = 45$ **b** 3 hours
7 a $2x = 3 - x$ **b** $3x + 8 = 19$ **c** $6x = 4$
d $\frac{10}{x} - 1 = \frac{x}{6}$ **e** $7(2x + 5) = 0$
f $2x - 100 = x + 50$
8 600 km
9 a $x < 4$ **b** $x \geq \frac{5}{6}$ **c** $x < -2$
d $x > -14$ **e** $x \leq -2$ **f** $x < -1\frac{1}{5}$
g $x \geq 24$ **h** $x > -8\frac{1}{3}$ **i** $x < -\frac{2}{5}$
j $x \geq \frac{2}{5}$ **k** $x \leq -7$ **l** $x > -1\frac{1}{2}$

m $x \leq -3$ **n** $x \leq -4\frac{1}{2}$ **o** $x > \frac{7}{12}$
p $x \leq 7$ **q** $x > -10$ **r** $x \geq 1$
10 a $x = \frac{y+4}{6}$ **b** $x = \frac{y-c}{m}$ **c** $P = \frac{q-2r}{2} + 1$
d $w = \frac{P-2l}{2}$ **e** $a = \frac{v-u}{t}$ **f** $t = \frac{2s}{u+v}$
g $a = \frac{v^2-u^2}{2s}$ **h** $b = \frac{2A-ah}{h}$

Chapter 8 Linear graphs

Are you ready?



- 2 a** $y = 7$
b $y = 1$
c $y = 11$
3 a $y = x + 4$

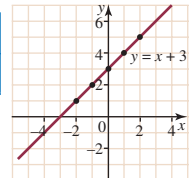
x	-2	-1	0	1	2
y	2	3	4	5	6

b $y = 3x - 2$

x	-2	-1	0	1	2
y	-8	-5	-2	1	4

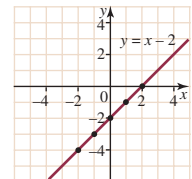
4 a $y = x + 3$

x	-2	-1	0	1	2
y	1	2	3	4	5



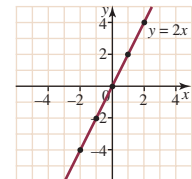
b $y = x - 2$

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



c $y = 2x$

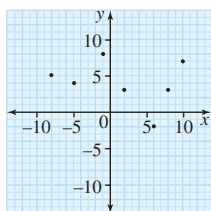
x	-2	-1	0	1	2
y	-4	-2	0	2	4



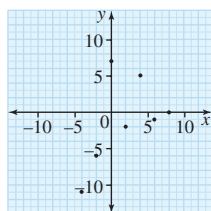
- 5 a** $y = -2x + 8$
b $y = 3x + 4$
c $y = -2x + \frac{1}{2}$
6 a $\frac{2}{3}$ **b** $\frac{1}{2}$

Exercise 8A — Plotting graphs

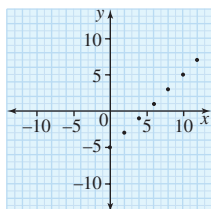
1 a



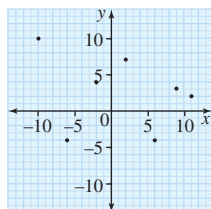
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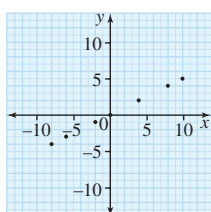
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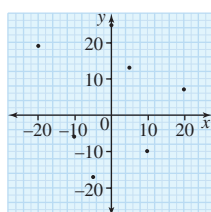
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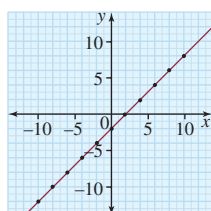
e



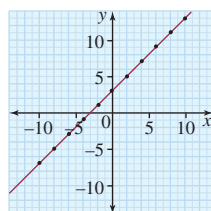
f



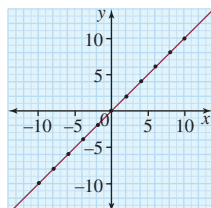
2 a



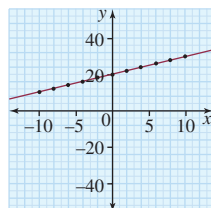
b



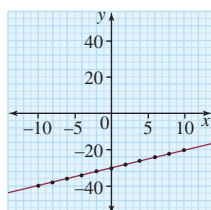
c



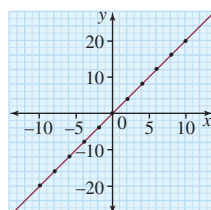
d



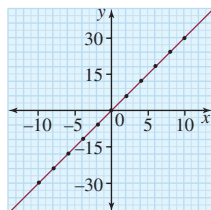
e



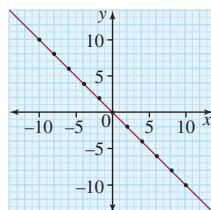
f



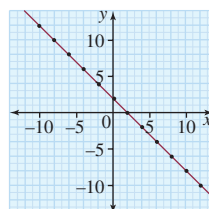
g



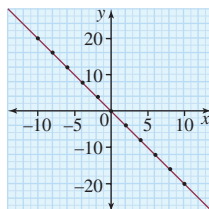
h



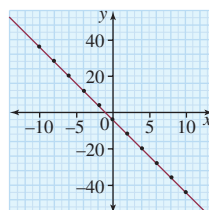
i



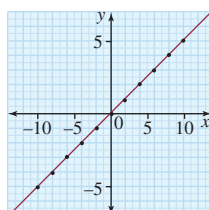
j



k



l



3 a B

b C

c D

4 a, c, e, f, g, h, j, k

Exercise 8B — General equation of a straight line

- 1 a Gradient = 4
c Gradient = 0
e Gradient = 400
g Gradient = 0
i Gradient = -300
k Gradient = undefined
- b Gradient = 1
d Gradient = 20
f Gradient = -5.2
h Gradient = -5
j Gradient = 11
l Gradient = -1

- 2 a Gradient = 6
c Gradient = 0
e Gradient = -2.2
g Gradient = 0
i Gradient = -2.6
k Gradient = 9
- b Gradient = -4
d Gradient = 1.2
f Gradient = -45
h Gradient = 0.1
j Gradient = 0
l Gradient = -0.1

- 3 a 5
f 0.5
k -2
- b -3
g -1
l $\frac{7}{2}$ or 3.5
- c 3
h 0
- d -2
i 23
- e 0.5
j 2

- 4 a 23
f 5.2
k $-\frac{5}{2}$
- b 54
g 100
l $-\frac{19}{6}$
- c -6
h 100
- d 70
i -87
- e 1
j $-\frac{5}{2}$

- 5 a Gradient = 4, y-intercept = 8
b Gradient = -4, y-intercept = 8
c Gradient = -2, y-intercept = 7
d Gradient = 12, y-intercept = 0
e Gradient = 0.5, y-intercept = 2.5
f Gradient = -40, y-intercept = 83
g Gradient = -4, y-intercept = -18
h Gradient = 1.2, y-intercept = -3.6
i Gradient = 0.5, y-intercept = 1.5
j Gradient = 0.067, y-intercept = 0
k Gradient = 3, y-intercept = 5
l Gradient = 4, y-intercept = -8

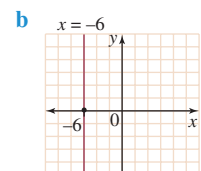
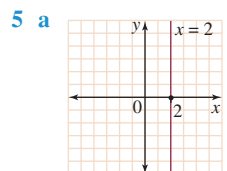
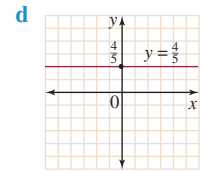
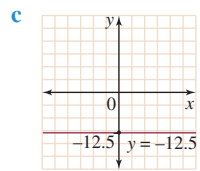
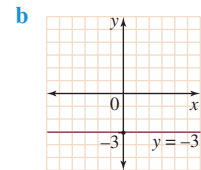
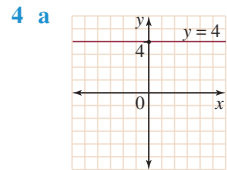
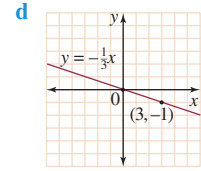
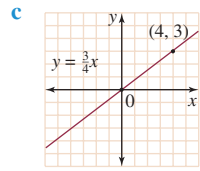
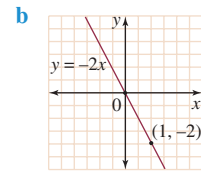
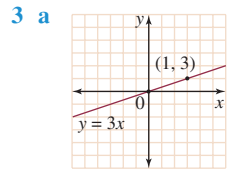
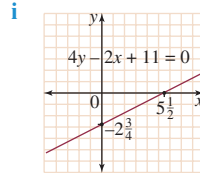
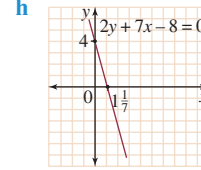
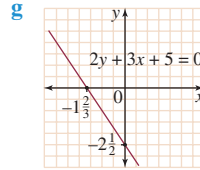
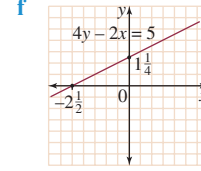
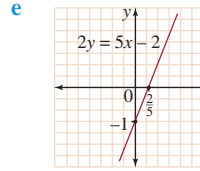
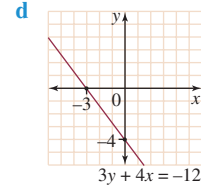
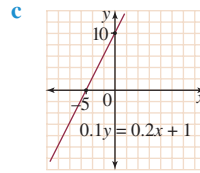
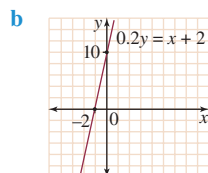
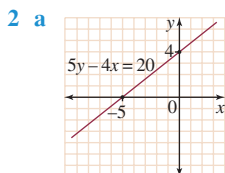
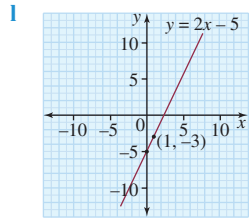
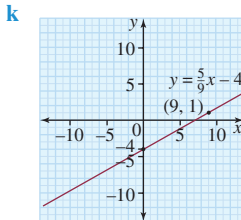
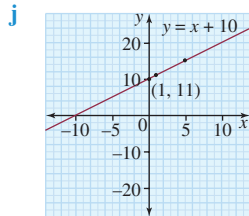
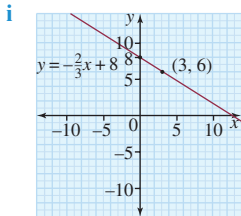
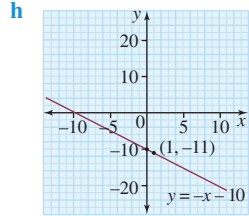
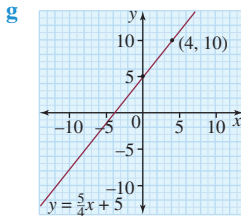
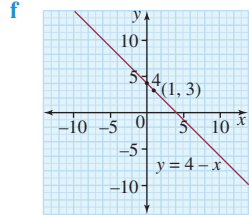
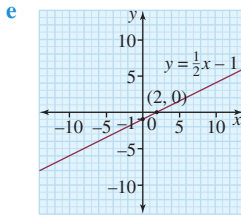
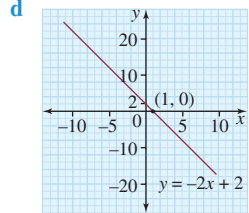
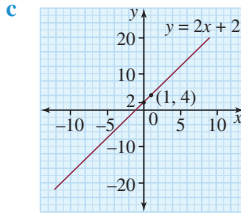
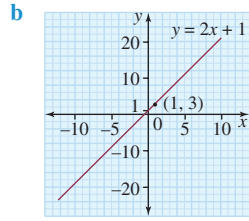
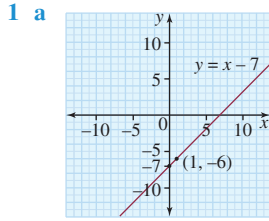
- 6 a $y = 5x - 2$
d $y = -999$
g $y = -4x$
- b $y = 1.2x$
e $y = 3$
h $x = 6$
- c $y = -6x + 2$
f $y = -2x - 5$
i $y = 3x + 4$

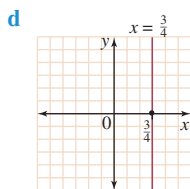
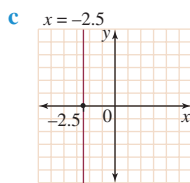
7 C

8 x-intercept = $-\frac{c}{m}$

9 Check with your teacher.

Exercise 8C — Sketching linear graphs





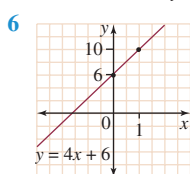
6 a D b E

Maths Quest challenge (page 279)

- 1 Athlete number 5
2 9 different line segments

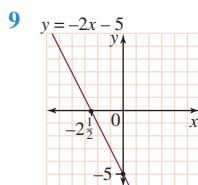
10 Quick Questions 1

- 1 3 2 $-\frac{2}{5}$
3 $-\frac{9}{2}$ or -4.5 4 -5.3
5 Gradient = 4, y-intercept = 6



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

8 -5



- 10 a Vertical line cutting the x-axis at 5.
b Horizontal line cutting the y-axis at -8.
c Line passing through the origin with a gradient of 4.

Exercise 8D — Determining linear rules

- 1 a $y = 4x + 2$ b $y = -4x + 1$ c $y = 4x + 8$
d $y = 6x + 7$ e $y = -2.5x + 6$ f $y = 45x + 135$
2 a $y = -2x$ b $y = 4x$ c $y = 10.5x$
d $y = -20x$ e $y = 1.07x$ f $y = 32x$
3 a $y = x + 2$ b $y = -x + 8$ c $y = -4x - 8$
d $y = 2x - 13$ e $y = -5x + 70$ f $y = 2x - 23$
g $y = -6x + 11$ h $y = -x - 1.5$ i $y = -6x - 42$
j $y = -3.5x + 15.5$ k $y = 1.2x - 4.08$
l $y = 0.2x - 1.76$
4 a $y = -4x + 24$ b $y = 2x - 6$
c $y = -2x + 4$ d $y = 5x + 35$
e $y = 1.5x - 3.75$ f $y = 0.4x - 0.96$
5 a $y = x + 3$ b $y = -\frac{5}{4}x + 5$
c $y = -6x + 6$ d $y = \frac{7}{8}x + 35$
e $y = x + 8$ f $y = -2x + 6$
g $y = -\frac{3}{7}x - 3$ h $y = \frac{1}{4}x + 50$
i $y = 2x + 3$ j $y = 0.625x + 2.5$
k $y = \frac{13}{31}x + 13$ l $y = -0.282x + 15.3$
6 a $y = x + 17$ b $y = -x + 3$ c $y = 11$
d $y = x + 3.5$ e $y = -x + 3.5$
f $y = \frac{1}{9}x + \frac{34}{9}$ (or $9y = x + 34$)

- g $y = -6x + 90$ h $y = 20x$ i $y = -x + 4$
j $y = -0.25x + 5.5$ k $y = \frac{2}{7}x - \frac{32}{7}$ (or $7y = 2x - 32$)

l $y = \frac{2}{3}x + \frac{10}{3}$

7 a $y = \frac{7}{4}x$ b $y = x$ c $y = -2x$

d $y = -\frac{37}{12}x$ or $y = -3.083x$ e $y = -\frac{24}{11}x$ f $y = -\frac{x}{3}$

8 a B b B c A d E

Maths Quest challenge (page 285)

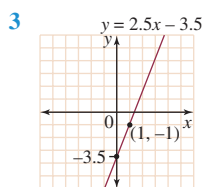
- 1 a 90 000 b 83
2 91
3 140
4 204

Exercise 8E — Applications of linear graphs to worded problems

- 1 a $A = 25t + 60$ b \$5060 c \$60
2 a $C = 0.55s + 2.0$ b \$8.60
3 a $y = 900x - 1800$ b 3150
c 20 700
4 a $N = -30t + 300$ b 10 months
5 a $N = -22t + 164$ b 120
c 5 d 7.5 months
6 a 27 b 108
7 a $C = 0.75d + 2.50$ b \$11.13
c \$19.83
8 a $C = 0.7d + 2.70$ b \$10.75
c 27.6 km
9 21.4 months
10 240°C

10 Quick Questions 2

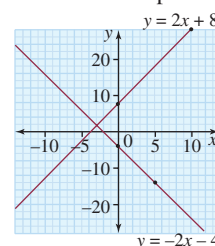
- 1 4 2 $-\frac{1}{2}$



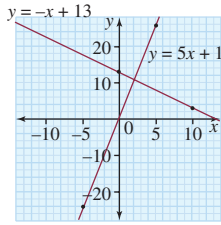
- 4 $(-4, 0)$ and $(0, 7)$
5 $(0, 12)$ only (no x-intercept)
6 $y = -4x - 12$
7 $y = -2x - 3$
8 $y = 4.5x + 6.75$
9 $y = -2x$
10 a $y = 5x + 55$ b 115 cm

Exercise 8F — Simultaneous linear equations

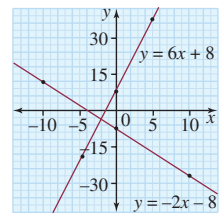
- 1 Intersection point is $(-3, 2)$.



2 Intersection point is (2, 11).



3 Intersection point is (-2, -4).



4 a $C = 65 + 0.65k$

b $C = 80 + 0.45k$

c 75 km, cost = \$113.75

5 a 3 minutes

b 90 km

6 a Company XYZ, cost = \$4.80

b 15 km, cost = \$8.40

7 a HoleWorld, cost = \$2000

b 500 disks, cost = \$1350

Summary

1 horizontal

3 linear graph

5 steepness, $\frac{\text{rise}}{\text{run}}$

7 constant term

9 two

11 x-intercept

13 zero

15 $x = a$

17 c

19 simultaneously

2 rules

4 $y = mx + c$

6 constant

8 positive

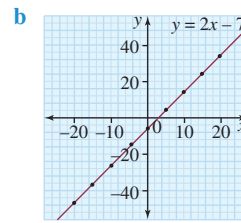
10 standard form

12 $x = 0$

14 $y = c$

16 gradient, $\frac{y_2 - y_1}{x_2 - x_1}$

18 one



3 a, c, e, f

4 a 2

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

c 0

5 a 2

b $\frac{5}{4}$

6 a $m = -3$, $c = 7$

b $m = \frac{3}{2}$, $c = 3$

c $m = -\frac{2}{5}$, $c = 0$

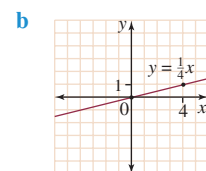
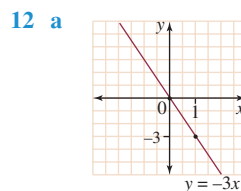
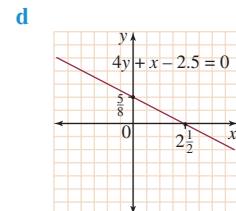
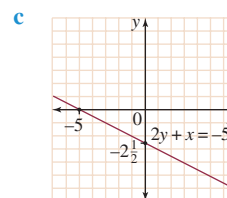
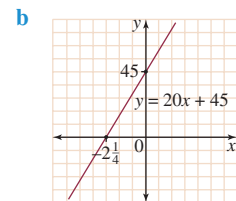
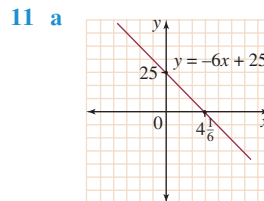
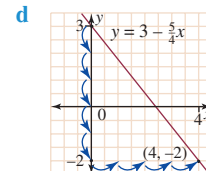
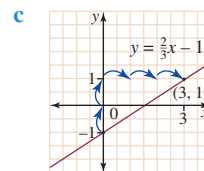
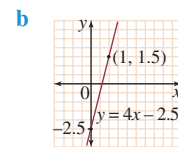
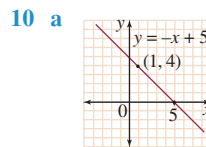
d $m = 0$, $c = 4$

7 a $y = 2x$

b $y = 2 - \frac{2}{7}x$

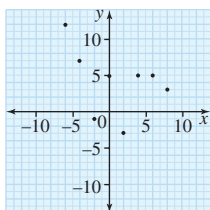
8 E

9 B



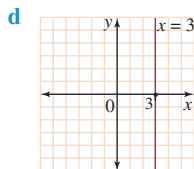
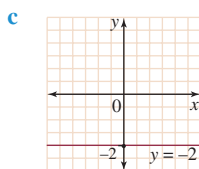
Chapter review

1



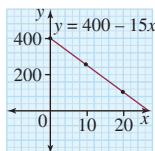
2 a

x	-20	-15	-10	-5	0	5	10	15	20
y	-47	-37	-27	-17	-7	3	13	23	33



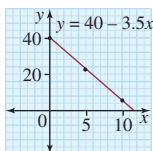
- 13 a $y = 2x - 7$ b $y = 2x - 14$ c $y = 2x - 5$
 d $y = -5x$ e $y = -x - 2$ f $y = -2.75x + 7.75$
 g $y = x - 3$ h $y = -2x + 5$

- 14 a $y = 400 - 5x$



- b 26.7 or 27 weeks c \$175 d 21 repayments

- 15 a $y = 40 - 3.5x$



- b 11.4 hours

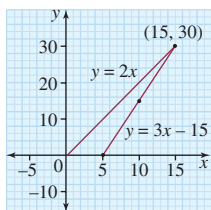
- c 22.75 km

- 16 a $x = 2; y = 5$

- b $x = -4; y = 7.5$

- 17 a $y = 3x - 15$

b



- c $x = 15, y = 30$ (that is, after 15 days)

Chapter 9 Solving quadratic equations

Are you ready?

- 1 a Linear d Linear c Non-linear e Linear f Non-linear
 2 a $x^2 - 3x - 6 = 0$ b $2x^2 + 2x + 4 = 0$ c $3x^2 - 8x + 1 = 0$
 3 a $x = 6$ b $x = -3$ c $x = 2$
 4 a $(x + 2)(x - 2)$ b $(x + 5)(x - 5)$ c $(3 + y)(3 - y)$
 5 a $x(x + 6)$ b $x(x - 1)$ c $2x(2x + 5)$
 6 a $(x + 1)(x + 3)$ b $(x - 7)(x + 5)$ c $(2x + 3)(x + 1)$

Exercise 9A — What are quadratic equations?

- 1 a linear d quadratic g quadratic j linear b quadratic e other h quadratic k other c quadratic f linear i other l other
 2 a $x^2 + 2x - 1 = 0$ b $x^2 + x - 10 = 0$ c $4x^2 + 5x - 30 = 0$ d $8x^2 - 11x + 2 = 0$ e $2x^2 + x - 60 = 0$ f $x^2 - 17 = 0$ g $2x^2 + 5x - 40 = 0$ h $x^2 - 3x + 6 = 0$ i $3x^2 - 4x + 23 = 0$

- 3 a D b C
 4 a $A_{SI} = x^2$ b $A_C = \pi x^2$ c $\pi x^2 - 4 \text{ cm}^2$
 d $x^2 = \pi x^2 - 4$ e $(\pi - 1)x^2 - 4 = 0$

Exercise 9B — Solving quadratic equations of the form $(x - a)(x - b) = 0$

- 1 a $x = -3, x = 2$ b $x = -2, x = 3$
 c $x = -2, x = 3$ d $x = -2\frac{1}{2}, x = -\frac{3}{4}$
 e $x = -4, x = -\frac{1}{2}$ f $x = \frac{1}{2}, x = -30$
 g $x = -\frac{1}{2}, x = 3$ h $x = 1, x = \frac{1}{3}$
 i $x = 0, x = 2$ j $x = -\frac{1}{3}, x = \frac{1}{4}$
 k $x = -2.3, x = 0.3$ l $x = -\frac{1}{6}, x = \frac{1}{6}$
 m $x = 2$ n $x = 0, x = \frac{15}{4}$ o $x = -4$
 2 a, b, d, f, h and i are in the correct form.
 c No, not an equation.
 e No, the right-hand side is not equal to 0.
 g No, not expressed as a product of 2 factors.
 3 a $x = 2, x = -2, x = -3$ b $x = -2, x = 2.5$
 c $x = -2, x = -4$ d $x = 0, x = -2, x = -4$
 e $x = 1.1, x = -2.4, x = -2.6$
 f $x = -3, x = -\frac{1}{2}, x = 1\frac{2}{3}$ g $x = 3$
 h $x = -1, x = 2$
 4 a D b B
 5 4 seconds

10 Quick Questions 1

- 1 Quadratic — highest power of 2
 2 Linear — highest power of 1
 3 $4x^2 - 15x - 7 = 0$
 4 $2x^2 - 7x + 5 = 0$
 5 $7x^2 + 2x - 8 = 0$
 6 $x = 7$
 7 $x = -1, x = -2$
 8 $x = \frac{3}{4}, x = \frac{5}{2}$
 9 $p = 0, p = \frac{5}{3}$
 10 $x = \pm\frac{3}{2}$

Exercise 9C — Solving quadratic equations with 2 terms

- 1 a $x = -3, x = 3$ b $x = -4, x = 4$
 c $x = -3, x = 3$ d $x = -5, x = 5$
 e $x = -10, x = 10$ f $x = -7, x = 7$
 g $x = -3, x = 3$ h $x = -2, x = 2$
 i No real solutions j No real solutions
 k $x = -3, x = 3$ l $x = -4, x = 4$
 m $x = -5, x = 5$ n $x = 0$ o $x = 0$
 2 a $x = 0, x = -6$ b $x = 0, x = 8$
 c $x = 0, x = -9$ d $x = 0, x = 11$
 e $x = 0, x = 6$ f $x = 0, x = 7.5$
 g $x = 0, x = \frac{2}{3}$ h $x = 0, x = -1\frac{3}{4}$
 i $x = 0, x = 2\frac{1}{2}$ j $x = 0, x = -1$
 k $x = 0, x = \frac{1}{4}$ l $x = 0, x = -5$
 m $x = 0, x = -12$ n $x = 0, x = 18$
 o $x = 0, x = 2.5$
 3 a A b C
 4 The number is either -4 or 4.

- 5 a x^2 b $x^2 - x$ c $x^2 - x = 0$ d $x = 0, 1$
 e The number is 1. 0 is not a solution because it is not a positive number.
 6 a Let $\$x$ be Kylie Ciccone's fee.
 b $\$x^2$ c $\$64\,000\,000$
 d $x^2 = 64\,000\,000$ e $\$8000$

Exercise 9D — Solving quadratic equations with 3 terms

- 1 a $x = 2, x = 4$ b $x = -2, x = -4$
 c $x = -1, x = -5$ d $x = 2, x = -3$
 e $x = 3, x = -5$ f $x = -2$
 g $x = 4, x = -6$ h $x = 8, x = -3$
 i $x = -3, x = 4$ j $x = -12, x = -1$
 k $x = 11, x = -1$ l $x = 4, x = -5$
 m $x = -25, x = -4$ n $x = 5, x = 10$
 o $x = 4, x = -2$
 2 a $-3, -\frac{1}{2}$ b $-1, \frac{1}{2}$ c $-2\frac{1}{2}, 3$ d $-3, -1$
 e $-2\frac{1}{3}, -2$ f $-1, -\frac{2}{3}$ g $1\frac{2}{5}, 3$ h $\frac{2}{5}, 3$
 i $-\frac{5}{7}, 1$ j $\frac{5}{7}, 4$ k $-1\frac{1}{2}, \frac{1}{2}$ l $-2\frac{1}{2}, -\frac{1}{3}$
 3 a B b D c D
 4 a 0 b $0 = 2 - t^2 - t$ or $2 - t^2 - t = 0$
 c $t = -2, 1$ d 1 s
 5 a $x = 0$
 b $0 = t^2 - 5t + 4$ or $t^2 - 5t + 4 = 0$
 c $t = 1, 4$ d after 1 min e 4 min

Maths Quest challenge (page 318)

- 1 Zoe plus 15 friends (16 altogether)
 2 5 different-sized squares



Exercise 9E — Solving quadratic equations in turning point form

$$a(x - b)^2 + c = 0$$

- 1 a $x = -1, x = -3$ b No real solutions
 c $x = 1, x = -7$ d $x = 0, x = 8$
 e $x = 1, x = -5$ f No real solutions
 g No real solutions h $x = 7.2, x = -2.8$
 i No real solutions j $x = 3.8, x = -4.2$
 k $x = -3.8, x = -1.8$ l $x = 0.2, x = -5.8$
 m $x = -7, x = -3$ n No real solutions
 o $x = 4, x = 12$ p $x = 0.8, x = -5.2$
 q No real solutions r $x = -6.5, x = 3.5$
 s $x = 1.2, x = -1.2$ t $x = 2.45, x = 0.95$
 2 D

10 Quick Questions 2

- 1 Other
 2 $x^2 - 4x + 12 = 0$
 3 $x = -7, x = -6$
 4 $x = \frac{1}{10}$ $x = -\frac{1}{27}$
 5 $x = \pm 4$
 6 $x = 0$ or $x = \frac{12}{5}$
 7 $x = 1, x = 11$
 8 $x = -2, x = 1$
 9 $x = -3, x = 7$
 10 There are no real solutions.

Exercise 9F — Problems and applications using quadratic equations

- 1 10 s
 2 3 s
 3 7.9 m/s and 39.5 m/s
 4 a \$12 b \$11
 5 a 30 m b 10 m
 6 -15
 7 2 or 5
 8 2
 9 a 1 m b 3 m
 10 180 m
 11 7 m
 12 a $2x\text{ m}^2$ b $2x^2\text{ m}^2$ c 2 m

Summary

- 1 quadratic 2 zero
 3 standard 4 common factors
 5 Null Factor 6 $x = 3$
 7 difference 8 coefficient
 9 turning 10 define
 11 valid

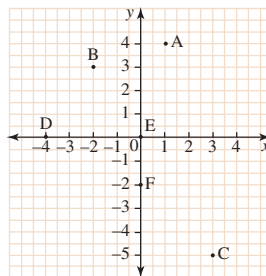
Chapter review

- 1 D 2 A
 3 $x = -4, x = 3$ 4 B
 5 $x = 3.5, x = 4$ 6 $x = -3, x = 3$
 7 $x = -5, x = 5$ 8 $x = -7, x = 0$
 9 $x = -1, x = 5$ 10 $x = 1, x = 10$
 11 $x = -\frac{1}{2}, x = 5$
 12 a $x = -10, x = -1$ b $x = -2, x = 0$
 c No real solutions
 13 a $x = -6, x = 2$ b $x = 0, x = 6$
 c $x = -6, x = 4$
 14 6 s 15 -2

Chapter 10 Quadratic graphs

Are you ready?

- 1 a $x = -2$ b $x = 3$ c $x = 1\frac{1}{2}$ or $\frac{3}{2}$
 2 a 0 b -16 c -38
 3



- 4 a $x = -6, x = -8$ b $x = 3, x = -\frac{7}{2}$
 c $x = -\frac{1}{14}, x = \frac{1}{12}$
 5 a $(x + 3)(x + 4)$ b $(x + 6)(x - 2)$
 c $(x - 12)(x - 1)$
 6 a $x = -8, x = -3$ b $x = 3, x = 7$
 c $x = -12, x = 5$

Exercise 10A — Key features of the graph of a quadratic function

- 1 a $x = 0$ b $x = 0$ c $x = -1$ d $x = 0$
 e $x = 0$ f $x = 2$

- 2 a (0, 0) min b (0, -3) min c (-1, -2) min
d (0, 0) max e (0, 2) max f (2, -1) max

- 3 a $x = 0$, (0, 1), min b $x = 1$, (1, -3), min
c $x = -2$, (-2, 2), max d $x = -1$, (-1, -2), max
e $x = 2$, (2, 2), min f $x = 0$, (0, 1), max

- 4 a x-intercepts are -1 and 1, y-intercept is -1
 $x = 0$, (0, -1), min
b x-intercepts are -1 and 1, y-intercept is 1
 $x = 0$, (0, 1), max
c x-intercepts are -1 and 3, y-intercept is -3
 $x = 1$, (1, -4), min
d x-intercepts are -3 and -1, y-intercept is -3
 $x = -2$, (-2, 1), max

- e x-intercepts are $-1\frac{1}{2}$ and $\frac{1}{2}$, y-intercept is $-\frac{3}{4}$
 $x = -\frac{1}{2}$, $(-\frac{1}{2}, -1)$, min

- f No x-intercepts, y-intercept is $2\frac{1}{4}$
 $x = \frac{1}{2}$, $(\frac{1}{2}, 2)$, min

- g x-intercept is 2, y-intercept is 4
 $x = 2$, (2, 0), min

- h x-intercept is -1, y-intercept is -1
 $x = -1$, (-1, 0), max

- i x-intercepts are -1 and 3, y-intercept is 3
 $x = 1$, (1, 4), max

- j x-intercepts are -1 and 5, y-intercept is -5
 $x = 2$, (2, -9), min

- 5 a B b C c A d D

Exercise 10B — Plotting points to draw graphs of quadratic functions

- 1 a $y = 2x^2$

x	-3	-2	-1	0	1	2	3
$y = 2x^2$	18	8	2	0	2	8	18

(-3, 18), (-2, 8), (-1, 2), (0, 0), (1, 2), (2, 8), (3, 18)

- b $y = x^2 - 4$

x	-3	-2	-1	0	1	2	3
$y = x^2 - 4$	5	0	-3	-4	-3	0	5

(-3, 5), (-2, 0), (-1, -3), (0, -4), (1, -3), (2, 0), (3, 5)

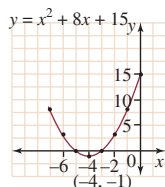
- c $y = -x^2 + 4x + 5$

x	-2	-1	0	1	2	3	4	5	6
y	-7	0	5	8	9	8	5	0	-7

(-2, -7), (-1, 0), (0, 5), (1, 8), (2, 9), (3, 8), (4, 5), (5, 0), (6, -7)

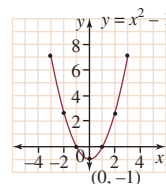
- 2 a $y = x^2 + 8x + 15$, $-7 \leq x \leq 0$

- i $x = -4$
ii (-4, -1), min
iii x-intercepts are -5 and -3, y-intercept is 15



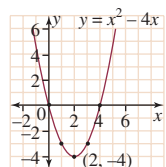
- b $y = x^2 - 1$, $-3 \leq x \leq 3$

- i $x = 0$,
ii (0, -1), min
iii x-intercepts are -1 and 1, y-intercept is -1



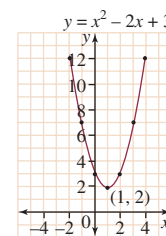
- c $y = x^2 - 4x$, $-1 \leq x \leq 5$

- i $x = 2$,
ii (2, -4), min
iii x-intercepts are 0 and 4, y-intercept is 0



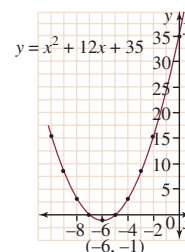
- d $y = x^2 - 2x + 3$, $-2 \leq x \leq 4$

- i $x = 1$
ii (1, 2), min
iii No x-intercepts, y-intercept is 3



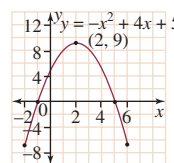
- e $y = x^2 + 12x + 35$, $-9 \leq x \leq 0$

- i $x = -6$
ii (-6, -1), min
iii x-intercepts are -7 and -5, y-intercept is 35



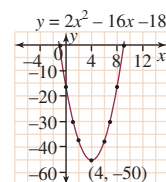
- f $y = -x^2 + 4x + 5$, $-2 \leq x \leq 6$

- i $x = 2$
ii (2, 9), max
iii x-intercepts are -1 and 5, y-intercept is 5



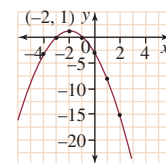
- g $y = 2x^2 - 16x - 18$, $-1 \leq x \leq 9$

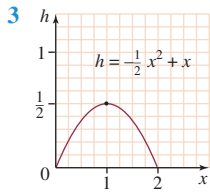
- i $x = 4$
ii (4, -50), min
iii x-intercepts are -1 and 9, y-intercept is -18



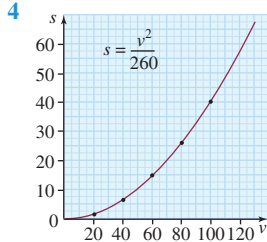
- h $y = -x^2 - 4x - 3$, $-4 \leq x \leq 2$

- i $x = -2$
ii (-2, 1), max
iii x-intercepts are -3 and -1, y-intercept is -3

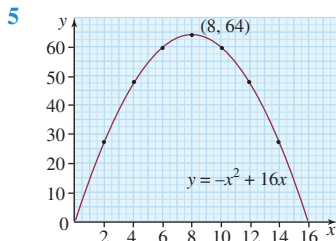




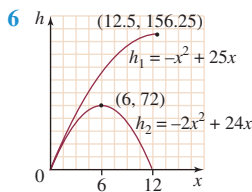
Maximum height is 500 m.



- a Stopping distances
- i 14 m
 - ii 38 m
 - iii 55 m
- b 81 km/h

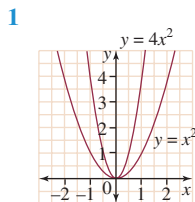


No. They were 2.3 metres across.

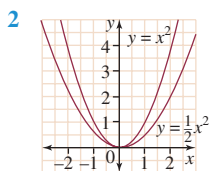


The 9 iron

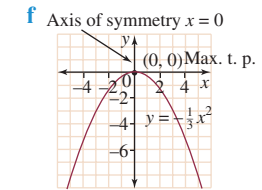
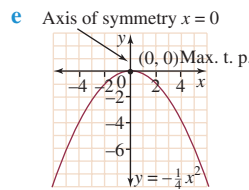
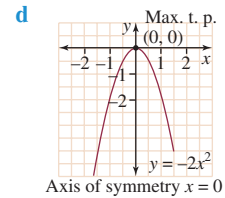
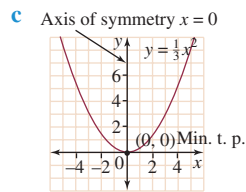
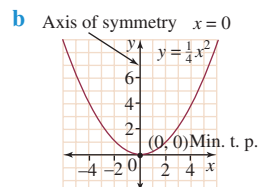
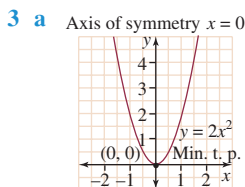
Exercise 10C — Sketching parabolas of the form $y = ax^2$



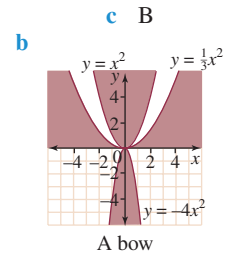
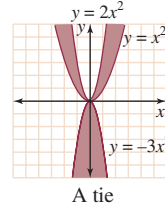
$y = 4x^2$ is narrower.
 Turning point for each is at (0, 0)
 x-int. and y-int. is 0 for both.



$y = x^2$ is narrower.
 Turning point for each is at (0, 0)
 x-int. and y-int. is 0 for both.



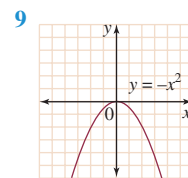
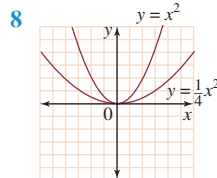
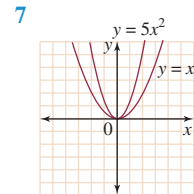
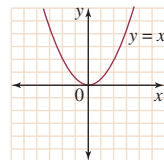
4 a B
 5 a



6, 7 Discuss in class.

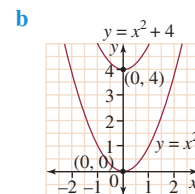
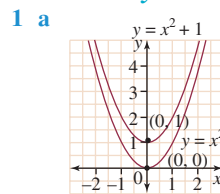
10 Quick Questions 1

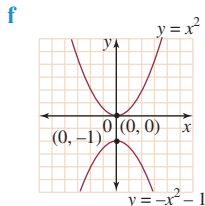
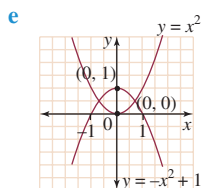
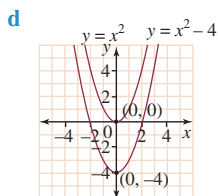
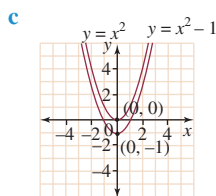
- 1 $x = 3$
- 2 Minimum turning point is at (3, -1).
- 3 The x-intercepts are 1 and 3; y-intercept is -3.
- 4 9
- 5 3 and -3
- 6



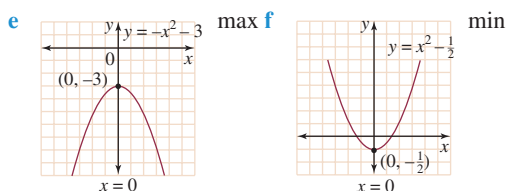
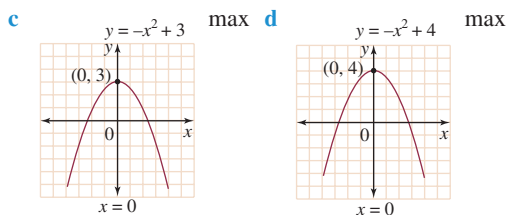
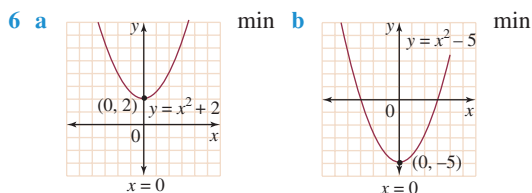
- 10 The parabola is inverted. For $-1 < a < 0$, the parabola is wider than $y = x^2$ (or $y = -x^2$) and for $a < -1$, the parabola is narrower than $y = x^2$ (or $y = -x^2$).

Exercise 10D — Sketching parabolas of the form $y = ax^2 + c$



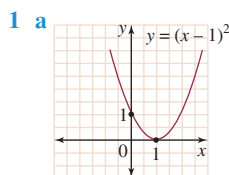


- 2 A positive number moves the graph up.
 3 A negative number moves the graph down.
 4 **a** No
b A negative sign inverts the graph.
 5 The y-axis or the line $x = 0$.

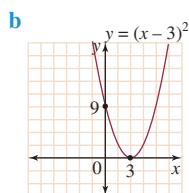


- 7 **a** C **b** E
c E **d** E
 8 5 km above sea level
 9 12 m

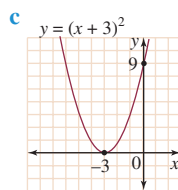
Exercise 10E — Sketching parabolas of the form $y = (x - b)^2$



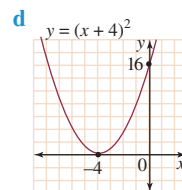
min at (1, 0)



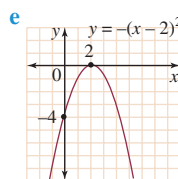
min at (3, 0)



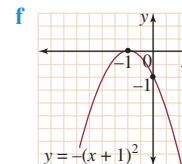
min at (-3, 0)



min at (-4, 0)



max at (2, 0)



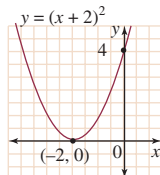
max at (-1, 0)

- 2 **a** $x = 1$ **b** $x = 3$
c $x = -3$ **d** $x = -4$
e $x = 2$ **f** $x = -1$

- 3 The graph of $y = x^2$ is moved to the right (horizontal translation to the right).
 4 The graph of $y = x^2$ is moved to the left (horizontal translation to the left).
 5 No. The graph is inverted with the same turning point and axis of symmetry.

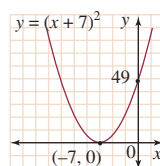
- 6 **a** C **b** D

- 7 **a**



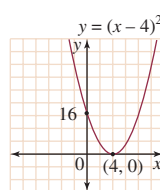
min, $x = -2$

- b**



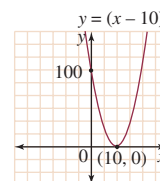
min, $x = -7$

- c**

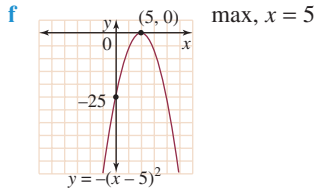
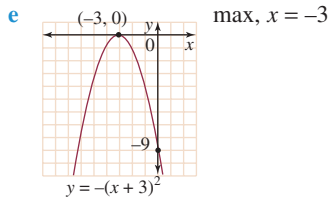


min, $x = 4$

- d**



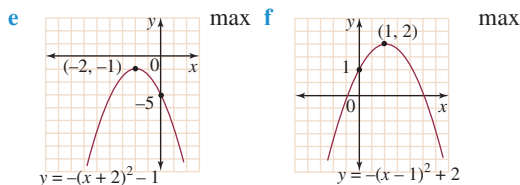
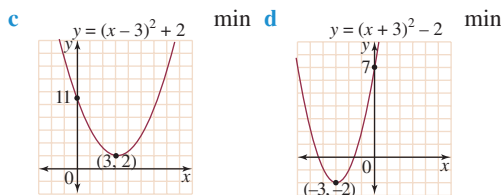
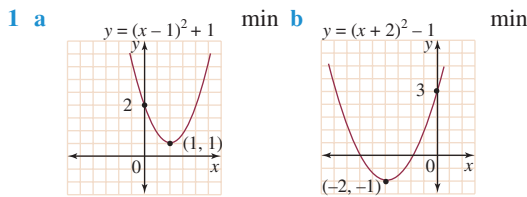
min, $x = 10$



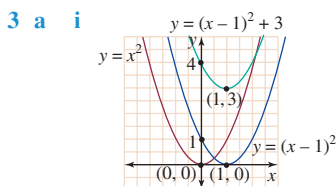
Maths Quest challenge (page 353)

- 1 36
- 2 Brad took less time. The difference in their travel times was 3 minutes and 6 seconds.

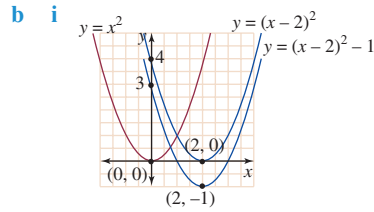
Exercise 10F — Sketching parabolas of the form $y = (x - b)^2 + c$ (turning point form)



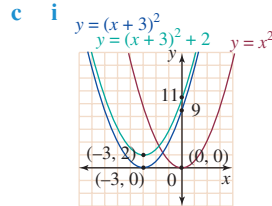
- 2 It is easy to find the turning point from the equation.



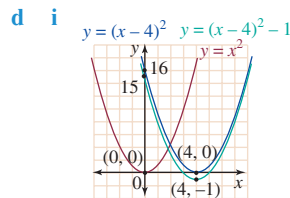
- ii** 1 right **iii** 1 right, 3 up



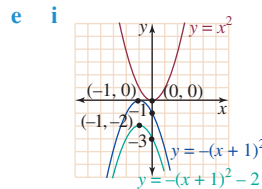
- ii** 2 right **iii** 2 right, 1 down



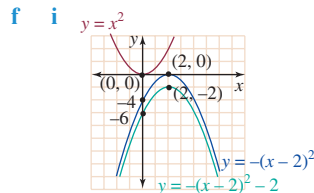
- ii** 3 left **iii** 3 left, 2 up



- ii** 4 right **iii** 4 right, 1 down

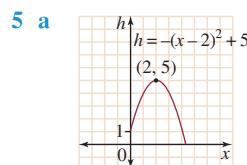


- ii** reflect in the x -axis, 1 left
iii reflect in the x -axis, 1 left, 2 down



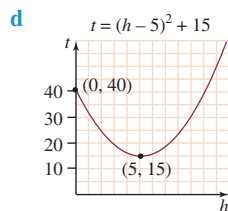
- ii** reflect in the x -axis, 2 right
iii reflect in the x -axis, 2 right, 2 down

- 4 a** E **b** A **c** C



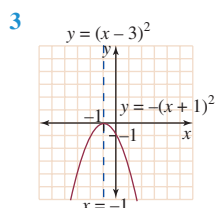
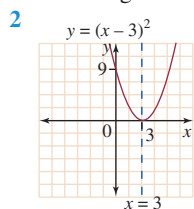
- b** 1 metre **c** 5 metres

- 6 a 40°C b 15°C c 5 hours



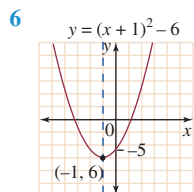
10 Quick Questions 2

- 1 To the right



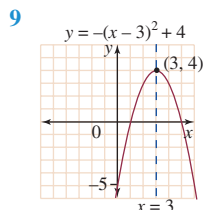
- 4 Minimum turning point is at $(-1, -6)$.

- 5 -5



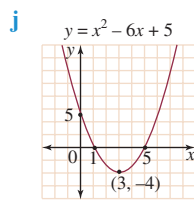
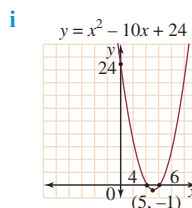
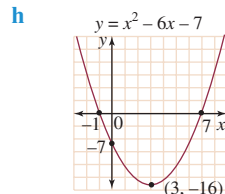
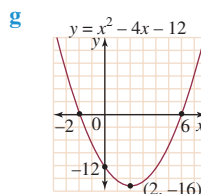
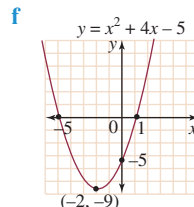
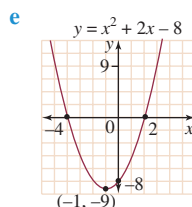
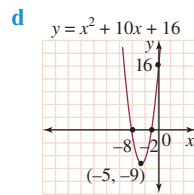
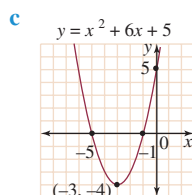
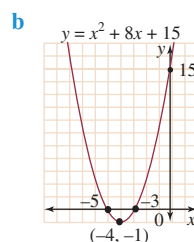
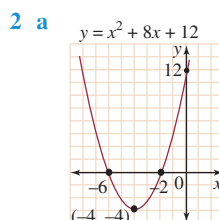
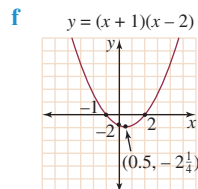
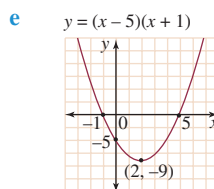
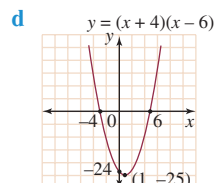
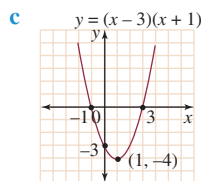
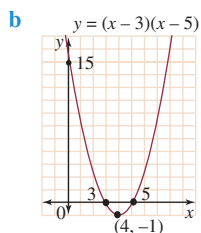
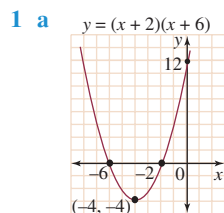
- 7 Maximum turning point is at $(3, 4)$.

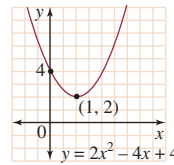
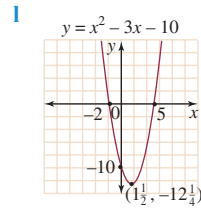
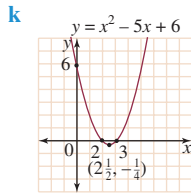
- 8 -5



- 10 $(0, -1)$

Exercise 10G — Sketching parabolas of the form $y = (x + a)(x + b)$ (intercept form)

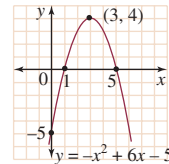




$x = 1, (1, 2)$, min,
no x -intercepts,
 y -intercept is 4.

d $y = -x^2 + 6x - 5, 0 \leq x \leq 6$

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



$x = 3, (3, 4)$, max,
 x -intercepts are 1 and 5,
 y -intercept is -5.

Summary

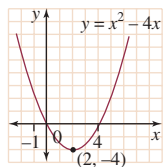
- | | |
|--------------------------------------|--------------------------------|
| 1 symmetrical, parabola | 2 axis of symmetry |
| 3 point | 4 maximum |
| 5 minimum | 6 positive |
| 7 negative | |
| 8 a turning point form | |
| b intercept form | |
| c factorised, x -intercepts | |
| 9 $y = 0$ | 10 $x = 0$ |
| 11 dilation | 12 horizontal, vertical |
| 13 sketched | |

Chapter review

- 1 a** $x = 0, (0, -4)$, min, x -intercepts are -2 and 2, y -intercept is -4.
b $x = 0, (0, 9)$, max, x -intercepts are 3 and -3, y -intercept is 9.
c $x = 1, (1, 0)$, min, x -intercept is 1, y -intercept is 1.
d $x = -3, (-3, 0)$, max, x -intercept is -3, y -intercept is -9.
e $x = -1, (-1, 1)$, min, no real x -intercepts, y -intercept is 2.
f $x = -1, (-1, -4)$, min, x -intercepts are 1, -3, y -intercept is -3.

2 a $y = x^2 - 4x, -2 \leq x \leq 6$

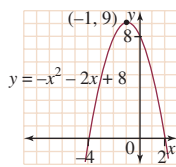
x	-2	-1	0	1	2	3	4	5	6
y	12	5	0	-3	-4	-3	0	5	12



$x = 2, (2, -4)$, min,
 x -intercepts are 0 and 4,
 y -intercept is 0.

b $y = -x^2 - 2x + 8, -5 \leq x \leq 3$

x	-5	-4	-3	-2	-1	0	1	2	3
y	-7	0	5	8	9	8	5	0	-7

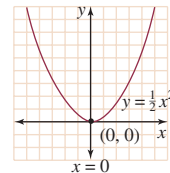
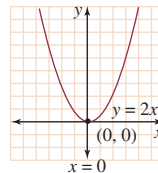


$x = -1, (-1, 9)$, max,
 x -intercepts are -4 and 2,
 y -intercept is 8.

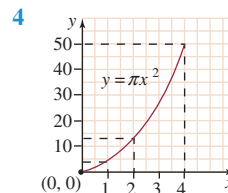
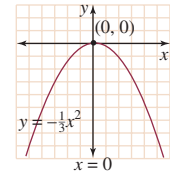
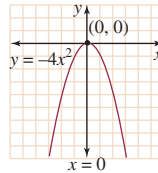
c $y = 2x^2 - 4x + 4, -2 \leq x \leq 3$

x	-2	-1	0	1	2	3
y	20	10	4	2	4	10

3 a min **b** min

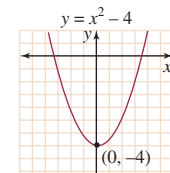
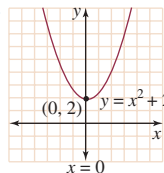


c max **d** max

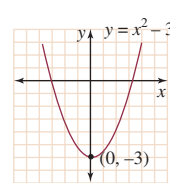
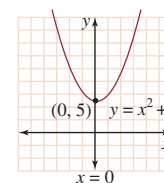


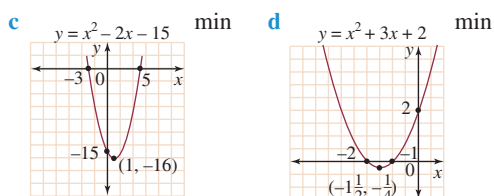
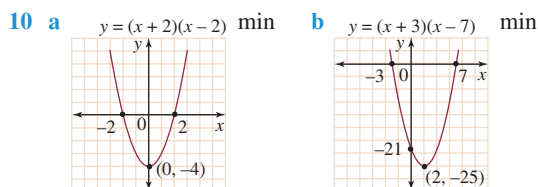
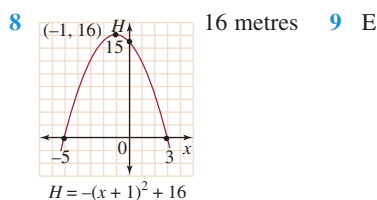
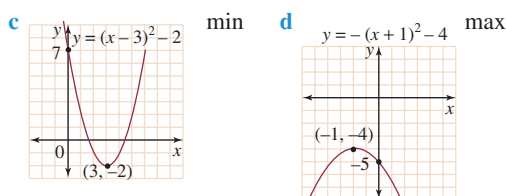
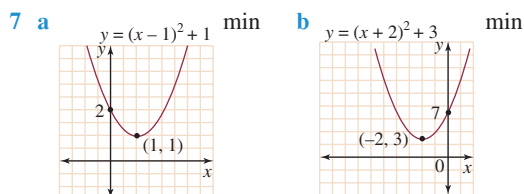
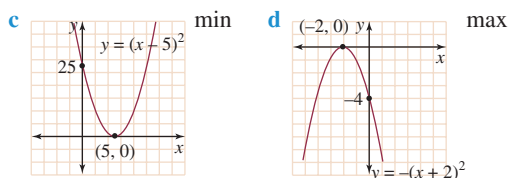
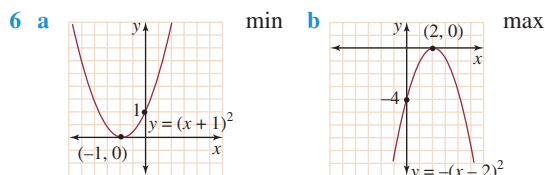
i $A \approx 3$ units; **ii** $A \approx 12.6$ units; **iii** $A \approx 50$ units.
The area is roughly 4 times the original area.

5 a min **b** min



c min **d** min





11 50 metres, 20 metres

12 Yes

Chapter 11 Geometry

Are you ready?

1 GKP or PKG

2 a Reflex b Right c Obtuse
d Acute e Straight f Reflex

3 a 55° b 145°

4 a $x = 62^\circ$ b $a = 77^\circ, b = 103^\circ$ c $y = 45^\circ$

5 a i Co-interior ii Corresponding iii Alternate
b $a = 52^\circ, b = 128^\circ, c = 52^\circ, d = 128^\circ$

c Line AB is not parallel to line CD. For parallel lines, alternate angles should be equal.

6 a $a = 84^\circ$ b $b = 88^\circ$ c $c = 75^\circ$

Exercise 11A — Angle review

1 a $\angle AOB$ b $\angle MON$ c $\angle BAC$

2 a Reflex b Acute c Straight

d Obtuse e Obtuse f Reflex

g Obtuse h Right i Reflex

j Revolution

3 a Complementary = 70° , supplementary = 160°

b Complementary = 45° , supplementary = 135°

c Complementary = 0° , supplementary = 90°

d Complementary = 18° , supplementary = 108°

e Complementary = 1° , supplementary = 91°

f Complementary = $(90 - q)^\circ$,
supplementary = $(180 - q)^\circ$

g Complementary = $(40 - n)^\circ$,
supplementary = $(130 - n)^\circ$

h Complementary = $(100 - k)^\circ$,
supplementary = $(190 - k)^\circ$

i Complementary = $(70 + p)^\circ$,
supplementary = $(160 + p)^\circ$

j Complementary = x° , supplementary = $(90 + x)^\circ$

4 a $x = 50^\circ$ b $x = 20^\circ$

c $x = 160^\circ, y = 20^\circ, z = 160^\circ$

d $x = 90^\circ, y = 72^\circ$ e $x = 40^\circ$ f $x = 160^\circ$

g $x = 40^\circ$ h $x = 330^\circ$ i $x = 85^\circ$

j $x = 30^\circ$ k $x = 20^\circ$ l $m = 45^\circ$

5 a 55° b 120°

6 a Corresponding b Alternate

c Alternate d Co-interior

e Alternate f Corresponding

7 a $p = 89^\circ$ (alternate), $q = 89^\circ$ (vertically opposite p)

b $i = 120^\circ$ (corresponding)

c $k = 95^\circ$ (co-interior)

d $a = 102^\circ$ (straight), $b = 78^\circ$ (vertically opposite),
 $c = e = 78^\circ$ (corresponding to 78°),
 $d = f = 78^\circ$ (corresponding to b)

e $x = 65^\circ$ (co-interior), $n = 115^\circ$ (alternate),
 $m = 115^\circ$ (alternate), $y = 65^\circ$ (co-interior)

f $m + 40^\circ = 70^\circ$ (alternate), $m = 30^\circ$

g $x + 60^\circ = 80^\circ$ (corresponding), $x = 20^\circ$

h $3x = 120^\circ$ (corresponding), $x = 40^\circ$

i $4m = 80^\circ$ (co-interior), $m = 20^\circ$

j $a = 30^\circ$ (straight angle)

$b = 30^\circ$ (alternate)

$c = 25^\circ$ (alternate)

$d = 155^\circ$ (straight angle)

$e = 155^\circ$ (straight angle)

k $p = 30^\circ$ (straight angle)

$q = 30^\circ$ (corresponding angle)

$t = 115^\circ$ (vertically opposite)

$s = 65^\circ$ (co-interior)

$r = 85^\circ$ (straight angle)

l $t = 15^\circ$ (straight angle)

$u = 120^\circ$ (corresponding angle)

8 a Parallel (corresponding angles are equal)

b Not parallel (co-interior angles are not equal)

c Not parallel (alternate angles are not equal)

d Not parallel (corresponding angles are not equal)

9 Roof a as corresponding angles are equal, making the rafters parallel.

10 a 85° b 25° c 45° d 30°

e 75° f 48° g 20°

h $a = b = c = 60^\circ$ i $j = 75^\circ$, $k = 52.5^\circ$

11 a $x = 58^\circ$ b $x = 66^\circ$

c $y = 105^\circ$, $x = 80^\circ$ d $x = 65^\circ$, $y = 64^\circ$

e $a = 40^\circ$, $b = 20^\circ$ f $x = 30^\circ$

g $x = 110^\circ$, $y = 115^\circ$, $z = 100^\circ$

h $x = 34^\circ$ i $x = 20^\circ$

12 a 1080° b 135° c 45°

13 a Triangle b 120°

14 a Interior = 144° , exterior = 36°

b Interior = 150° , exterior = 30°

c Interior = 162° , exterior = 18°

15 a 120° b 60°

Maths Quest challenge (page 376)

1 150° 2 36°

10 Quick Questions 1

1 $m = 36^\circ$, $4m = 144^\circ$

2 49°

3 139°

4 $a = 240^\circ$

5 $a = 45^\circ$, $3a = 135^\circ$, $b = 45^\circ$, $c = 45^\circ$

6 $a = 66^\circ$, $b = 66^\circ$, $c = 64^\circ$

7 $a = 72^\circ$, $b = 54^\circ$, $c = 11^\circ$, $d = 61^\circ$

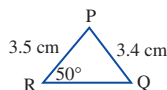
8 $a = 112^\circ$, $b = 68^\circ$, $c = 112^\circ$, $d = 68^\circ$

9 2340°

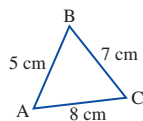
10 144°

Exercise 11B — Sketching and constructing 2-dimensional shapes

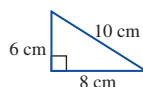
1



2

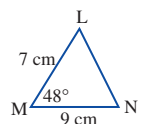


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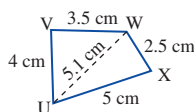


It is a right-angled triangle.

4



5



6 a An equilateral triangle: **i** Set the pair of compasses to a desired length and, from a point at the beginning of a baseline, draw an arc. **ii** Then, using the same radius, and using the point of intersection of the line and the arc, draw another arc. **iii** Join each pair of points; that is, the starting point, the point where the line and the arc meet and the point where the two arcs meet, by straight lines.

b i Draw a 4 cm line. Set the pair of compasses at 2 cm and draw arcs from both ends of the line.

ii Using a protractor, construct 120° angles at both ends of the line. **iii** Draw a line at this angle to intersect the arc at each end. **iv** Join the points of intersections of the arcs and the arms joining the angles by a straight line.

7 In a triangle, the sum of the two smaller sides needs to be more than the largest side.

a The sum of the two smaller sides is less than the largest side.

b The sum of the two smaller sides is equal to the largest side.

c The largest side has to be the hypotenuse in a right triangle.

8 b Altitudes

9 Tangent

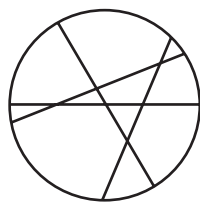
10 Decagon

11 to 16 Check your constructions with your teacher.

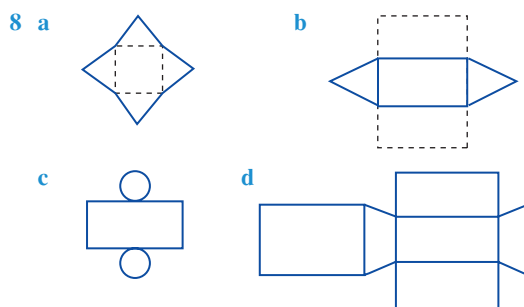
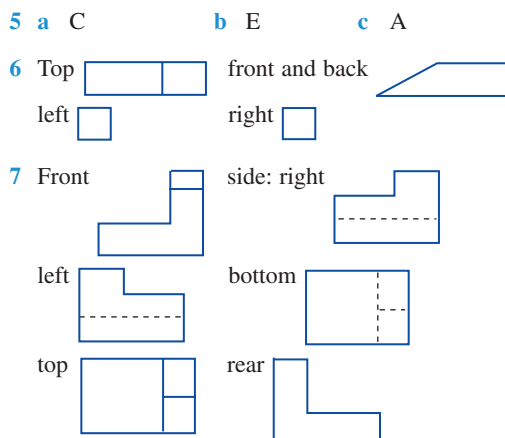
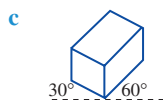
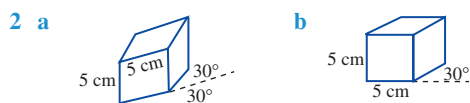
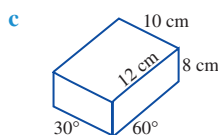
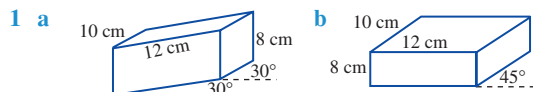
Maths Quest challenge (page 386)

11 pieces

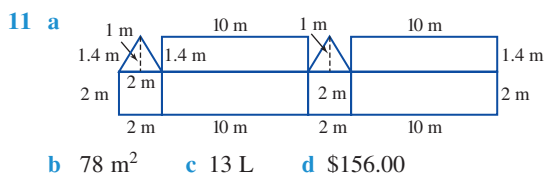
One possible solution:



Exercise 11C — Drawing 3-dimensional solids



- 9 a Cone b Square pyramid
c Hexagonal pyramid d Triangular pyramid
- 10 a Cupboards, fridges, safes, bookcases; ...
b Cans, drums
c Balls (soccer, cricket, tennis)
d Ice-cream cones, party hats, cones used as markers on roadsides and sports fields

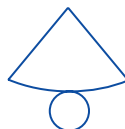


Exercise 11D — Inscribed and circumscribed circles

Check with your teacher.

10 Quick Questions 2

- 1 Complement = 56°, supplement = 146°
2 $a = 35^\circ$
3 $a = 92^\circ$, $b = 51^\circ$, $c = 37^\circ$
4 156°
5, 6 Check with your teacher.
7

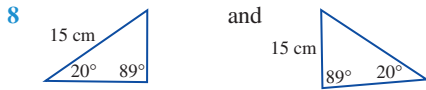


8 to 10 Check with your teacher.

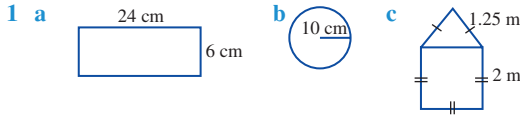
Exercise 11E — Congruent figures

- 1 a ii and iii b i and iii c i and iv
2 a $\triangle ABC$ and $\triangle PQR$, SSS
b $\triangle ABC$ and $\triangle LMN$, SSS
c $\triangle LMN$ and $\triangle PQR$, SAS
d $\triangle ABC$ and $\triangle PQR$, ASA
e $\triangle ABC$ and $\triangle LMN$, RHS
f $\triangle ABC$ and $\triangle DEF$, ASA
- 3 a $x = 3$ cm b $x = 85^\circ$
c $x = 80^\circ$, $y = 30^\circ$, $z = 70^\circ$ d $x = 30^\circ$, $y = 7$
e $x = 40^\circ$, $y = 50^\circ$, $z = 50^\circ$, $n = 90^\circ$, $m = 90^\circ$
- 4 a 2 cm b 8 cm c 8 mm d 7 mm
5 D
6 a SSS b SSS c SAS

- 7 The third side and the other two angles can be different.



Exercise 11F — Similar figures



- 2 a i and iii, AAA
c i and ii, SAS
e i and iii, SSS
- b i and ii, SSS
d i and iii, RHS

- 3 a Triangles ABC and DEC
b Triangles PQR and ABC
c Triangles PQR and STR
d Triangles ABC and DEC
e Triangles ADB and ADC

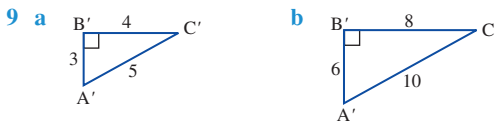
4 $\triangle EDC$

5 Check with your teacher.

- 6 a i 1.3 cm ii 2.6 cm b 2

- 7 a $\frac{AB}{AD} = \frac{BC}{DE} = \frac{AC}{AE}$ b $f = 9, g = 8$

- 8 a $i = 3\frac{1}{3}, h = 3\frac{1}{3}$ b $j = 1.8, k = 4.53$



- 10 $x = 4$

- 11 $x = 20^\circ, y = 2\frac{1}{4}$

- 12 $x = 3, y = 4$

- 13 8 m

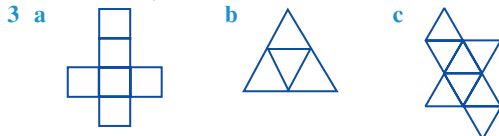
- 14 2.4 m

- 15 14.36 m

Exercise 11G — Polyhedra construction

- 1 b 8 faces, octahedron

- 2 Check with your teacher.



- 4 Check with your teacher.

Summary

- 1 acute, obtuse, reflex
2 complementary, supplementary
3 opposite, corresponding, alternate
4 Co-interior
5 180°
6 exterior

- 7 360°

- 8 $180^\circ \times (n - 2)$

- 9 isometric, oblique, planometric, perspective, Orthogonal

- 10 net

- 11 Congruent

- 12 Similar

- 13 $\frac{\text{image length}}{\text{object length}}$

- 14 Mediators, circumcentre

- 15 incentre

- 16 polyhedron

Chapter review

- 1 a Acute b Acute c Reflex
d Obtuse e Reflex f Obtuse

- 2 a 18° b 30°

- 3 a 150° b 108°

- 4 a 60° b 50°

- c $a = 120^\circ, z = 60^\circ$ d $a = 60^\circ, c = 60^\circ$

- e $f = 80^\circ, d = 80^\circ$ f $g = 70^\circ, h = 70^\circ, j = 110^\circ$

- g 75° h 40° i 10°

- 5 $a = 140^\circ, b = 40^\circ, c = 40^\circ, d = 90^\circ$

- 6 a $x = 83^\circ, y = 97^\circ$ b $x = 70^\circ$

- c $x = 60^\circ$ d $x = 50^\circ$

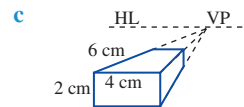
- e $x = 20^\circ$ f $m = 35^\circ$

- g $x = 107^\circ$ h $x = 75^\circ, y = 25^\circ$

- i $x = 280^\circ$

- 7 a 720° b 120° c 60°

- 8 to 10 Check with your teacher.



- 12 Top view:

Front and rear views:

Left and right views:

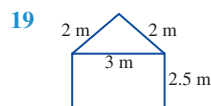
- 13, 14 Check with your teacher.

- 15 $x = 12$ cm, $y = 80^\circ, z = 40^\circ$

- 16 a 3 b $x = 3, y = 12$

- 17 $\angle BAC$ and $\angle CFE$, $\angle ABC$ and $\angle CEF$, $\angle ACB$ and $\angle ECF$

- 18 $\angle PQR = \angle STR$, $\angle QPR = \angle TSR$, $\angle R$ is common,
 $\therefore \triangle PQR \sim \triangle STR$, AAA



20 5 m

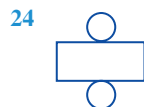
21 a 10 m b 40°

22 a $\angle P = \angle S$, given angle O is common
 $\angle R = \angle T$, third angle in a triangle, AAA

b $OP = OR = OS = OT$ (all radii)

c If two corresponding sides are equal, that implies that the third side should also be equal, given all corresponding angles are equal.

23 Check with your teacher.

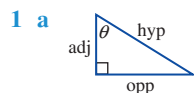


Chapter 12 Trigonometry

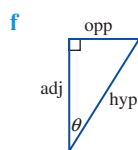
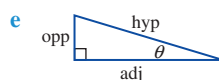
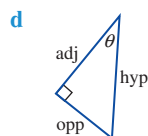
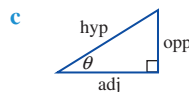
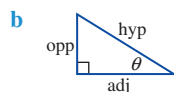
Are you ready?

- 1 a 30° b 58°
 2 a 4.74 b 18.5 c 0.378
 d 507.182 e 10.80 f 0.7643
 3 a $x = 12$ b $x = 13.05$ c $x = 3.444$ 16
 4 a $x = 24$ b $x = 0.36$ c $x = 540$
 5 a East b South; west
 c C d B e Southwest
 6 a 6.9 cm b 25.1 cm
 7 a Isosceles b $\angle ABC = \angle ACB = 45^\circ$
 c 2.83 cm

Exercise 12A — Naming the sides of a right-angled triangle



- 2 a $DE = \text{hyp}$ $DF = \text{opp}$ $\angle E = \theta$
 b $GH = \text{hyp}$ $IH = \text{adj}$ $\angle H = \theta$
 c $JL = \text{hyp}$ $KL = \text{opp}$ $\angle J = \theta$



3 a iv

Triangle	Angle θ	Adjacent side	Opposite side	Hypotenuse	Sine ratio $\left(\frac{\text{opp}}{\text{hyp}}\right)$	Cosine ratio $\left(\frac{\text{adj}}{\text{hyp}}\right)$	Tangent ratio $\left(\frac{\text{opp}}{\text{adj}}\right)$
$\triangle MNO$	$\angle M = 60^\circ$	15 mm	25 mm	29 mm	0.86	0.52	1.67
$\triangle PQR$	$\angle P = 60^\circ$	18 mm	30 mm	35 mm	0.86	0.51	1.67
$\triangle STU$	$\angle S = 60^\circ$	11 mm	18 mm	21 mm	0.86	0.52	1.64

b sine ratio ≈ 0.86 , cosine ratio ≈ 0.52 , tangent ratio ≈ 1.66

c sine ratio = $\frac{47 \text{ mm}}{54 \text{ mm}} = 0.87$, cosine ratio = $\frac{27 \text{ mm}}{54 \text{ mm}} = 0.50$,

tangent ratio = $\frac{47 \text{ mm}}{27 \text{ mm}} = 1.74$

d ≈ 0.87 , ≈ 0.50 , ≈ 1.74

4 D

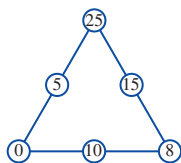
5 a E

b C

c C

Maths Quest challenge (page 432)

1 2 39 3 0

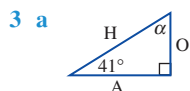


5 About 62°

6 Just over 13 minutes more

Exercise 12B — Trigonometric ratios

- 1 a i $\sin \theta = \frac{e}{f}$ ii $\cos \theta = \frac{d}{f}$ iii $\tan \theta = \frac{e}{d}$
 b i $\sin \alpha = \frac{i}{g}$ ii $\cos \alpha = \frac{h}{g}$ iii $\tan \alpha = \frac{i}{h}$
 c i $\sin \beta = \frac{l}{k}$ ii $\cos \beta = \frac{j}{k}$ iii $\tan \beta = \frac{l}{j}$
 d i $\sin \gamma = \frac{n}{m}$ ii $\cos \gamma = \frac{o}{m}$ iii $\tan \gamma = \frac{n}{o}$
 e i $\sin \beta = \frac{b}{c}$ ii $\cos \beta = \frac{a}{c}$ iii $\tan \beta = \frac{b}{a}$
 f i $\sin \gamma = \frac{v}{u}$ ii $\cos \gamma = \frac{t}{u}$ iii $\tan \gamma = \frac{v}{t}$
- 2 a $\sin \theta = \frac{12}{15}$ b $\cos \theta = \frac{25}{30}$ c $\tan \theta = \frac{4}{5}$
 d $\tan \theta = \frac{2.7}{p}$ e $\sin 35^\circ = \frac{17}{t}$ f $\sin \alpha = \frac{14.3}{17.5}$
 g $\sin 15^\circ = \frac{7}{x}$ h $\tan \theta = \frac{20}{31}$ i $\cos \alpha = \frac{3.1}{9.8}$



- b O = 34 mm A = 39 mm H = 51 mm
 c i $\sin 41^\circ = 0.67$ ii $\cos 41^\circ = 0.76$
 iii $\tan 41^\circ = 0.87$
 d $\alpha = 49^\circ$
 e i $\sin 49^\circ = 0.76$ ii $\cos 49^\circ = 0.67$
 iii $\tan 49^\circ = 1.15$
 f They are equal.
 g They are equal.
 h The sin of an angle is equal to the cos of its complement angle.

4 a D b A c E

Exercise 12C — Finding trigonometric ratios using a calculator

- 1 a 0.7314 b 0.9613 c 1.2349 d 0.9962
 e 28.6363 f 0.9063 g 0.5774 h 0.9903
 i 0.1392 j 0 k 0.5150 l 0.9325
- 2 d i 0.5736 ii 0.8192 iii 0.7002

Exercise 12D — Finding side lengths

- 1 a 13.02 m b 7.04 m c 27.64 mm
 d 2.79 cm e 6.27 m f 14.16 m
- 2 a 2.95 cm b 25.99 cm c 184.73 cm
 d 14.06 km e 8.43 km f 31.04 m

- 3 a 26.96 mm b 60.09 cm c 0.84 km
 d 0.94 km e 5.59 m f 41.67 m
 g 54.73 m h 106.46 cm i 298.54 mm
- 4 a $a = 17.95$ $b = 55.92$
 b $a = 15.59$ $b = 9.00$ $c = 10.73$
 c $a = 12.96$ $b = 28.24$ $c = 15.28$
- 5 a 275.75 km b 48.62 km
- 6 21.32 m
- 7 285.63 m
- 8 a E b B c A d D

10 Quick Questions 1

- 1 $\sin \beta = \frac{b}{c}$ 2 0.4067
 3 0.675 4 $\cos \theta = \frac{y}{z}$
 5 0.54 m 6 17.11 mm
 7 45.9 cm 8 63.34 cm
 9 59.14 cm 10 2.6 m

Exercise 12E — Finding the size of an angle

- 1 a 39° b 72° c 37° d 53°
 e 69° f 71° g 79° h 77°
 i 15°
- 2 a 19° b 42° c 55° d 21°
 e 49° f 80° g 35° h 45°
 i 41° j 23° k 58° l 80°
- 3 a 47° b 45° c 24° d 43°
 e 45° f 18° g 26° h 12°
 i 76°
- 4 30.56°
 5 21.80°
 6 Path 1 as it has the steepest gradient.
 Site 1 $\theta = 74^\circ$
 Site 2 $\theta = 18^\circ$
 Site 3 $\theta = 61^\circ$

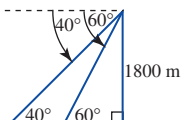
7 a D b B c E d C

10 Quick Questions 2

- 1 0.2924 2 31.06 m
 3 3.20 mm 4 9.5 m
 5 30° 6 65°
 7 38° 8 31°
 9 57° 10 77°

Exercise 12F — Angles of elevation and depression

- 1 11° Yes, the ramp meets specifications.
 2 14.11 m
 3 66.35 m
 4 a b 1105.93 m



- 5 a b 42.01 m
-

- 6 1.59 m
 7 63°
 8 34°, 3.17 m
 9 Con: 34° John: 30°
 Con, as he is able to kick the ball through a wider angle

- 10 595.88 m
 11 25.36 m
 12 68.69 m
 13 a B b D c C d E

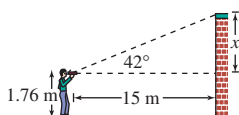
Exercise 12G — Further applications of trigonometric ratios

- 1 a $a = 15$ $\theta = 37^\circ$ $\beta = 56^\circ$
 b $x = 13.86$ $y = 40.52$
 c $x = 30^\circ$ $y = 56^\circ$ $z = 30$
 d $x = 56$ $y = 48.50$
 e $x = 12.77$ $y = 4.37$ $\theta = 41^\circ$
 f $x = 11.65$ $y = 24.45$ $\theta = 39^\circ$
 g $w = 11.34$ $x = 11.33$ $y = 11.34$ $z = 54.04$
 h $a = 90.46$ $b = 15^\circ$
 $c = 93.85$ if Pythagoras' theorem used or $c = 96.59$ if $\sin 15^\circ$ is used.

- 2 a 8.43 m b 56.54 m

- 3 44.88 m

- 4 a b 15.27 m



- 5 63°
 6 5.36 m, 4.50 m, 2.82 m, 19.62 m²
 7 51.78 cm 37.62 cm
 8 111.87 km
 9 66 m

- 10 a 54° b 0.75 m

History of mathematics

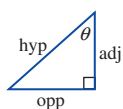
- 1 Mt Everest
 2 The Great Trigonometric Survey of India
 3 A leveller, zenith, sector, telescope, chronometer, theodolite, heist and chain

Summary

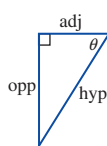
- 1 angle
 2 hypotenuse, opposite, adjacent
 3 $\sin \theta = \frac{O}{H}$
 4 cosine ratio
 5 opposite side (O) to the adjacent side (A)
 6 SOH-CAH-TOA
 7 length
 8 two
 9 inverse
 10 trigonometric inverses
 11 angle of elevation
 12 angle of depression
 13 is equal to

Chapter review

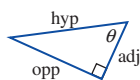
- 1 a



- b



- c



- 2 a AB = adj BC = hyp AC = opp
 b DE = adj DF = hyp $\angle D = \theta$
 c GI = hyp HI = opp $\angle G = \theta$

- 3 E

- 4 a $\cos \theta = \frac{6}{7}$ b $\tan \beta = \frac{12}{5}$ c $\sin \gamma = \frac{11}{13}$

- 5 C

- 6 a 0.8090 b 0.7771 c 0.2126

- 7 a 7.76 b 36.00 c 2.56 m

- d 19.03 e 6.79 km f 394.29 mm

- 8 32.34 cm

- 9 7.78 m

- 10 1.44 m

- 11 B

- 12 B

- 13 a 9° b 33° c 28°

- 14 A

- 15 a 32° b 45° c 39°

- d 52° e 68° f 30°

- g 60° h 60° i 83°

- 16 74.41°

- 17 0.033 km or 33 m

- 18 a Length = 4.63 cm Width = 2.36 cm

- b 10.93 cm^2

- 19 $s = 41.69$ $t = 16.84$

- 20 $\alpha = 74.45^\circ$ $\beta = 27.42^\circ$

- 21 5.80 km

- 22 21°

Chapter 13 Measurement

Are you ready?

- 1 a 5400 cm b 87 mm c 0.025 m

- 2 a 20 cm b 18 cm c 31.42 cm d 25.76 cm

- 3 a 20 cm b 22 mm c 60 m d 18.85 m

- 4 a 36 cm^2 b 44 m^2 c 52 cm^2
 d 706.95 cm^2 (using $\pi = 3.142$) or 706.86 cm^2 (using π on a calculator)

- 5 a 25 cm^2 b 24 mm^2 c 150 m^2

- d 28.27 m^2

- 6 a 96 cm^2 b 142 m^2

- 7 a 64 cm^3 b 105 m^3

Exercise 13A — Errors of measurement

- 1 a 0.8°C b 0.070 c 7%

- 2 a i 0.69 km ii 0.054 iii 5.4%

- b i 2860 m ii 0.186 iii 18.6%

- c i 5 min ii 0.036 iii 3.6%

- d i 1.99 m^2 ii 0.161 iii 16.1%

- 3 a 0.5 cm b $94.5 \text{ cm} \leq \text{width} \leq 95.5 \text{ cm}$

- 4 a 0.005 s b $38.245 \text{ s} \leq \text{lap time} \leq 38.255 \text{ s}$

- 5 a 0.5°C b 5 km c 2.5 cents d 0.0005 s

- 6 C

- 7 a $11.52 \text{ V} \leq \text{volts} \leq 12.48 \text{ V}$

- b Batteries with 11.57 V, 11.63 V, 11.64 V, 12.15 V and 12.32 V will be accepted. The battery with 11.38 V will be rejected.

- c This batch of batteries is accepted.

- 8 a i $38.4 \text{ km/h} \leq \text{speed} \leq 41.6 \text{ km/h}$

- ii $57.6 \text{ km/h} \leq \text{speed} \leq 62.4 \text{ km/h}$

- iii $74 \text{ km/h} \leq \text{speed} \leq 86 \text{ km/h}$

- iv $92.5 \text{ km/h} \leq \text{speed} \leq 107.5 \text{ km/h}$
 v Range at 77 km/h is $71.225 \text{ km/h} \leq \text{speed} \leq 82.775 \text{ km/h}$

b The speedometer is acceptable.

c 5.1%

9 a $3.18^\circ \leq \text{temperature} \leq 3.42^\circ\text{C}$

b 3.19°C (3.1944°C) $\leq \text{temperature} \leq 3.41^\circ\text{C}$ (3.4056°C)

c The Imbetter thermometer is better. It has a smaller tolerance range (more accurate).

Exercise 13B — Perimeter

1 Answers will vary. Check answers with your teacher.

2 a 50 mm b 152 cm c 0.125 m
 d 32.2 mm e 0.006 57 km f 0.000 64 km

g 14.35 mm h 0.000 183 5 km

3 a 1800 mm, 2100 mm, 2400 mm, 2700 mm
 180 cm, 210 cm, 240 cm, 270 cm
 1.8 m, 2.1 m, 2.4 m, 2.7 m

b 4 pieces c 330 cm

4 a 1990 m b 841 m

5 a 1170 or 1.17 km b 20 minutes

6 a 118 mm b 68 mm c 75 mm

d 123 mm e 140 mm f 75 mm

7 a 1060 cm b 85.4 cm c 206 cm

d 78.4 cm e 113 cm f 130 mm

8 a 9.6 cm b 46 mm c 31 km

9 a 25.13 cm b 25.13 m c 69.12 mm

d 44.61 cm e 19 741.77 km f 3314.38 mm

10 a 192 m b 1220 mm c 260 cm

d 74 mm e 9.6 km f 800 cm or 8 m

11 a 127.12 cm b 104.83 cm c 61.70 cm

d 8 m e 480 mm f 405.35 cm

g 125.66 cm h 245.66 mm i 70.41 cm

j 138 mm

12 222.5 m 13 37.5 km

14 12 km 15 479 897.13 km

Maths Quest challenge (page 482)

1 20-cent pieces

2 12 hours 37 minutes

3 8.3 seconds (to 1 decimal place)

Exercise 13C — Area

1 a 24 cm^2 b 16 mm^2 c 537.5 cm^2

d 149.5 cm^2 e 16.32 m^2 f 11.25 cm^2

g 292.5 cm^2 h 2.5 cm^2 i 1250 m^2

j 50.27 m^2 k 3.14 mm^2 l 36.32 m^2

2 D

3 a $13\,400 \text{ m}^2 = 0.0134 \text{ km}^2$

b $0.04 \text{ cm}^2 = 4 \text{ mm}^2$

c $3\,500\,000 \text{ cm}^2 = 350 \text{ m}^2$

d $0.005 \text{ m}^2 = 50 \text{ cm}^2$

e $0.043 \text{ km}^2 = 43\,000 \text{ m}^2$

f $200 \text{ mm}^2 = 2 \text{ cm}^2$

4 a 3481.7 mm^2 b 7.6 m^2

c 734.2 cm^2 d 578.5 cm^2

e 7086.7 m^2 f 5.4 mm^2

g 1143.4 m^2 h 100.5 cm^2

i 821 cm^2 j 661.25 mm^2

5 5.17 m^2

6 \$29 596.51

7 a 5000 km^2 b 0.5%

8 \$9229.02

9 378 cm^2

10 20.15 cm^2

11 a 100.53 cm^2

c 301.59 cm^2

b 1244.07 m^2

d 103.67 mm^2

Exercise 13D — Area and perimeter of a sector

1 a 14.14 cm^2

c 27.71 cm^2

2 a 12.6 cm^2

c 102.1 m^2

3 D

4 a 1869.2 cm^2

d 7243.6 m^2

5 $60\,318.6 \text{ m}^2$

6 a 14.3 cm b 43.6 cm c 40.7 m d 5.4 m

7 a 184.6 cm b 66.8 m c 27.4 cm

d 342.1 m e 406.3 cm f 104.4 cm

8 303.4 cm

9 170.2 m^2

10 a 14.8 m^2

b 4.4%

10 Quick Questions 1

1 4545 cm

3 50 cm

5 29.16 km

7 80 cm^2

9 47.5 m

2 5.56 m, 4.23 m

4 142 cm

6 128.8 cm

8 420 cm^2

10 152.52 m^2

Exercise 13E — Surface area of rectangular and triangular prisms

1 a 66 cm^2 b 62 m^2 c 6.7 m^2

d 4.44 m^2 e $11\,572.92 \text{ cm}^2$ f 1.9 m^2

2 a 86 cm^2 b 210.7 m^2 c 8.37 cm^2

3 a 840 cm^2 b 191.08 cm^2 c 2370 mm^2

4 261.5 cm^2

5 2 cans

7 2.21 m^2

9 9.9 m^2

11 a 150 cm^2

d 850 cm^2

12 66 cm^2

6 77.76 cm^2

8 26.44 m^2

10 2080 cm^2

b 250 cm^2 c 350 cm^2

Exercise 13F — Surface area of a cylinder

1 a 75.4 m^2 b 28.3 cm^2 c 2010.6 m^2

d 1121.5 cm^2 e 6.6 m^2 f 25.6 m^2

2 a 131.9 m^2 b 84.8 cm^2 c 3619.1 m^2

d 1575.5 cm^2 e 9.7 m^2 f 61.8 m^2

3 a 136.66 m^2 b \$8199.60

4 243.9 cm^2

5 2035.75 cm^2

6 154.73 cm^2

10 Quick Questions 2

1 67.5 km

3 13.85 m^2

5 51.5 cm

7 2.6934 cm^2

9 202 cm^2

2 Side length of 12.5 cm

4 37.5 m^2

6 269.34 mm^2

8 603.19 cm^2

10 159.40 cm^2

Exercise 13G — Surface area of spheres and other solids

- 1 615.8 cm²
- 2 a 50.3 m² b 120.8 cm² c 125 663.7 km²
d 176.7 m²
- 3 a 5026.55 cm² b 201.06 m² c 24.63 mm²
d 1.54 m² e 89 727.03 m²
- 4 5.11×10^8 km²
- 5 a 80 cm² b 390 cm² c 370.8 cm²
d 120 m² e 235.62 cm² f 56 cm²
g 339.29 cm² h 43.9 m²
- 6 98 000 m²

Maths Quest challenge (page 509)

- 1 4 m²
- 2 16 cm²

Exercise 13H — Volume of prisms and cylinders

- 1 a, b, c and e are not prisms.
- 2 a 36 cm³ b 15 cm³ c 72 cm³
- 3 a 12 cm³ b 68 cm³ c 9.6 m³
- 4 a 36 cm³ b 30 m³ c 1.144 m³
- 5 a 7020 cm³ b 6.91 m³ c 300 m³
d 8806 cm³
- 6 a 16 085.0 m³ b 4766.6 cm³ c 2.3 m³
d 30.8 m³ e 30.6 m³ f 56.5 mm³
- 7 14 476.46 L 8 75 322.8 L
- 9 0.1764 m³ 10 4580 mL
- 11 2.916×10^9 m³ 12 1147.5 L
- 13 Check with your teacher.
- 14 a 4.95 m³ b 4950 L
- 15 45.9 cm³
- 16 234 256 cm³ or 2.343 m³
- 17 7696.902 kL

Exercise 13I — Volume of pyramids, cones and composite figures

- 1 a 169.6 cm³ b 3539.5 mm³
- 2 a 784 cm³ b 8960 cm³ c 5.34 m³
d 540 cm³
- 3 a 33.50 m³ b 64 000 cm³ c 3.7 m³
- 4 a 630 mm³ b 420 cm³ c 3152.7 mm³
d 1319.5 mm³
- 5 C, D 6 6.8 m³ 7 2
- 8 4775.22 cm³ 9 84 823 cm³

Exercise 13J — Volume of spheres and composite solids

- 1 a 523.6 cm³ b 7238.2 cm³
c 2395.1 cm³ d 1150.3 cm³
e 796.3 m³ f 0.3 m³
- 2 a 1436.8 cm³ b 268.1 cm³
c 9202.8 cm³ d 137.3 cm³
e 6287.9 m³ f 7 238 229.5 km³
- 3 a 2094.40 cm³ b 10.29 m³
c 718.38 cm³ d 32.72 mm³
e 2255.43 cm³ f 3441.16 cm³
- 4 a 646.0 cm³ b 25.7 m³
c 95.4 cm³ d 2160 cm³
e 20.8 m³ f 6783 cm³
g 1.5 m³ h 18.1 cm³
- 5 2200 cm³ 6 33 510.3 cm³

- 7 a 5227.6 cm³ b 36 727.3 cm³ c 31 499.7 cm³
- 8 17.4 mL 9 9.285×10^{11} km³
- 10 1937.32 m³

Maths Quest challenge (page 527)

- 1 Approximately 56%
- 2 The parallelogram has twice the area of the triangle.

Summary

- | | |
|---------------------------|-------------|
| 1 absolute relative error | 2 Maximum |
| 3 metre | 4 multiply |
| 5 divide | 6 perimeter |
| 7 $2\pi r$ | 8 area |
| 9 πr^2 | 10 square |
| 11 sector | 12 fraction |
| 13 cross-sections | 14 face |
| 15 circles, rectangle | 16 space |
| 17 Capacity | 18 height |
| 19 cone | 20 sphere |

Chapter review

- 1 a 735 cm³ b 0.118 c 11.8%
- 2 a $\frac{1}{2}$ hour b $7\frac{1}{2}$ hours \leq time $\leq 8\frac{1}{2}$ hours
- 3 a $1.97 \text{ mm} \leq \text{width} \leq 2.03 \text{ mm}$
b Widths of 1.97 mm, 2.03 mm and 2.02 mm are accepted.
Widths of 1.96 mm and 2.04 mm are rejected.
c Since more than 1 coin is rejected, the manufacturer needs to reset the machines.
- 4 a 26 mm = 2.6 cm b 1385 mm = 138.5 cm
c 1.63 cm = 16.3 mm d 1.5 km = 1500 m
e 0.077 km = 77 m f 2850 m = 2.85 km
- 5 \$7497
- 6 a 25.1 cm b 35.2 m c 37.7 cm
- 7 a 70.4 cm b 30.4 mm c 34 m
d 240 mm or 24 cm e 13.1 m
f 308.5 cm³ g 97.1 cm
h 192 mm or 19.2 cm
- 8 a i 31.428 571 43 m ii 31.415 927 m
b 0.0004
c i 3142.857 143 m ii 3141.5927 m
absolute relative error = 0.0004
d The absolute relative error does not change, even though the radius is now 100 times bigger.
- 9 a 25 m² b 950 cm² c 387.5 cm²
d 6120 m² e 135 mm² f 2170 cm²
g 279.4 cm² h 6939.8 mm²
- 10 a 1486.9 cm² b 362.5 m² c 520.4 cm²
d 473.2 cm²
- 11 a 628.32 m² b 59.45 cm² c 197.92 cm²
d 10 734.47 m²
- 12 a 102.83 m b 31.07 cm c 57.99 cm
d 470.27 m
- 13 48 920 cm²
- 14 3550 cm²
- 15 \$99.80
- 16 a 176.71 cm² b 1576.33 m²
c 106 361.76 mm²
- 17 a 343 cm³ b 672 cm³ c 153 938.04 cm³
d 1.45 m³ e 1800 cm³ f 1256.64 cm³
g 297 cm³ h 8400 cm³ i 7238.23 mm³
- 18 1261.80 cm³

Chapter 14 — Consumer mathematics

Are you ready?

- 1 a \$23.50 b \$207.90
- 2 a 24 months b 156 weeks
- c 21 fortnights d 5 years
- 3 a \$611 b \$2619.39
- c \$27 493.44 d \$876.92
- 4 a \$16.98 b \$13.63
- 5 12.25 hours or 12 h 15 min
- 6 a \$12.84 b \$32.25
- 7 a 0.34 b 0.79
- c 0.04 d 0.672
- e 0.0825 f 0.175
- 8 a \$35 b \$356
- c \$1620 d \$571.25
- 9 a 85% b 87.5% c 10% d 94.5%
- 10 a 14% b 65% c 20%
- 11 a 125% b 105% c 200% d 112.5%

Exercise 14A — Money

- 1 a 755 cents b 305 cents c 240 cents
- d 900 cents
- 2 a \$6.85 b \$4.50 c \$0.05 d \$8.05
- 3 a \$4.75 b \$12.60 c \$159.30 d \$83.45
- 4 \$81.80
- 5 \$2.25
- 6 a \$33.05 b \$30.05 c \$25.05
- 7 $3.7 \approx 4$ wk
- 8 \$529.85
- 9 \$89.90
- 10 $7\frac{1}{2}$ hours
- 11 \$31; interest charges
- 12 \$39.20
- 13 a \$14, \$14.05 b \$6, \$5.95
- 14 a \$26, \$26.22 b \$4, \$3.80 after rounding to nearest 5 cents

Maths Quest challenge (page 539)

- 1 Sam receives \$100.20, Georgia receives \$66.80.
- 2 68.8%
- 3 8
- 4 20 days

Exercise 14B — Wages and salaries

- 1 a \$701.58 b \$1403.15 c \$3040.17
- 2 a 813.46 b \$1626.92 c \$3525
- 3 a \$19 136 b \$22 750 c \$27 473.68
- 4 a \$20 358 b \$21 759.40 c \$26 742.56
- 5 a \$9.75 b \$12.17 c \$11.49 d \$10.63
- 6 a \$2390 per month = \$28 680 p.a.
b \$2063.58 per fortnight = \$53 653.08 p.a.
- 7 Paul: \$40 508
Hannah: \$41 293.15
Hannah, by \$785.15
- 8 \$80.78
- 9 \$77.37
- 10 \$148.75
- 11 Rob (Rhonda gets \$342, Rob gets \$349.20)
- 12 \$11.25 per hour

- 13 Gabrielle must work 41 hours to earn more than Russell.
- 14 a \$625 b \$1663.50 c \$1250 d \$8770
- 15 B
- 16 Michelle

10 Quick Questions 1

- 1 \$164.35 2 \$175
- 3 \$4551.20 4 \$1346.15
- 5 \$29 361.80 6 \$368.60
- 7 \$15.95 8 \$4666.67
- 9 38 hours 10 \$443.50

Exercise 14C — Working overtime

- 1 a \$38.43 b \$114.12 c \$173.25
- 2 a \$512.50 b \$675.13 c \$842.72
- 3 a \$12.44 b \$55.98 c \$528.78
- 4 a \$13.24 b \$39.72 c \$556.02
- 5 \$542.92
- 6 \$482.66
- 7 a \$9.45 b \$42.53
- 8 a \$1022 b \$2401.70
- 9 \$744.51
- 10 \$336
- 11 B

Exercise 14D — Piecework

- 1 \$97.50
- 2 a \$103.50 b \$94.50 c \$85.50
- d \$81.00 e \$139.50 f \$40.50
- 3 \$89.50
- 4 \$175.50
- 5 \$213.75
- 6 a \$90 b 34 c \$13.50
- 7 a \$336 b \$503 c \$1030
- 8 a \$29.40 b \$44.40 c \$58.50
- 9 a \$70 b 3572 c \$4.67
- 10 a \$52 b \$9.45
- 11 a \$116 b \$125 c \$132.50 d \$16.09
- 12 D

Exercise 14E — Commission and royalties

- 1 \$3000
- 2 a \$1280 b \$1115.60
- 3 \$1425
- 4 a \$200 b \$620
- 5 a \$290 b \$482.50 c \$641.12
- 6 a \$500 b \$590 c \$1175 d \$1568.75
- 7 \$7200
- 8 \$7450
- 9 a \$1920 b \$2020 c \$5700
- 10 a \$1600 b \$3687.50 c \$15 875
- 11 a Veronica: \$276 b \$6000
Francis: \$216
- 12 a \$725 b \$973 c \$1078.65
- 13 A
- 14 D

Exercise 14F — Discount

- 1 a \$850 b \$200 c \$83.60
- d \$104 e \$64.70
- 2 a \$70 b \$280
- 3 \$62.96
- 4 a \$41.65 b Yes

- 5 \$75.76
 6 a 40% b 28% c 28%
 d 22%
 7 20%
 8 25%
 9 17.3%
 10 20%
 11 a \$21.33 b \$18.13
 12 a \$218.18 b \$170.18
 13 A
 14 E

Exercise 14G — Profit and loss

- 1 60%
 2 a \$545 b 156%
 3 a $33\frac{1}{3}\%$ profit b 25% profit c 25% loss
 d $13\frac{1}{3}\%$ profit e 22.2% loss
 4 a \$79.95 b 57%
 5 18.75%
 6 166.5%
 7 \$1643.40
 8 a \$39 b \$27 c \$274.45 d \$66
 9 \$48.62
 10 a \$25 b \$48.18 c \$40.89
 11 a \$77 b 49% c 33%
 12 172%
 13 a \$54.55 b \$70.59
 14 C

10 Quick Questions 2

- 1 13%
 2 \$1.99
 3 \$5486.67
 4 \$221.69
 5 \$520
 6 \$32.20
 7 \$144.65
 8 \$42.75
 9 \$1125
 10 \$238.10

Exercise 14H — Simple interest

- 1 a \$1200 b \$6200
 2 \$1950
 3 a i \$100 ii \$1100
 b i \$720 ii \$4720
 c i \$144 ii \$944
 d i \$263.25 ii \$2963.25
 e i \$5048.32 ii \$20 726.32
 4 a \$3300 b \$5053.75
 5 \$849.32
 6 a \$6162.75 b \$205.43
 7 \$216.00
 8 2 years 6 months
 9 \$1250
 10 8.5%
 11 a 2 years b $2\frac{1}{2}$ years c \$600
 d \$4500 e 8% f 3.8%
 12 a \$180 000 b \$80 550 c \$260 550
 d \$4342.50
 13 a i \$29.95 ii \$3029.25
 b i \$301.37 ii \$25 301.37

Summary

- 1 Money, decimal
 2 multiply, divide
 3 salary
 4 overtime
 5 commission, Royalties
 6 piecework
 7 discount
 8 price
 9 selling, Loss, profit, cost
 10 simple interest, principal, annum, time

Chapter review

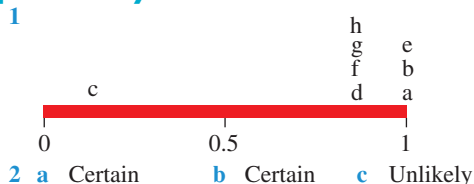
- 1 a \$21.70 b \$178.35 c \$67.55
 2 \$5.95
 3 \$85
 4 Estimate: \$140, \$10 Exact amount: \$138.35, \$11.65
 5 \$2644.23
 6 \$33 225.92
 7 \$129.50
 8 \$460
 9 a \$12.34 b \$524.28
 10 a \$27.50 b 80 cards
 11 \$23.50
 12 \$570
 13 \$3428.57
 14 a \$140.40 b 44.4%
 15 \$77.03
 16 \$83.68
 17 34%
 18 59.6%
 19 a 488% b \$415
 20 a \$147 b \$4147
 21 \$414.06
 22 11.5%

Chapter 15 Probability

Are you ready?

- 1 a 0 b 0.5 c 1
 d 0.8
 2 a 26 b 4 c 2
 d 1 e 4 f 12
 3 a {1, 2, 3, 4, 5, 6} b {Heads, Tails}
 c {1, 2, 3, 4, 5}
 4 a $\frac{4}{15}$ b $\frac{6}{15} = \frac{2}{5}$ c $\frac{5}{15} = \frac{1}{3}$
 d 1
 5 a The card is not a spade (that is, the card is a diamond or a heart or a club).
 b The number that appears uppermost is less than 4 (or is 1, 2 or 3).
 6 0.4

Exercise 15A — Introduction to probability

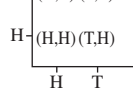


d Likely **e** Certain **f** Likely

g Likely **h** Likely

- 3** **a**, **b** and **c** are equally likely, **d** and **e** are not equally likely

- 4** T: (H,T) (T,T) $S = \{(H, H), (H, T), (T, H), (T, T)\}$



5

	R	O	Y	G	B	I	V
1	(R,1)	(O,1)	(Y,1)	(G,1)	(B,1)	(I,1)	(V,1)
2	(R,2)	(O,2)	(Y,2)	(G,2)	(B,2)	(I,2)	(V,2)
3	(R,3)	(O,3)	(Y,3)	(G,3)	(B,3)	(I,3)	(V,3)
4	(R,4)	(O,4)	(Y,4)	(G,4)	(B,4)	(I,4)	(V,4)
5	(R,5)	(O,5)	(Y,5)	(G,5)	(B,5)	(I,5)	(V,5)
6	(R,6)	(O,6)	(Y,6)	(G,6)	(B,6)	(I,6)	(V,6)

$S = \{(R, 1), (R, 2), (R, 3), (R, 4), (R, 5), (R, 6), (O, 1), (O, 2), (O, 3), (O, 4), (O, 5), (O, 6), (Y, 1), (Y, 2), (Y, 3), (Y, 4), (Y, 5), (Y, 6), (G, 1), (G, 2), (G, 3), (G, 4), (G, 5), (G, 6), (B, 1), (B, 2), (B, 3), (B, 4), (B, 5), (B, 6), (I, 1), (I, 2), (I, 3), (I, 4), (I, 5), (I, 6), (V, 1), (V, 2), (V, 3), (V, 4), (V, 5), (V, 6)\}$

- 6 a** {red, blue, yellow} **b** no

- 7 a** {AA, AB, AC, BA, BB, BC, CA, CB, CC}

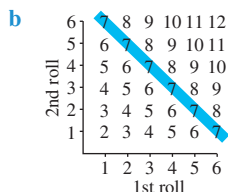
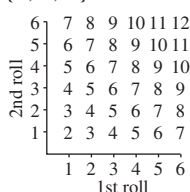
b {AA, AB, AC}

- 8 a** {3, 4, 5, 6, 7, 8, 9} **b** {4, 6, 8}

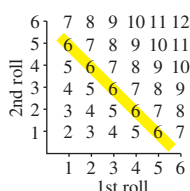
- 9 a** {2, 4, 6, 8, 10} **b** {1, 2, 4, 8}

c {2, 4, 8}

10 a



c



Exercise 15B — Estimating probability

- Generate 30 random numbers between 1 and 150 using a graphics calculator or spreadsheet.
- By selecting a random sample representing the whole school and finding the proportion of the sample agreeing for the abolition of the SRC. It can be concluded that the same proportion have similar views in the whole school.
- Select a random sample of trees. Calculate the proportion of trees with 100 or more apples. As the sample is random, the proportion of trees in the plantation with 100 or more apples should be similar to that of the sample.
- 70% This answer will vary each time the experiment is conducted.

- 5** Number each team 1 to 6. Roll the die many times, say 100. The number which occurs the most will indicate the team that wins.

- 6** 252 This answer will vary each time the experiment is conducted.

- 7 a** Team A = 3 Team B = 1

- b** Team A = 17 Team B = 21

- c** Team A = 99 Team B = 73

- d** No, as this is an experiment, the results will be different each time.

Exercise 15C — Experimental probability

1 $\frac{9}{16}$

2 a $\frac{11}{20}$

b $\frac{3}{10}$

c $\frac{17}{20}$

d $\frac{3}{20}$

3 a $\frac{7}{10}$

- b** The probability that the cashier will make a mistake is $\frac{7}{10}$. Therefore, the next customer's objection to being served by this cashier is fair.

4 a $\frac{2}{13}$

b $\frac{7}{39}$

c $\frac{37}{78}$

5 a i $\frac{9}{100}$

ii $\frac{1}{25}$

iii $\frac{3}{5}$

- b** No, only $\frac{2}{5}$ are expected to have a functioning time of less than or equal to 60 hours.

6 Chickens $\frac{1}{2}$, Turkeys $\frac{1}{4}$, Ducks $\frac{1}{4}$

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

b $\frac{6}{25}$

c $\frac{18}{25}$

8 a $\frac{1}{3}$

b $\frac{2}{15}$

c $\frac{11}{30}$

9 a B

b B

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

b $\frac{18}{25}$

c $\frac{7}{25}$

11

Number of runs	Expected probability
1	0.19
2	0.20
3	0.21
4	0.28
5	0
6	0.12

Exercise 15D — Relative frequencies and expected values

1 a $\frac{3}{10}$

b $\frac{9}{20}$

c $\frac{1}{20}$

2 a

x	f	Relative frequency	
1	2	$\frac{1}{10}$	0.1
2	3	$\frac{3}{20}$	0.15
3	8	$\frac{2}{5}$	0.4
4	3	$\frac{3}{20}$	0.15
5	4	$\frac{1}{5}$	0.2
Total	$\Sigma f = 20$	1	1

x	f	Relative frequency	
10	1	$\frac{1}{20}$	0.05
11	3	$\frac{3}{20}$	0.15
12	5	$\frac{1}{4}$	0.25
13	6	$\frac{3}{10}$	0.3
14	2	$\frac{1}{10}$	0.1
15	3	$\frac{3}{20}$	0.15
Total	$\Sigma f = 20$	1	1

3 200

4 20

5 4

6 300

7 Svetlana 6 Sarah 4 Leonie 3 Trang 2

8 a 140 b 48 c 4 d 72

9 240

10 40

11 a $\frac{1}{5}$ b 10

12 a i 0.095 ii 0.06 iii 0.12 iv 0.25

v 0.29

b i 0.415 ii 0.765

Exercise 15E — Theoretical probability of an event

1 a $\frac{1}{4}$ b $\frac{3}{13}$

2 a $\frac{9}{20}$ b $\frac{7}{20}$ c $\frac{4}{5}$

3 a {(H, 1), (H, 2), (H, 3), (H, 4), (H, 5), (H, 6), (T, 1), (T, 2), (T, 3), (T, 4), (T, 5), (T, 6)}

b $\frac{1}{4}$

4 a $\frac{1}{5}$ b $\frac{9}{100}$ c $\frac{1}{2}$

5 a There are 36 outcomes.

Blue die	6	7	8	9	10	11	12
5	6	7	8	9	10	11	
4	5	6	7	8	9	10	
3	4	5	6	7	8	9	
2	3	4	5	6	7	8	
1	2	3	4	5	6	7	
	1	2	3	4	5	6	
	Green die						

b 7 c 2 or 12 d $\frac{1}{6}$ e $\frac{5}{36}$

6 a $\frac{2}{5}$ b $\frac{1}{5}$ c 0

7 a $\frac{5}{24}$ b $\frac{59}{72}$

8 a $\frac{1}{26}$ b $\frac{1}{2}$ c $\frac{3}{4}$ d $\frac{2}{13}$

9 a $\frac{1}{12}$ b $\frac{1}{20}$

c No. John has a better chance of winning as his experiment involves less outcomes.

10 a i 6 ii 356, 365, 536, 563, 635, 653

b $\frac{2}{3}$ c $\frac{1}{3}$ d $\frac{1}{3}$

11 $\frac{3}{1357510}$

12 a C b C

13 a B b C c E

Maths Quest challenge (page 591)

1 1000

2 a $\frac{1}{6}$ b $\frac{1}{9}$ c $\frac{1}{2}$ d $\frac{5}{6}$

10 Quick Questions 1

1 R - R G - R A - R R - G G - G A - G
R - A G - A A - A

2 There are 2 black jacks and two red queens; thus, the outcomes are equally likely.

3 $\text{Pr}(\text{red}) = \frac{4}{15}$

4 $\frac{3}{10}$

5 $\text{Pr}(\text{blue}) = \frac{9}{16}$

6 $\frac{11}{19}$

7 $\text{Pr}(\text{more than 10 months}) = \frac{32}{70} = 0.457$

8 Since 66 lasted at least 8 months, yes, it is true to say that 90% lasted at least 8 months.

9 $\text{Pr}(\text{passing}) = \frac{170}{214} = 0.794$

10 $\text{Pr}(\text{between 51 and 85}) = \frac{145}{214} = 0.678$

Exercise 15F — Venn diagrams

1 a Both sandwich and chips for lunch

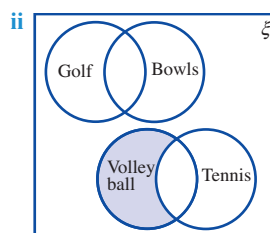
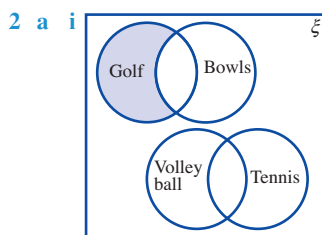
b Fishing and video for leisure but not surfing

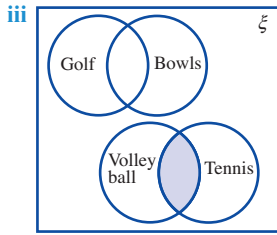
c Either surfing only, or surfing and fishing only, or surfing and video only for leisure

d Either 7 irons or 9 irons but not sand irons used for chipping

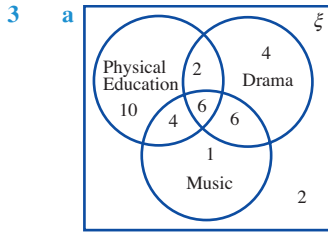
e Homework only done for evening activity

f All homework except science





- b i 8 ii 7
c i 38 ii 34 iii 30



- b i $\frac{2}{7}$ ii $\frac{6}{35}$ iii $\frac{6}{35}$ iv $\frac{4}{35}$
v $\frac{18}{35}$ vi $\frac{2}{35}$ vii $\frac{16}{35}$

- 4 a 32 b 7 c 3 d 2 e 2

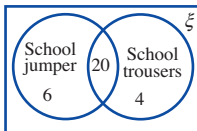
- 5 a $\frac{7}{32}$ b $\frac{5}{32}$ c $\frac{3}{16}$ d $\frac{1}{8}$ e $\frac{1}{16}$

- 6 a i 14 ii 2 iii 9

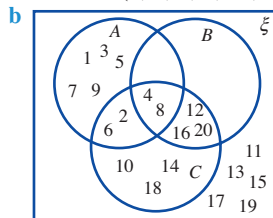
- b i $\frac{5}{14}$ ii $\frac{1}{7}$ iii $\frac{9}{14}$

- 7 a C b A c B d C e D

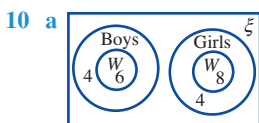
- 8 a School uniform b $\frac{2}{3}$



- 9 a Event A {1, 2, 3, 4, 5, 6, 7, 8, 9}
Event B {4, 8, 12, 16, 20}
Event C {2, 4, 6, 8, 10, 12, 14, 16, 18, 20}



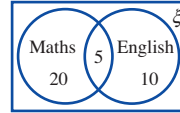
- c i $\frac{9}{20}$ ii $\frac{1}{2}$ iii $\frac{1}{10}$ iv $\frac{3}{4}$ v $\frac{1}{4}$



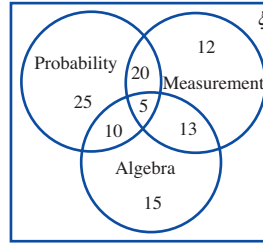
Key:
W – wearing a watch

- b i $\frac{6}{11}$ ii $\frac{4}{11}$ iii $\frac{7}{11}$ iv $\frac{2}{11}$

- 11 Competitions, 5 students entered both, $\frac{1}{7}$



- 12 a Favourite topic



- b 25 c 15 d 12 e 43
f $\frac{3}{5}$ g $\frac{43}{100}$ h $\frac{9}{50}$ i $\frac{13}{100}$ j $\frac{1}{20}$

Maths Quest challenge (page 601)

- 1 4464
2 53% (35 out of 66)
3 19 students

Exercise 15G – Mutually exclusive and complementary events

1 $\frac{2}{13}$

2 $\frac{2}{3}$

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

b 1

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

b $\frac{3}{4}$

c $\frac{1}{10}$

d $\frac{2}{5}$

5 a $\frac{7}{26}$

b $\frac{2}{13}$

c $\frac{3}{13}$

d $\frac{19}{26}$

6 D

7 a $\frac{34}{35}$

b $\frac{5}{6}$

c $\frac{73}{84}$

d $\frac{3}{7}$

e $\frac{1}{2}$

8 $\frac{12}{13}$

9 A

10 $\frac{215}{216}$

11 $\frac{4}{5}$

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

b $\frac{3}{4}$

c $\frac{3}{4}$

d $\frac{1}{4}$

- 13 No, the two events are not complementary, as the sum of their probabilities does not equal one. Getting one Head is also an outcome.

14 a $\frac{17}{70}$

b $\frac{53}{70}$

c $\frac{9}{70}$

d $\frac{61}{70}$

Maths Quest challenge (page 607)

The four of diamonds

10 Quick Questions 2

- 1 $\{(R - R), (R - B), (R - G), (B - R), (B - B), (B - G), (G - R), (G - B), (G - G)\}$
2 $P \cap Q = \{11, 13, 17, 19, 23, 29\}$
3 $\Pr(\text{not from Machine A}) = \frac{21}{25}$
4 $\Pr(\text{multiple of 7}) = \frac{7}{50}$

- 5 $E(x) = 9$
 6 Relative frequency = $\frac{8}{49}$
 7 $\Pr(\text{lamb chop}) = \frac{11}{49}$
 8 $\Pr(\text{red queen}) = \frac{1}{26}$
 9 Drawing a 2, 3, 4, 5, 6, 7, 8, 9, or 10
 10 $\Pr(2, 3, 4, 5, 6, 7, 8, 9, \text{ or } 10) = \frac{9}{13}$

Exercise 15H — Odds and payouts

- 1 a 4 b 1 c $\frac{1}{5}$ d $\frac{4}{5}$
 2 6–5
 3 1–6
 4 \$68
 5 a Baz — \$50, Beachy — \$12.50 b \$2.50
 6 a \$105 b \$21
 7 They are the same, as both return \$45.
 8 a $\frac{1}{10}$ b $\frac{9}{10}$ c 9–1
 9 a $\frac{1}{3}$ b $\frac{5}{9}$ c $\frac{1}{11}$ d $\frac{3}{14}$ e $\frac{3}{4}$ f $\frac{9}{16}$
 10 a 2–1 b 3–7 c 9–11 d 1–2
 e 7–2 f 13–17
 11 a D b B
 12 a

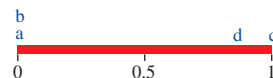
Dog	Payout for a win	Total collected by bookmaker	Bookmaker's profit (+) or loss (–)
Fantasy	\$70	\$60	– \$10
Angel	\$45	\$60	+ \$15
Swiftly	\$60	\$60	0
Secret	\$90	\$60	– \$30
Pride	\$130	\$60	– \$70
Prejudice	\$46.70	\$60	+ \$13.30

b Angel c Pride d Swiftly

Summary

- 1 likelihood
 2 0 and 1
 3 Outcomes
 4 event
 5 equally-likely
 6 sample space
 7 Sampling
 8 Experimental probability
 9 frequency
 10 relative frequency
 11 expected value
 12 number in the sample space
 13 universal
 14 intersection
 15 union
 16 complement
 17 subset
 18 mutually exclusive
 19 Addition
 20 complementary
 21 $\frac{b}{a+b}$
 22 $\frac{a}{a+b}$

Chapter review

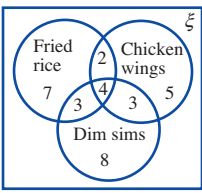
- 1 
 2 a Impossible b Impossible
 c Certain d Likely
 3 a Equally likely b Equally likely
 c Not equally likely d Equally likely
 4 a D b C
 5 a {R, B, Y} b {(YR), (YY), (YB)}
 c No, because there are only one red, black and yellow counter in the bag.
 6 Select a random sample. Calculate the proportion of students that would like lunchtime sporting activities to be introduced. As the sample is random, the proportion of students in the school who would like lunchtime sporting activities to be introduced should be similar to that of the sample.
 7 Results will vary each time the experiment is conducted.

- 8 a $\frac{1}{4}$ b $\frac{1}{10}$ c $\frac{1}{8}$

9 a

Groups	1	2	3	4	5
Relative frequencies	0.2	0.23	0.18	0.17	0.22

- b i 0.2 ii 0.18 iii 0.78
 10 a 40 b 33 c 25
 11 280
 12 a C b D
 13 a 12 b 60
 c i $\frac{9}{30}$ ii $\frac{17}{60}$ iii $\frac{1}{10}$ iv $\frac{1}{12}$ v $\frac{31}{60}$
 14 a Students who do not like music
 b People that like surfing and golf as leisure activities
 c People that have either Coke or Fanta or both but not Sprite as favourites

- 15 a  b 5
 c i $\frac{7}{32}$
 ii $\frac{1}{2}$
 iii $\frac{7}{16}$

- 16 $\frac{1}{2}$ 17 $\frac{2}{3}$ 18 $\frac{1295}{1296}$
 19 a $\frac{3}{5}$ b $\frac{2}{5}$ c \$10
 20 1–6

Chapter 16 Statistics

Are you ready?

1

Score	Tally	Frequency
1		3
2		5
3		7
4		4
5		2
6		3

- 2 a 40 b 5
 3 a 20, 21, 22, 25, 25, 29, 34
 b 215, 276, 277, 298, 304, 325, 345, 381, 400
 c 0.3, 1.8, 2.8, 2.9, 3.1, 3.5, 3.6, 3.6, 4.6, 5.8, 5.8
 4 a 25 b 304 c 3.5
 5 a 7 b 0.5
 6 a 2 b 25 c 8

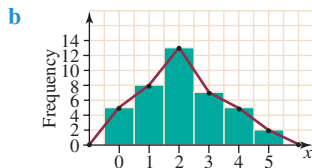
Exercise 16A — Collecting data

- 1 22, 30, 49, 3, 14 is one possible solution.
 2 a 94, 1, 54 b 60, 47, 33, 43 c 25, 49, 10
 3 Discuss and compare.
 4 Discuss and compare.
 5 D
 6 6, 4
 7 4, 2
 8 a 12, 8 b 5, 2, 1 c 3, 3, 2 d 15, 2, 2, 1
 9 Year 11: 6 boys, 5 girls Year 12: 4 boys, 5 girls
 10 B
 11 139, 176, 293, 125, 10, 220, 19, 18
 WA, QLD, NSW, SA, NT, VIC, TAS, ACT

Exercise 16B — Histograms and frequency polygons

1 a

x	Frequency	Relative frequency
0	5	$\frac{1}{8} \left(\frac{5}{40} \right)$
1	8	$\frac{1}{5} \left(\frac{8}{40} \right)$
2	13	$\frac{13}{40}$
3	7	$\frac{7}{40}$
4	5	$\frac{1}{8} \left(\frac{5}{40} \right)$
5	2	$\frac{1}{20} \left(\frac{2}{40} \right)$
Total	40	1



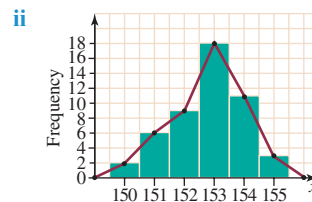
2 a i

x	Frequency	Relative frequency
1	4	0.20
2	3	0.15
3	5	0.25
4	0	0.00
5	2	0.10
6	6	0.30
Total	20	1.00



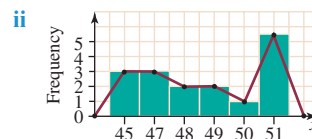
b i

x	Frequency	Relative frequency
150	2	0.041
152	6	0.122
154	9	0.184
156	18	0.367
158	11	0.224
160	3	0.061
Total	49	$0.999 \approx 1.000$



c i

x	Frequency	Relative frequency
50	3	0.188
52	3	0.188
54	2	0.125
56	2	0.125
58	1	0.063
60	5	0.313
Total	16	1.002



3 a

x	Frequency	Relative frequency
0	1	0.04
1	6	0.24
2	8	0.32
3	5	0.20
4	2	0.08
5	3	0.12
Total	25	1.00

b 2

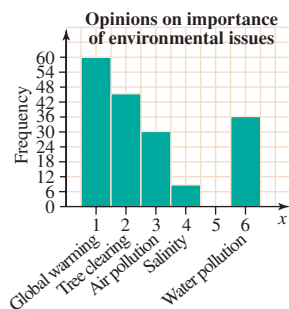
c 15

d 18

4 a

x	Frequency	Relative frequency
1	60	0.333
2	45	0.250
3	30	0.167
4	9	0.050
6	36	0.200
Total	180	1.000

b

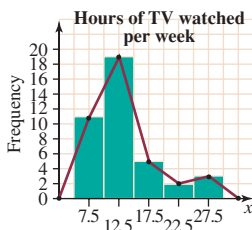


5 a 24

b

Class interval	Midpoint (Class centre)	Tally	Frequency
5–< 10	7.5		11
10–< 15	12.5		19
15–< 20	17.5		5
20–< 25	22.5		2
25–< 30	27.5		3
Total			40

c



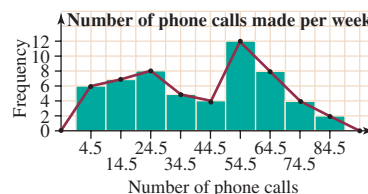
6

Class interval	Midpoint (Class centre)	Tally	Frequency
0–4	2		6
5–9	7		3
10–14	12		12
15–19	17		2
20–24	22		9
Total			32

7 a

Class interval	Midpoint (class centre)	Tally	Frequency
0–9	4.5		6
10–19	14.5		7
20–29	24.5		8
30–39	34.5		5
40–49	44.5		4
50–59	54.5		12
60–69	64.5		8
70–79	74.5		4
80–89	84.5		2
Total			56

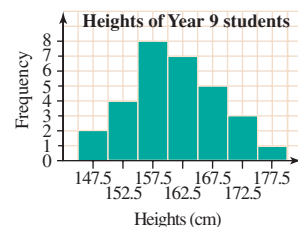
b



8 a

Class interval	Midpoint (class centre)	Tally	Frequency
145–< 150	147.5		2
150–< 155	152.5		4
155–< 160	157.5		8
160–< 165	162.5		7
165–< 170	167.5		5
170–< 175	172.5		3
175–< 180	177.5		1
Total			30

b



c No. Individual scores are lost when data are grouped into class intervals.

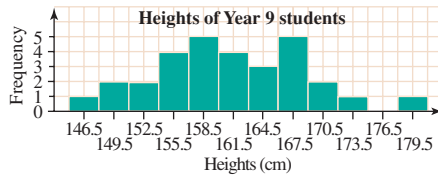
d 16

e 70%

f

Class interval	Midpoint (class centre)	Tally	Frequency
145–<148	146.5		1
148–<151	149.5		2
151–<154	152.5		2
154–<157	155.5		4
157–<160	158.5		5
160–<163	161.5		4
163–<166	164.5		3
166–<169	167.5		5
169–<172	170.5		2
172–<175	173.5		1
175–<178	176.5	—	0
178–<181	179.5		1
Total			30

g

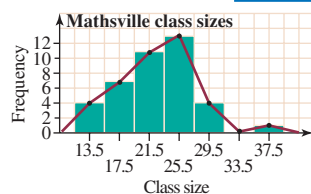


Discuss in class.

9 a

Class interval	Midpoint (class centre)	Tally	Frequency
12–15	13.5		4
16–19	17.5		7
20–23	21.5		11
24–27	25.5		13
28–31	29.5		4
32–35	33.5	—	0
36–39	37.5		1
Total			40

b



Exercise 16C — Stem-and-leaf plots

1 Key: 1|7 = 17

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

The youngest participant is 17, the oldest is 45. The aerobics class was most popular among participants in their late teens and 20s.

2 a Key: 1|8 = 18

Stem	Leaf
1	8 9 9
2	0 0 0 1 1 2

b Key: 1|9 = 19

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

c Key: 33|6 = 336

Stem	Leaf
33	6
34	6 6 9
35	0 3 9
36	2 8
37	1

d Key: 4|3 = 43

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

e Key: 1|1 = 1.1

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

3 a Key: 1*|8 = 18

Stem	Leaf
1*	8 9 9
2	0 0 0 1 1 1

b Key: 1*|9 = 19

Stem	Leaf
1*	9 9
2	0 4 4
2*	5 6 7 9
3	1 1
3*	6 8
4	2 3

c Key: 33*|6 = 336

Stem	Leaf
33*	6
34	
34*	6 6 9
35	0 3
35*	9
36	2
36*	8
37	1

d Key: 4|3 = 43

Stem	Leaf
4	3 4
4*	6 7 8 9
5	2
5*	5
6	
6*	7
7	0
7*	7
8	1 2 3 3 4
8*	5 8

- e Key: $1|1 = 1.1$
 $1^*|5 = 1.5$

Stem	Leaf
1	1 3
1*	5 9
2	4
2*	7 8 9
3	3
3*	6 9
4	1 2
4*	6

- 4 a Key: $10|0 = 10.8$

Stem	Leaf
10	8 9
11	0 2 5 8
12	0 4 5 6 8 8
13	2 6 6 9 9
14	0 1
15	0

- b Range = 4.2 Discuss in class.

- c Discuss in class.

- 5 Key: $0|0 = 0$

Leaf	Stem	Leaf
3 2 1 1 1 1 0 0 0 0	0	0 0 1 1 1 1 1 2 2 2

Mitch scored between 0 and 3 goals inclusive.

Yani scored between 0 and 2 goals inclusive.

- 6 a Mitch: 2, Yani: 3

- b Mitch

- c Yani: 11

- d Yani, as he scored goals in more games.

- 7 a Key: $3|2 = 32$

Leaf	Stem	Leaf
(9A)		(9B)
2	3	
9	4	6
7 4	5	5
8 7 5 5 0	6	0 2 8
3	7	3 3 4 5 7 8
5	8	1
6	9	

- b 9A: 83%, 9B: 92%

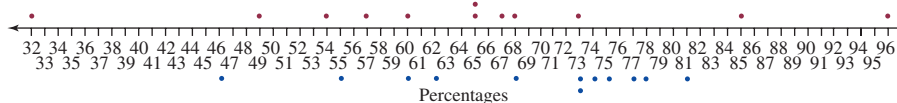
- c 9A: 2

- d Discuss in class.

- e Discuss in class.

- f 9A: 64.3; 9B: 68.5

g



- h Discuss in class.

- 8 a C

- b D

Maths Quest challenge (page 637)

- 1 Row 7
Row 8
Row 9

Pattern is: two dots of the same colour produce a red dot in the row below; two dots of different colour produce a black dot in the row below. The last dot in the row is always black.

- 2 No, there must be a black dot at the end of each row.

- 3 No, as pattern starts to repeat in Row 9 and no rows have all black dots.

- 4 Yes

Exercise 16D — Measures of central tendency

- 1 a 8.4 b 7.7 c 49.7 d 1.7 e 1.8

- 2 a 2 b 7.8 c 24.9 d 2.3

- 3 a 7 b 8 c 50 d 1.75 e 1.7

- 4 a 23 b 116 c 6.28

- 5 a 5 b 82.5 c 2.55

- 6 a 5 b None c 52 d 1.5, 1.7, 1.8

- e 1.7

- 7 a 1 b 7 c 30 d 2.0

- 8 a 23 b 112 c 6.34

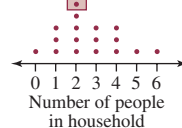
- 9 a 5 b 81 c 2.4

- 10 a

Score x	Frequency f	Freq. \times score $f \times x$
0	1	0
1	3	3
2	6	12
3	3	9
4	3	12
5	1	5
6	1	6
$n = 18$		$\Sigma fx = 47$

$$\bar{x} = 2.6$$

- b 2 c 2



- d i Median

- ii Mean

- iii Mode

- 11 a \$18 000

- b \$29 444 c \$26 000

- d i Mode

- ii Mean

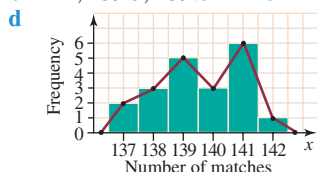
- 12 75.6

- 13 7

14 a C b A c D

Score x	Frequency f	Freq. \times score $f \times x$
137	2	274
138	3	414
139	5	695
140	3	420
141	6	846
142	1	142
$n = 20$		$\Sigma fx = 2791$

b 141, 139.5, 139.6 c Mean



16 a The median was calculated by taking the average of the 2 middle scores.

b 13

17 2

18 a 55 250 km, 52 000 km, 52 000 km

b Discuss in class.

c 51 810 km; It is reduced by 3440 km.

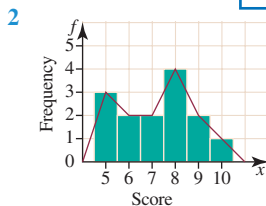
d 52 000 km

e 3333

f 50 000 km; 92% last that distance or more.

10 Quick Questions 1

Score	Tally	Frequency
5		3
6		2
7		2
8		4
9		2
10		1
Total		14



3 10

4 8

5 7.2

6 Key: 5 | 3 = 53 years

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

7 18

8 37.5 years

9 39 years

10 45 years

Maths Quest challenge (page 647)

1 $2080 \div 8 = 260$

2	1	48	31	50	33	16	63	18
	30	51	46	3	62	19	14	35
	47	2	49	32	15	34	17	64
	52	29	4	45	20	61	36	13
	5	44	25	56	9	40	21	60
	28	53	8	41	24	57	12	37
	43	6	55	26	39	10	59	22
	54	27	42	7	58	23	38	11

3 260

4 130

Exercise 16E — Grouped data — mean and modal class

1 a i 63.3

ii 23.1

b i 70–79

ii $30 < 40$

2 a

Class interval	Midpoint x	Frequency f	Freq. \times midpoint $f \times x$
0–9	4.5	10	45
10–19	14.5	20	290
20–29	24.5	30	735
30–39	34.5	40	1380
40–49	44.5	10	445
50–59	54.5	5	272.5
$n = 115$			$\Sigma(f \times x) = 3167.5$

i 27.5

ii 30–39

b

Class interval	Midpoint x	Frequency f	Freq. \times midpoint $f \times x$
0–0.9	0.45	1	0.45
1.0–1.9	1.45	2	2.90
2.0–2.9	2.45	4	9.80
3.0–3.9	3.45	10	34.50
4.0–4.9	4.45	10	44.50
5.0–5.9	5.45	3	16.35
$n = 30$			$\Sigma(f \times x) = 108.5$

i 3.6

ii 3.0–3.9 and 4.0–4.9

c

Class interval	Midpoint x	Frequency f	Freq. \times midpoint $f \times x$
20–<30	25	2	50
20–<40	35	5	105
20–<50	45	3	135
20–<60	55	12	660
20–<70	65	18	1170
20–<80	75	2	150
$n = 42$			$\Sigma(f \times x) = 2270$

i 54.0 **ii** 60–<70

3 a

Class interval	Midpoint x	Frequency f	Freq. \times midpoint $f \times x$
45–49	37	2	74
50–54	52	3	156
55–59	57	5	285
60–64	62	7	434
65–69	67	7	469
70–74	72	6	432
$n = 30$			$\Sigma(f \times x) = 1850$

b 61.7 **c** 60–64, 65–59 **d** 60–64

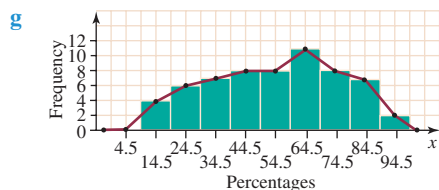
e 13; $43\frac{1}{3}\%$ **f** 6.7%

4 a

Class interval	Midpoint x	Frequency f	Freq. \times midpoint $f \times x$
0–9	4.5	0	0
10–19	14.5	4	58
20–29	24.5	6	147
30–39	34.5	7	241.5
40–49	44.5	8	356
50–59	54.5	8	436
60–69	64.5	11	709.5
70–79	74.5	8	596
80–89	84.5	7	591.5
90–99	94.5	1	94.5
$n = 60$			$\Sigma(f \times x) = 3230$

b 53.8 **c** 16 **d** 60–69

e 50–59 **f** $28\frac{1}{3}\%$



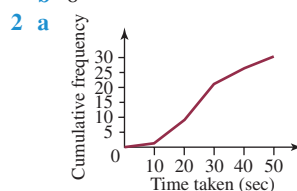
5 D

Exercise 16F — Cumulative frequency

1 a

x	f	cf
6	4	4
7	3	7
8	6	13
9	2	15
10	5	20
$n = 20$		

b 8



b 26

c 24

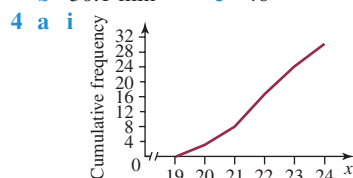
3 a

x	f	cf
0–<10	4	4
10–<20	8	12
20–<30	12	24
30–<40	22	46
40–<50	2	48
50–<60	2	50
$n = 50$		

b 30.1 min

c 46

d 26

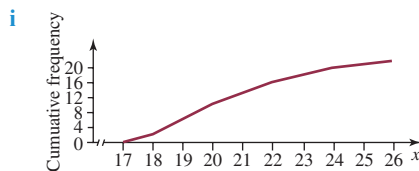


ii 21.5

iii 24

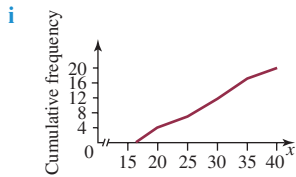
b

x	f	cf
18	2	2
20	8	10
22	6	16
24	4	20
26	2	22
$n = 22$		



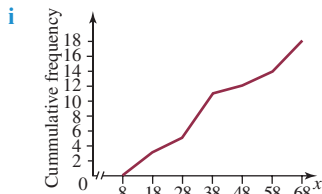
ii 20.4 iii 18

Class interval	f	cf
16–20	4	4
21–25	3	7
26–30	5	12
31–35	5	17
36–40	3	20
$n = 20$		



ii 28 iii 6

Class interval	f	cf
8–<18	3	3
18–<28	2	5
28–<38	6	11
38–<48	1	12
48–<58	2	14
58–<68	4	18
$n = 18$		

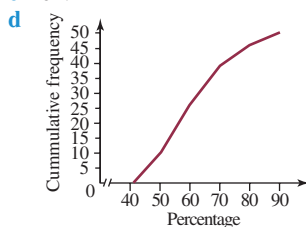


ii 34.5 iii 4

Class interval	Midpoint x	Frequency f	Cum. frequency cf	Freq. \times midpoint $f \times x$
41–50	45.5	10	10	455
51–60	55.5	16	26	888
61–70	65.5	13	39	851.5
71–80	75.5	7	46	528.5
81–90	85.5	4	50	342
$n = 50$				$\Sigma(f \times x) = 3057$

b 51–60

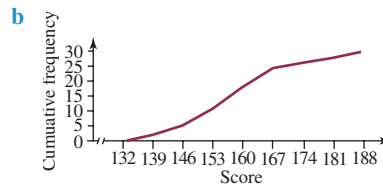
c 61.1



e 59.5%

f 18

Class interval	Midpoint x	Frequency f	Cum. freq. cf
133–139	136	2	2
140–146	143	3	5
147–153	150	6	11
154–160	157	7	18
161–167	164	6	24
168–174	171	2	26
175–181	178	2	28
182–188	185	2	30
$n = 30$			

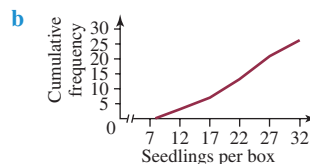


c 157

d 154–160

e 9

Class interval	Midpoint x	Frequency f	Cum. freq. cf
8–12	10	3	3
13–17	15	4	7
18–22	20	6	13
23–27	25	8	21
28–32	30	5	26
$n = 26$			



c 22

d 23–27

e 21

8 E

Maths Quest challenge (page 658)

1 a 24 b 120

2 ace, J K J
 Q A Q
 K A K

Exercise 16G — Measures of spread

1 a 68 b 29.8

2 B

3 C

4 a 3 b 7 c 6

5 a i 15 ii 12

iii 17 iv 5

b i 26 ii 18

iii 32 iv 14

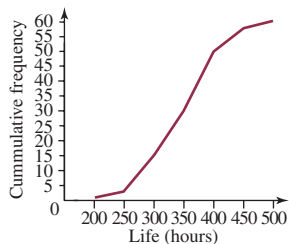
c i 7.9 ii 6.9

iii 8.3 iv 1.4

6 a i 13 ii 14, 12

b 2

7 a



b i 350 hours ii 385 hours, 300 hours

iii 85 hours iv 23 v 7

8 a \$26 200 b \$33 000, \$21 500

c \$11 500 d 26 e 14 f 22

9 a 70 kg, 14 kg b 27 c 4

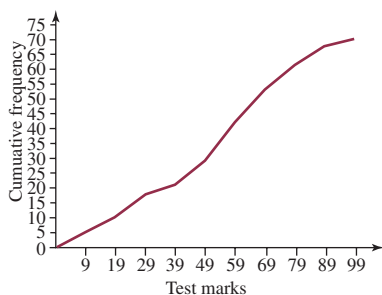
d 16 e i $\approx 20\%$ ii $\approx 44\%$

10 a

Class interval	Midpoint x	Frequency f	Cum. freq. cf
0–9	4.5	5	5
10–19	14.5	5	10
20–29	24.5	8	18
30–39	34.5	3	21
40–49	44.5	8	29
50–59	54.5	13	42
60–69	64.5	11	53
70–79	74.5	8	61
80–89	84.5	7	68
90–99	94.5	7	75

$n = 75$

b



c i 56 ii 94 iii 19, 0–34 d 40

10 Quick Questions 2

1 8.5

2 8.4

3 7.7, 9.6

4 Key: $3|6 = 36$

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

5 42.8

6 40.5

7 47

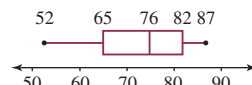
8 20.5

9 $222 \div 50 = 4.44$

10 2

Exercise 16H — Boxplots

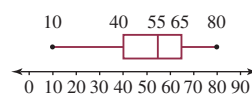
1 a



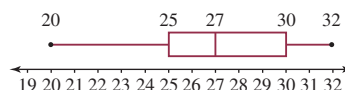
b 35

c 17

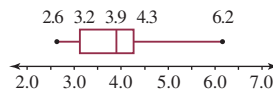
2 a



b



c



3 a

13.5

b

12, 16

c

4

d

i 50% ii 25% e 20 hours f 10 hours

g

Most of the original scores have been lost.

h

i In the second 25%

ii In the third 25%

iii In the fourth 25%

4 a

11.5 cm

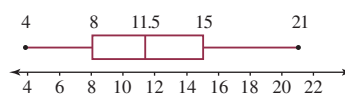
b

15, 8

c

7

d

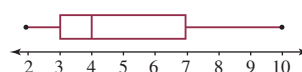


5 a C

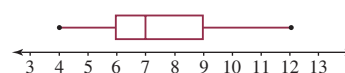
b

B

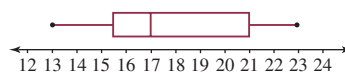
6 a

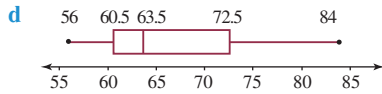


b



c

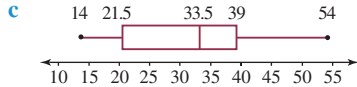




7 a Key: 1 | 4 = 14

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

b 14, 21.5, 33.5, 39, 54



d 40

e 17.5

f 39 min

g Among best 50% for speed

8 a A: 70, B: 65

b A: 52, B: 56

c A: 35, B: 40

d B: larger interquartile range, lower range

e One quarter

f A: 95, B: 85

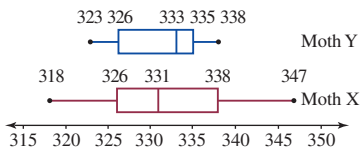
9 a Key: 1 | 4 = 14

Leaf (X)	Stem	Leaf (Y)
9 8	31	
9 8 7 6 6	32	3 4 5 6 7 8
8 8 7 4 4 1	33	3 3 3 4 4 5 5 6 8
7 5	34	

b X: 331.8, Y: 330.9

c $X > Y$ by 0.9. The mean for Moth X is greater than the mean for Moth Y as it contains two values which are significantly greater than the other values, hence resulting in a greater mean.

d e Y



f X: 29, Y: 15; Y is more predictable.

g X: 12, Y: 9 X spreads more widely due to outliers.

Summary

- census, sample, random
- title, axes, evenly, clearly, key
- score, frequency
- histograms, polygons
- horizontal, vertical
- leaf, stem, shape
- total, median, numerical, common
- sum, divided
- Outliers, mean
- class intervals, midpoint
- cumulative
- ogive

13 difference, interquartile

14 5-number summary, box, extreme

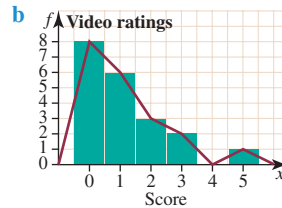
Chapter review

1 D

2 B

3 a

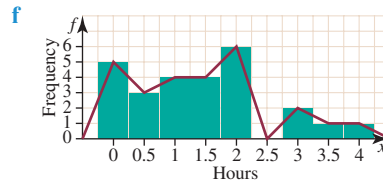
Video rating	Frequency
0	8
1	6
2	3
3	2
4	0
5	1
Total	20



4 a

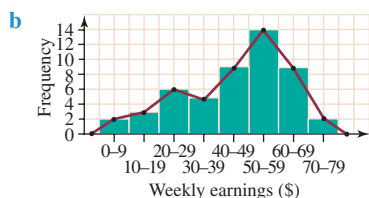
x	f
0	5
$\frac{1}{2}$	3
1	4
$1\frac{1}{2}$	4
2	6
$2\frac{1}{2}$	0
3	2
$3\frac{1}{2}$	1
4	1
Total	26

b 26 c 2 h d 4 e 8



5 a

Class interval	Frequency f
0-9	2
10-19	3
20-29	6
30-39	5
40-49	9
50-59	14
60-69	9
70-79	2
	n = 50



c Key: 0|8 = 8

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

d 32%

6 3.1 **7** 8

8 a **i** 5 **ii** 5.5 **iii** 7.9 **iv** 25

v 6 **vi** 17.9, 15.5

b Discuss in class.

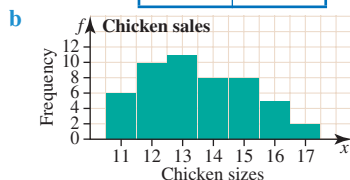
9 4.3, 5, 5

10 a There is no mode since none of the values occur more than once.

b 7

11 a

x	f	xf
11	6	66
12	10	120
13	11	143
14	8	112
15	8	120
16	5	80
17	2	34
Total	50	675



c 13

d 13.5, 13

e 13; as this is the most frequently sold size.

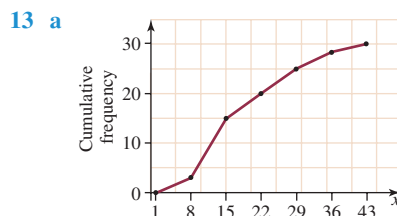
f 6 **g** 58% **h** Discuss

12

Class interval	Midpoint x	Frequency f	Freq. \times midpoint $f \times x$
1-5	3	2	6
6-10	8	9	72
11-15	13	10	130
16-20	18	6	108
21-25	23	4	92
26-30	28	1	28
		$n = 32$	$\Sigma(f \times x) = 436$

i 13.6

ii 11-15



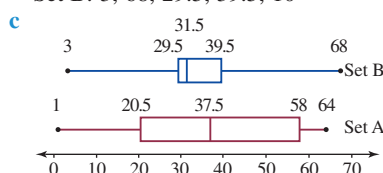
b **i** 16.5 **ii** 14.7 **iii** 7 **iv** 9

14 a Key: 3|1 = 31

Leaf Set A	Stem	Leaf Set B
1	0	3
3	1	
8	2	9
0	3	0 1 2 8
5	4	1
9 7	5	
4	6	8

b Set A: 1, 64, 20.5, 58, 37.5

Set B: 3, 68, 29.5, 39.5, 10



d Set A: 63, 37.5 Set B: 65, 10 Discuss in class.

15 a

Score x	Frequency f	Freq. \times score $f \times x$	Cum. freq. cf
0	2	0	2
1	5	5	7
2	6	12	13
3	8	24	21
4	9	36	30
5	3	15	33
	$n = 33$	$\Sigma(f \times x) = 92$	

b 4, 3, 2.8

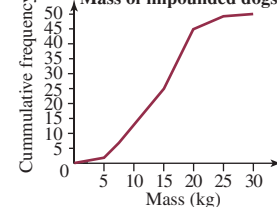
c 5, 2



16 a 14.7 kg

b 15-19 kg

c Mass of impounded dogs Median: 15



Interquartile range: 6.5

d 18-29 kg

17 a 4 **b** 15 **c** 10 **d** 7 **e** 13 **f** 6

g Between 4 and 15 pieces of mail are delivered to the households in the survey. Half of the households receive between 7 and 13 pieces of mail. One quarter receive between 4 and 7 while another quarter receive between 13 and 15 pieces of mail.

Strategies for problem solving

Strategies for investigation and problem solving

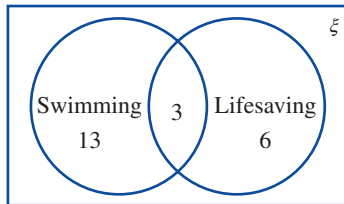
Create a table, then look for a pattern or a result

- 1 The difference between these two formulas is less than 1 cm for values of r equal to 3.5 cm and less.
- 2 The difference between these two formulas is less than 2 cm^2 for values of r equal to 1.8 cm and less.
- 3 The difference is no greater than 2 for positive x -values approximately equal to 4.58 and under.
- 4 The difference is no greater than 2 for x -values greater than 0.36.
- 5 A cone that fits exactly into a cube-shaped box has radius r and height $2r$. So $V = \frac{2}{3}\pi r^3$. Generate a spreadsheet and compare the values obtained for volume using $V = 2r^3$ and $V = \frac{2}{3}\pi r^3$. Consider how close the volume values must be for the model to be appropriate and what range of r values need to be used.

The difference between these two formulas is less than 2.5 units³ for values of r equal to 2.8 cm and less.

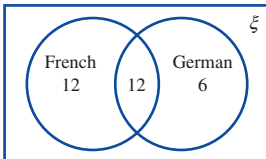
Draw a diagram, then look for a pattern or a result

- 1 Number of students = 22



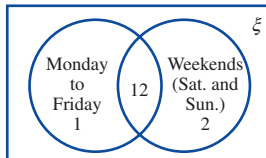
There are 3 students who attend both swimming practice and lifesaving.

- 2 Number of students = 30



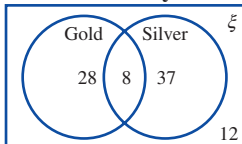
There are 12 students who study both French and German.

- 3 Number of employees = 15



There are 3 employees who do not work Monday to Sunday.

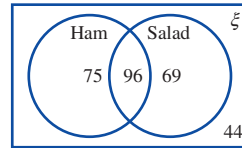
- 4 Jewellery



There are 12 pieces in the freshwater pearl display.

5

Types of rolls



There were 75 ham, 69 salad, and 96 ham and salad rolls sold.

Set up equations and find a solution, making use of technology such as a computer spreadsheet

- 1 Benjamin is 17 years old.
- 2 Elias is 81 years old.
- 3 One coffee cup has a capacity of 110 mL.
- 4 The two numbers are 5 and 6.
- 5 The length of the shortest side is 5.8 cm.

Work backwards from the answer

- 1 \$890
- 2 \$6.00 per kg
- 3 \$220
- 4 Joe's salary at the beginning of the year was \$62 540.
- 5 The original price of the hammer was \$85.

Use a process of elimination

- 1 There were 92 pizzas made.
- 2 There are 22 students enrolled.
- 3 There were 440 sheep shorn.
- 4 Farmer Brown has 32 apricot trees and 84 peach trees.
- 5 There are 35 new cars displayed in the yard.

Look at similar but simpler problems

- 1 2346 kph
- 2 7654 kph
- 3 1 029 654 kph
- 4 The faster spaceship is travelling at 18 360 km/h.
- 5 The faster spacecraft is travelling at a speed of 15 120 km/h.

Use trial and error (guess and check), making use of technology such as a computer spreadsheet

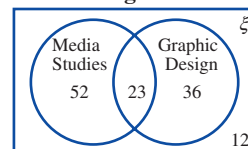
- 1 $a \approx 0.9259$
- 2 $a \approx 1.080$
- 3 $a \approx 0.001\ 95$
- 4 $a \approx 2.072$
- 5 $a \approx 36.555$

Communicating, reasoning and reflecting

- 1 The real perimeter differs from the tested value by less than 1 cm for values of r 7.06 cm and less.

2

Selecting electives



There were 23 students who liked both Media Studies and Graphic Design.

- 3 Sarah is 21 years old.
- 4 The original price of the vanity unit was \$810.

- 5 There are 12 pine trees and 17 eucalypt trees in the Botanical Gardens.
- 6 The slower satellite is travelling at a speed of 21 600 km/h.
- 7 $a \approx 1.189$
- 8 A spreadsheet could be set up as follows: Use one column to start with 400 litres and then subtract $1 \text{ mL} \times 60 \times 60 \times 24$ per day. Use the next column to add 20 L per day to the amount in the cell on the left. Link the subtracting taking place in the first column, to the column on the right and one row up. The tank runs dry after the sixth day.
- 9 A spreadsheet could be set up as follows: List lap numbers 1 to 20 in the first column, list the time elapsed as swimmer A completes each lap in the second column. In the third column, write a formula to divide the time elapsed by the time per lap of the next swimmer. If a whole number results then that swimmer has just touched an end of the pool. Repeat for the third swimmer.
Swimmers A and C will both touch an end simultaneously before the race ends: swimmer A at lap 13 and swimmer C at lap 12.
- 10 A spreadsheet could be set up as follows: Write Amelia in cell A1. Write Aana in cell B1. Write 17 in cell A2. Write **=A2+0.019** in cell A3. Copy cell A3 down the page until the answer 18 appears (about 70 lines). In cell B2 write 17. In cell B3 write **=B2+0.024**. Copy this into cells B4, B5, B6. In cell B7, write **=B6-0.015**. Highlight cells B3 to B7 and drag the bottom right corner down the page until the answer 18 appears (about 70 lines). Amelia throws over 18 m on the 54th day. Aana needs to practise for a further 9 days before throwing over 18 m.
- 11
 - a The relationship is linear. If we assume an 8-hour working day then cost (y) for Julie is $\$8 \times 8 + \$1 \times x$ where x is the number of pastries sold. That is, $y = 64 + x$.
 - b The cost (y) for Albert is $\$18 \times 8 - \$1 \times x$. That is, $y = 144 - x$.
 - c Julie's and Albert's costs will be the same if they each sell 40 pastries in an 8-hour day.
- 12
 - a The relationship is linear.
Cost = $\$500 + \$15 \times \text{volume}$.
 - b The relationship is linear.
Total volume = $3.2 \times 2.4 \times \text{sum of lengths of the rooms}$.
 - c The relationship is linear.
Cost = $\$500 + \$15 \times 3.2 \times 2.4 \times \text{sum of lengths of the rooms}$. That is, $y = 500 + 115.2x$.
 - d For the maximum number of rooms, we should start with the smallest rooms and calculate the total cost of air-conditioning. A spreadsheet could be used.

Number of rooms	Sum of lengths of rooms in metres (x)	Total cost (y)
1	2.6	\$799.52
2	$2.6 + 2.8 = 5.4$	\$1122.08
3	$2.6 + 2.8 + 3 = 8.4$	\$1467.68
4	$2.6 + 2.8 + 3 + 3.5 = 11.9$	\$1870.88
5	$2.6 + 2.8 + 3 + 3.5 + 4 = 15.9$	\$2331.68
6	$2.6 + 2.8 + 3 + 3.5 + 4 + 4.2 = 20.1$	\$2815.52

Four rooms could be air-conditioned for a budget of \$2000.

- e Four rooms could still be selected. If the rooms with lengths 4.2 m, 2.6 m, 2.8 m and 3 m are selected, the cost is \$1951.52.