UNIT 1 ANSWERS

UNIT 1: NUMBER 1

EXERCISE 1

1 ▶ $\frac{2}{3}$ 2 ▶ $\frac{2}{3}$ 3 ▶ $\frac{1}{3}$
4 ▶ $\frac{2}{3}$ 5 ▶ $\frac{1}{2}$ 6 ▶ $\frac{1}{3}$
7 ▶ 0.8 8 ▶ 0.375 9 ▶ $\frac{3}{4}$
10 ▶ $\frac{1}{5}$ 11 ▶ $2\frac{2}{3}$ 12 ▶ $3\frac{1}{4}$
13 ▶ $3\frac{2}{5}$ 14 ▶ $2\frac{5}{7}$ 15 ▶ $\frac{7}{3}$
16 ▶ $\frac{18}{5}$ 17 ▶ $\frac{11}{6}$ 18 ▶ $\frac{41}{7}$
19 ▶ $\frac{3}{10}$ 20 ▶ $1\frac{1}{2}$

EXERCISE 1*

1 ▶ $\frac{2}{7}$ 2 ▶ $\frac{2}{3}$ 3 ▶ $\frac{1}{6}$
4 ▶ $\frac{7}{11}$ 5 ▶ $\frac{1}{2}$ 6 ▶ $\frac{3}{8}$
7 ▶ 0.3125 8 ▶ 0.075 9 ▶ $\frac{7}{20}$
10 ▶ $\frac{3}{8}$ 11 ▶ $4\frac{1}{3}$ 12 ▶ $2\frac{1}{5}$
13 ▶ $3\frac{2}{7}$ 14 ▶ $4\frac{3}{4}$ 15 ▶ $\frac{14}{3}$
16 ▶ $\frac{45}{7}$ 17 ▶ $\frac{42}{5}$ 18 ▶ $\frac{188}{9}$
19 ▶ $\frac{13}{16}$ 20 ▶ $2\frac{2}{3}$

EXERCISE 2

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

EXERCISE 2*

1 ▶ $\frac{3}{4}$ 2 ▶ $\frac{1}{4}$ 3 ▶ $3\frac{3}{4}$
4 ▶ 36 5 ▶ $\frac{1}{6}$ 6 ▶ 6
7 ▶ α 8 ▶ 1 9 ▶ $\frac{1}{12}$
10 ▶ 10 000 m^2

EXERCISE 3

1 ▶ $\frac{6}{7}$ 2 ▶ $\frac{3}{8}$ 3 ▶ $\frac{3}{25}$
4 ▶ 12 5 ▶ $4\frac{1}{2}$ 6 ▶ $\frac{3}{10}$
7 ▶ $\frac{5}{9}$ 8 ▶ $1\frac{1}{9}$ 9 ▶ 6
10 ▶ 12

EXERCISE 3*

1 ▶ $\frac{21}{430}$ 2 ▶ $\frac{4}{9}$ 3 ▶ 56
4 ▶ $\frac{2}{9}$ 5 ▶ $\frac{5}{6}$ 6 ▶ $1\frac{3}{5}$
7 ▶ 6 8 ▶ $8\frac{1}{3}$ 9 ▶ 26
10 ▶ 64

EXERCISE 4

1 ▶ $\frac{6}{7}$ 2 ▶ $\frac{1}{3}$ 3 ▶ $\frac{1}{2}$
4 ▶ $\frac{1}{4}$ 5 ▶ $\frac{23}{24}$ 6 ▶ $\frac{1}{12}$
7 ▶ $4\frac{5}{12}$ 8 ▶ $2\frac{1}{10}$ 9 ▶ $4\frac{7}{12}$
10 ▶ $8\frac{1}{8}$ 11 ▶ $2\frac{3}{34}$ 12 ▶ $3\frac{19}{24}$
13 ▶ $\frac{5}{12}$ 14 ▶ $\frac{1}{3}$

EXERCISE 4*

1 ▶ $\frac{3}{4}$ 2 ▶ $\frac{7}{10}$ 3 ▶ $\frac{3}{5}$
4 ▶ $\frac{7}{12}$ 5 ▶ $\frac{19}{20}$ 6 ▶ $\frac{3}{8}$
7 ▶ $7\frac{2}{3}$ 8 ▶ $13\frac{11}{15}$ 9 ▶ $6\frac{1}{2}$
10 ▶ $1\frac{4}{9}$ 11 ▶ $6\frac{7}{9}$ 12 ▶ $1\frac{23}{60}$
13 ▶ $1\frac{17}{24}$
14 ▶ Total length is $7\frac{1}{9}$, $7\frac{1}{18} < 7\frac{1}{9} < 7\frac{1}{6}$ so it will fit.

EXERCISE 5

1 ▶ 20 2 ▶ 32 3 ▶ 2
4 ▶ 0 5 ▶ 4 6 ▶ 25
7 ▶ –1 8 ▶ 5
9 ▶ $4 \times (5 - 3) + 2 = 10$
10 ▶ $(7 - 5) \times 3 = 6$

EXERCISE 5*

1 ▶ 12 2 ▶ 8 3 ▶ 1
4 ▶ 1 5 ▶ 20 6 ▶ 1
7 ▶ 6 8 ▶ $\frac{1}{2}$
9 ▶ $8 - ((2 + 1) \times (5 - 3)) = 2$
10 ▶ $(8 + (6 \times 2)) \div 4 = 5$

EXERCISE 6

1 ▶ 800 2 ▶ 90 000 3 ▶ 3740
4 ▶ 80 300 5 ▶ 0.44 6 ▶ 0.56
7 ▶ 0.506 8 ▶ 0.105 9 ▶ 34.78
10 ▶ 0.65 11 ▶ 3.0 12 ▶ 9.1
13 ▶ a 300 000 000 m/s
b 299 792 000 m/s
14 ▶ a 0.02 mm b 0.019 mm
15 ▶ $179 400 000
16 ▶ 40 000 km

EXERCISE 6*

1 ▶ 10 2 ▶ 5000
3 ▶ 45.7 4 ▶ 89 500
5 ▶ 0.069 6 ▶ 0.0068
7 ▶ 0.0495 8 ▶ 0.000 568
9 ▶ 9.00 10 ▶ 2.08
11 ▶ 7.0 12 ▶ 78.2
13 ▶ a 0.000 b 0.000 498
14 ▶ a 1.414 214 b 1.414 21
15 ▶ a $10 000 b $12 721.9
16 ▶ a 0.000 000 1 mm
b 0.000 000 052 917 72 mm

EXERCISE 7 REVISION

1 ▶ a $\frac{2}{3}$ b $\frac{1}{15}$
2 ▶ a $\frac{1}{4}$ b 2
3 ▶ a $2\frac{13}{20}$ b $2\frac{1}{20}$
4 ▶ a 4 b 2 c 4
5 ▶ $12 \div (4 + 2) + 3 = 5$
6 ▶ $(3 + 5) \div 2 = 4$
7 ▶ a 12.000 50 b 12.000
8 ▶ a 4.5 b 5
9 ▶ 16
10 ▶ a $\frac{1}{3}$ b 4000

EXERCISE 7* REVISION

1 ▶ a $\frac{1}{3}$ b $\frac{1}{300}$
2 ▶ a $\frac{2}{3}$ b $1\frac{1}{12}$
3 ▶ a $1\frac{11}{20}$ b $1\frac{1}{24}$
4 ▶ a 2 b 7 c 4
5 ▶ $((2 \times 3) + 3) \div 3 = 3$
6 ▶ $(7 + 2) \times 2 \div 3 = 6$
7 ▶ a 8.999 b 9.00
8 ▶ a 2.718 281 8 b 2.718 281 83
9 ▶ 14
10 ▶ a $\frac{49}{80}$
b Space left is 918 gigabytes so yes.

EXAM PRACTICE: NUMBER 1

1 ▶ a $\frac{1}{3}$ b $3\frac{1}{3}$ c $\frac{1}{30}$
2 ▶ a $\frac{4}{9}$ b 6
3 ▶ $1\frac{1}{9}$
4 ▶ a 53 b $1\frac{1}{10}$
5 ▶ a 21 196.2 km b 20 000 km
6 ▶ a $\frac{1}{4}$ b 96
7 ▶ 32

UNIT 1: ALGEBRA 1

EXERCISE 1

1 ▶ $4ab$
2 ▶ $7xy$
3 ▶ $-3pq$
4 ▶ $y - xy$
5 ▶ $2 - 6x$
6 ▶ $2cd$
7 ▶ $-4xy$
8 ▶ $2ab + 5bc$
9 ▶ 0
10 ▶ $2gh - 5jk + 7$
11 ▶ $-3p^2 - 2p$
12 ▶ $5x^2y - 3xy^2$

EXERCISE 1*

1 ▶ $-xy$
2 ▶ $4ab - b$
3 ▶ $6ab$
4 ▶ 0
5 ▶ $3ab + 3bc$
6 ▶ $3q^2$
7 ▶ $x + 1$
8 ▶ $a^3 + 2a^2 + a = a(a^2 + 2a + 1)$
9 ▶ $h^3 + h^2 + 3h + 4$
10 ▶ $7a^2b - 3ab$
11 ▶ $a^2b^3c - 0.6a^3b^2c + 0.3$
12 ▶ $4pq^2r^5 - 2pq^2r^4$

EXERCISE 2

1 ▶ $6a$
2 ▶ $2x^2$
3 ▶ $3x^3$
4 ▶ $15a^5$
5 ▶ $6st$
6 ▶ $4rs^2$
7 ▶ $2a^2b^2$
8 ▶ $4y^3$
9 ▶ $12x^3$
10 ▶ $20a^3$

EXERCISE 2*

1 ▶ $8a^3$
2 ▶ $15x^4y^2$
3 ▶ $6a^7$
4 ▶ $18y^3$
5 ▶ $36x^5y^3$
6 ▶ $30a^3b^3c^5$
7 ▶ $56xy^4$
8 ▶ $10x^3y^3$
9 ▶ $3x^3y^4 - 2x^3y^2 = x^3y^2(3y^2 - 2)$
10 ▶ $14a^4b^6$

EXERCISE 3

1 ▶ $10 + 15a$
2 ▶ $2b - 8c$
3 ▶ $-6a - 24$
4 ▶ $4x - 12$
5 ▶ $2b - a$
6 ▶ $5a + 4b$
7 ▶ $3t - 18$
8 ▶ $6x + y$
9 ▶ $1.4x + 0.3y$
10 ▶ $2.1a - 11.7$

EXERCISE 3*

1 ▶ $12m - 8$
2 ▶ $2x - 2y + 2z$
3 ▶ $15a + 5b - 20c$
4 ▶ $2x - 3y + 4$
5 ▶ $3y - x$
6 ▶ $-1.4x - 2.2$
7 ▶ $-6x - 3y$
8 ▶ $4.6x - 6.2y - 0.4z$
9 ▶ $-0.6a - 4.2b + 0.7$
10 ▶ $-0.44x^2 - 3.8xy - 1.2y^2$

EXERCISE 4

1 ▶ $x = 4$
2 ▶ $x = 15$
3 ▶ $x = 25$
4 ▶ $x = 100$
5 ▶ $x = 12$
6 ▶ $x = 15$
7 ▶ $x = 2.4$
8 ▶ $x = 13.5$
9 ▶ $x = 26.6$
10 ▶ $x = 1.4$
11 ▶ $x = 0.985$
12 ▶ $x = 6.8$

EXERCISE 4*

1 ▶ $x = 99.9$
2 ▶ $x = 5.13$ (to 2 d.p.)
3 ▶ $x = 40.664$
4 ▶ $x = 580.39$
5 ▶ $x = 8.49$ (to 2 d.p.)
6 ▶ $x = 38.84$

EXERCISE 5

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

EXERCISE 5*

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

EXERCISE 6

1 ▶ $x = 1$
2 ▶ $x = 2$
3 ▶ $x = 2$
4 ▶ $x = 5$
5 ▶ $x = 4$
6 ▶ $x = -3$
7 ▶ $x = 1$
8 ▶ $x = -1$
9 ▶ $x = 0$
10 ▶ $x = -\frac{1}{2}$

EXERCISE 6*

1 ▶ $x = 4$
2 ▶ $x = -2$
3 ▶ $x = 1\frac{1}{2}$
4 ▶ $x = \frac{4}{5}$
5 ▶ $x = \frac{7}{9}$
6 ▶ $x = 3$
7 ▶ $x = 5$
8 ▶ $x = -9$
9 ▶ $x = 0.576$ (3 s.f.)
10 ▶ $x = 1.28$ (3 s.f.)

EXERCISE 7

1 ▶ $x = 13$
2 ▶ $x = 36$
3 ▶ $x = 3$
4 ▶ $x = 7$
5 ▶ $x = 2$
6 ▶ $x = 6$
7 ▶ $x = 4$
8 ▶ $x = 4$
9 ▶ $x = \frac{5}{2}$
10 ▶ $x = -\frac{5}{3}$

EXERCISE 7*

1 ▶ $x = 8$
2 ▶ $x = 5$
3 ▶ $x = 5$
4 ▶ $x = 1$
5 ▶ $x = 4$
6 ▶ $x = 3$
7 ▶ $x = 9$
8 ▶ $x = 5$
9 ▶ $x = \frac{3}{4}$
10 ▶ $x = \frac{3}{5}$

EXERCISE 8

1 ▶ 238, 239
2 ▶ $x = 10$, 40°, 80°, 60°
3 ▶ $x = 2$, 38
4 ▶ 13
5 ▶ **a** $20x - 10(30 - x) = 180$
b $x = 16$
6 ▶ **a** $3x + 5(x - 10) + 2(x + 20) = 890$
b 90c

EXERCISE 8*

1 ▶ 72, 74, 76
2 ▶ 11 kg, 44 kg, 67 kg
3 ▶ 42 years old
4 ▶ 6
5 ▶ 15
6 ▶ 4

EXERCISE 9 REVISION

1 ▶ $3x - 2$
2 ▶ ab
3 ▶ $6a$
4 ▶ $2a^2$
5 ▶ a^3
6 ▶ $2a^4$
7 ▶ $4a^4$
8 ▶ $-5a - 4ab$
9 ▶ $x + 7y$
10 ▶ $x = 7$
11 ▶ $x = 4.8$
12 ▶ $x = 2$
13 ▶ 145, 146, 147
14 ▶ **a** $4x + 12 = 54$
b 10.5, 16.5

EXERCISE 9* REVISION

1 ▶ $4xy^2 - 3x^2y$
2 ▶ $2x^3y^3$
3 ▶ 1
4 ▶ $2x^3y + xy^3 + x^4$
5 ▶ $x = 20$
6 ▶ $x = 1.25$
7 ▶ $x = -6$
8 ▶ $x = 2$
9 ▶ $x = 4$
10 ▶ 72 m²
11 ▶ 11 years old
12 ▶ 6 m/s
13 ▶ $294

EXAM PRACTICE: ALGEBRA 1

1 ▶ $-3xy$
2 ▶ $3ab^3 - 2ab^2$
3 ▶ $8b^6$
4 ▶ $32p^4$
5 ▶ $10x - 2y$
6 ▶ $x = 108$
7 ▶ $x = 12$
8 ▶ $x = 1$
9 ▶ $x = 2$
10 ▶ $x = 4$
11 ▶ $x + (x + 1) + (x + 2) = 219 \Rightarrow x = 72$
so numbers are 72, 73 and 74
12 ▶ $(5x - 50) + (2x) + (80 - x) = 180 \Rightarrow x = 25$
so angles are 75°, 50° and 55°
13 ▶ $4x - 3 = 9 - 2x \Rightarrow x = 2 \Rightarrow$ perimeter is 16

UNIT 1: GRAPHS 1

EXERCISE 1

1 ▶ 1 **2 ▶** –0.5
3 ▶ 3 **4 ▶** $\frac{1}{4}$
5 ▶ $-\frac{1}{4}$ **6 ▶** 2
7 ▶ –1 **8 ▶** 3 m
9 ▶ 10 km **10 ▶** 2.325 m
11 ▶ 2 m
12 ▶ **a** 14 m **b** $\frac{1}{30}$

EXERCISE 1*

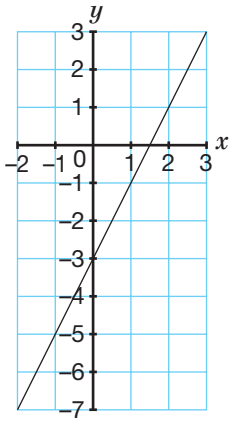
1 ▶ $\frac{3}{8}$
2 ▶ $-\frac{6}{7}$
3 ▶ 0.5
4 ▶ –3
5 ▶ 652
6 ▶ **a** –2 **b** 159 m
7 ▶ **a** $\frac{1}{6}$ cm **b** 0.1 cm
8 ▶ **a** 4 m **b** 8.2 m
9 ▶ No, the gradients between pairs of points are different.
10 ▶ $\frac{s-q}{r-p}$
11 ▶ $p = -2$
12 ▶ $q = 2.5$
13 ▶ 26 m

EXERCISE 2

1 ▶ **a**

x	–2	–1	0	1	2	3
y	–7	–5	–3	–1	1	3

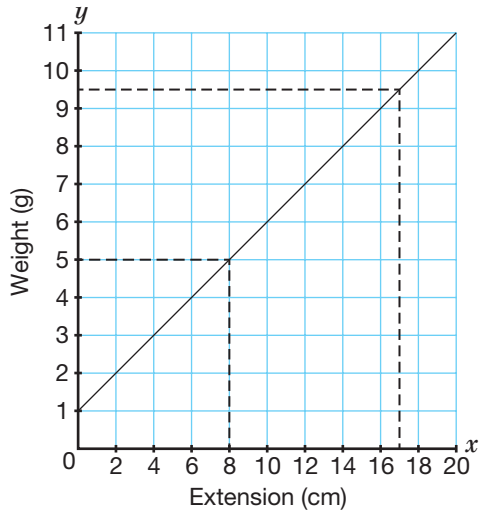
b



c Gradient = 2, y-intercept = –3
d –1.8; reading from a graph is not exact

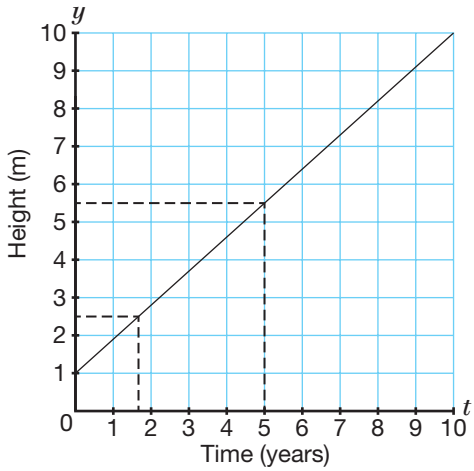
2 ▶ **a** $y = 4x - 2$
b $y = -3x + 5$
c $y = 2x + 3$ and $y = 2x - 4$

3 ▶ **a**



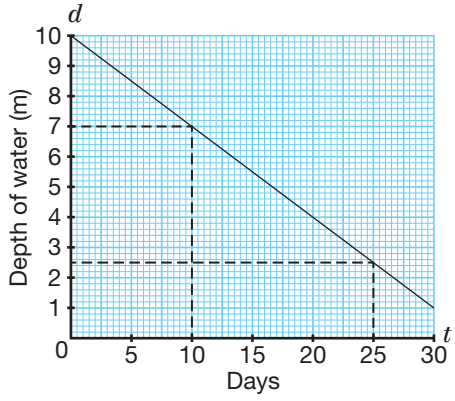
b **(i)** 9.5 g **(ii)** 8 cm
c 1998 cm, outside validity range

4 ▶ **a**



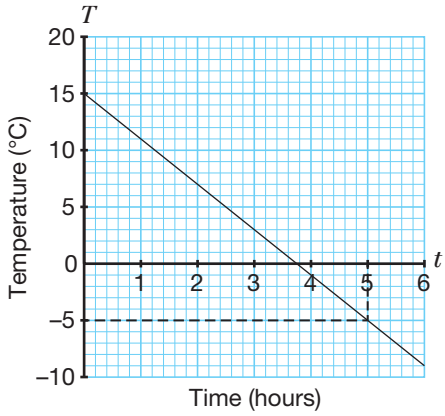
b **(i)** 1 m and 2.5 m **(ii)** 5 years
c $t = 20$ years, outside validity range

5 ▶ **a**



b **(i)** 2.5 m **(ii)** 10 December
c $t \approx 33.3$ days, outside validity range

6 ▶ a



b **(i)** 15°C **(ii)** 3:45pm, 5pm

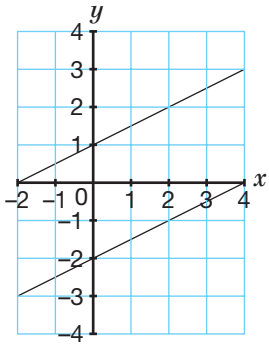
c −15°C, outside validity range

EXERCISE 2*

1 ▶ a

x	−2	0	2	4
$y = \frac{1}{2}x + 1$	0	1	2	3
$y = \frac{1}{2}x - 2$	−3	−2	−1	0

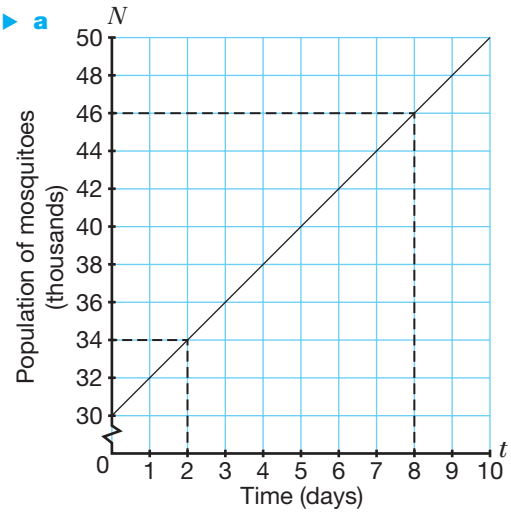
b



c For $y = \frac{1}{2}x + 1$ gradient $= \frac{1}{2}$, y-intercept = 1; for $y = \frac{1}{2}x - 2$ gradient $= \frac{1}{2}$, y-intercept = −2

d No, they are parallel lines.

2 ▶ a

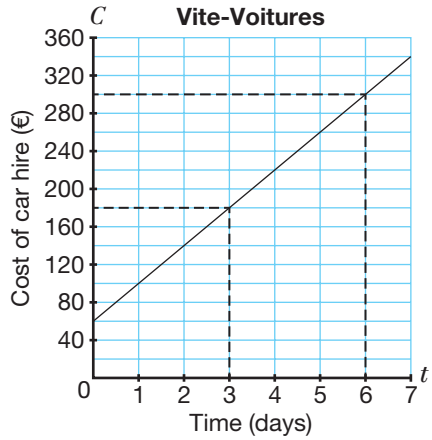


b **(i)** 34 000 **(ii)** 8 June

c 59 000

3 ▶ a $C = 40t + 60$

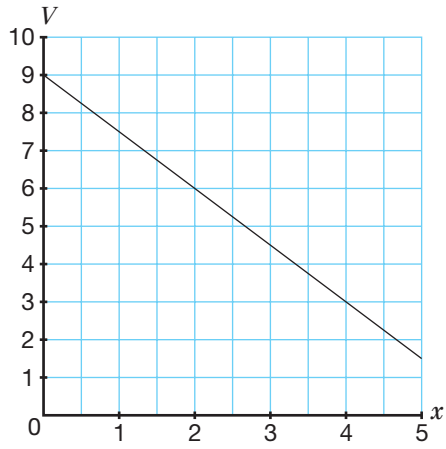
b



c **(i)** €300 **(ii)** 3 days

4 ▶ a $V = -1.5x + 9$

b

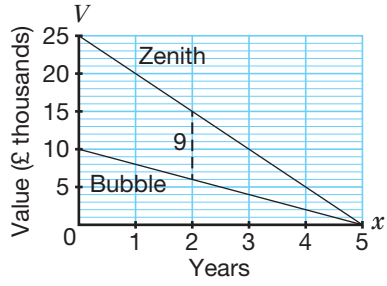


c **(i)** $525 **(ii)** 4 years

d 6 years

5 ▶ a Zenith: $V = -5x + 25$
Bubble: $V = -2x + 10$

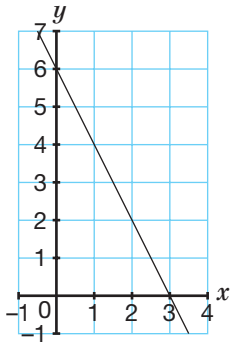
b



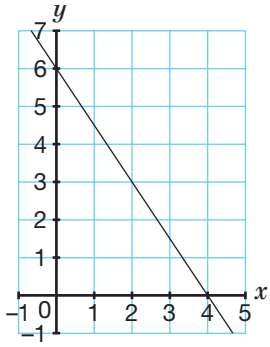
c **(i)** 5 years, £0 **(ii)** 2 years, £9000

EXERCISE 3

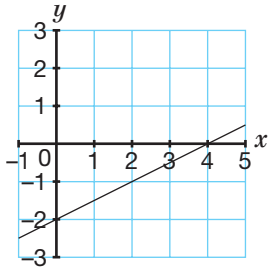
1 ▶ (3, 0), (0, 6)



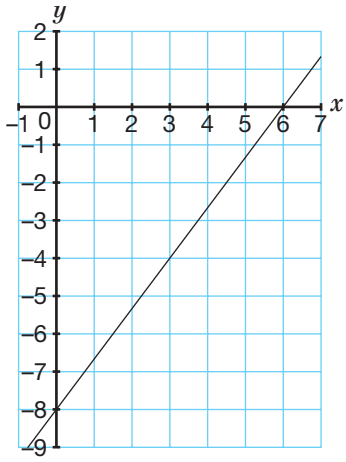
2 ▶ (4, 0), (0, 6)



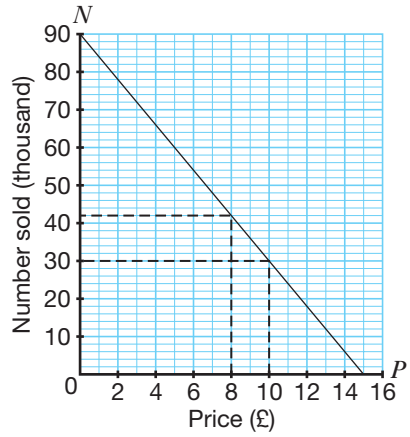
3 ▶ (4, 0), (0, –2)



4 ▶ (–8, 0), (0, 6)



5 ▶ a

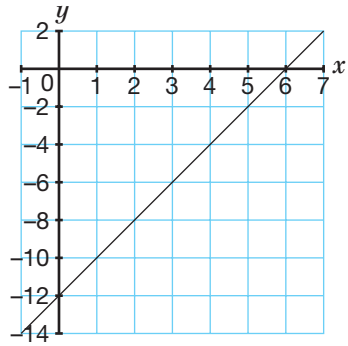


b £10 **c** 42 000

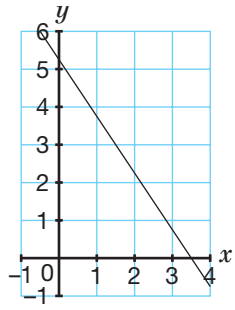
d £0; no, not a sensible value

EXERCISE 3*

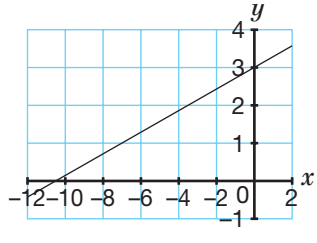
1 ▶ (6, 0) and (0, –12)



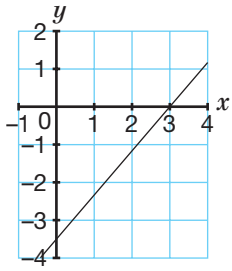
2 ▶ (3.5, 0), (0, 5.25)



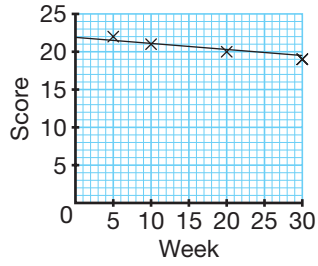
3 ▶ (–10.5, 0), (0, 3)



4 ▶ (–3.5, 0), (0, 3)



5 ▶ a



b ≈23

c $-\frac{3}{25}$, 23; about $25H + 3W = 575$

d 92 weeks; no, longer, unlikely to continue linear

6 ▶ a = any number, $b = 0$, $c \neq 0$

7 ▶ a $2x + y = 4$ **b** $\left(\frac{4}{3}, \frac{4}{3}\right)$

EXERCISE 4

1 ▶ a ¥12 000 **b** €60 **c** ¥7333

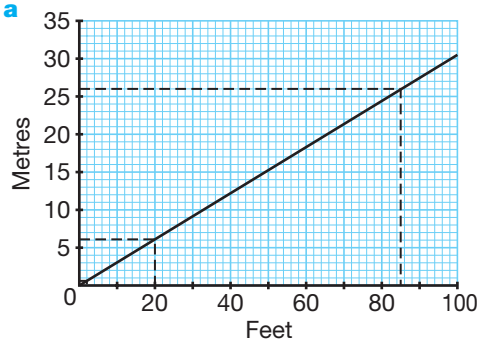
2 ▶ a $130 **b** 220 units

c No units

3 ▶ a 3 hr 40 mins **b** 1.8 kg

c No, graph should end at around $\frac{1}{2}$ kg

4 ▶ a



b 85 feet **c** 6.1 m **d** 0.61 m

EXERCISE 4*

1 ▶ a 56 mph **b** 120 kph

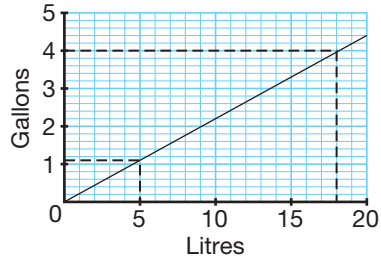
c 1220 kph

2 ▶ a 132 cm **b** 73 cm

c Suspect is running

3 ▶ a 3.6°C **b** 40 ppm **c** 200 ppm

4 ▶ a



b 18 litres **c** 1.1 gallons

d 11 gallons

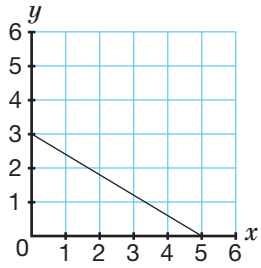
EXERCISE 5 REVISION

1 ▶ a 2 **b** –1

2 ▶ 4.5 m

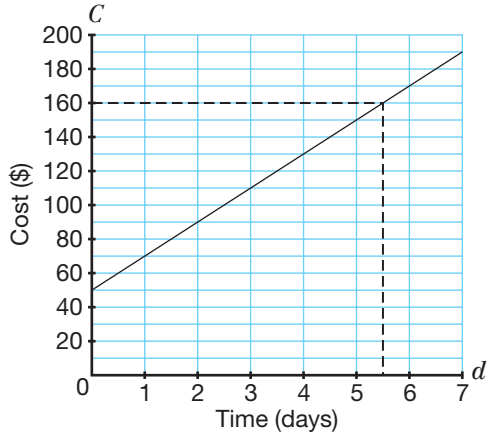
3 ▶ a 7 m **b** 8.2 m

4 ▶ a



b $-\frac{3}{5}$

5 ▶ a



b $50 **c** 5.5 days **d** $330

6 ▶ a 163 cm

b Estimated height of 134 cm so no.

EXERCISE 5* REVISION

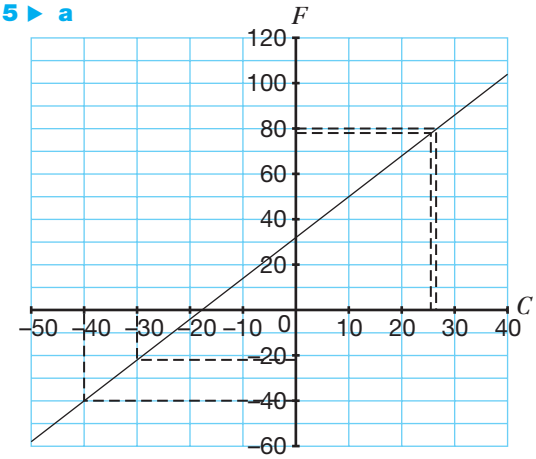
1 ▶ 5 m

2 ▶ Gradient of BC = gradient of AD = $-\frac{5}{6}$

3 ▶ $b = \pm 1.5$

4 ▶ 2

5 ▶ a

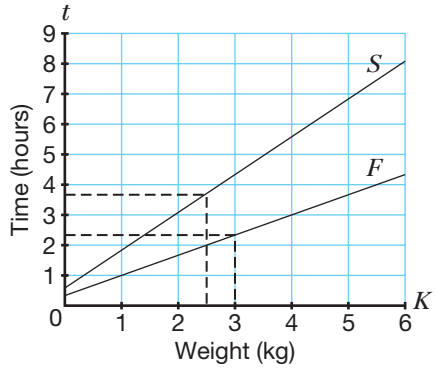


b **(i)** 27°C **(ii)** 77°F **(iii)** –30°C

c –40

6 ▶ a **(i)** $F = 40K + 20$ **(ii)** $S = 75K + 35$

b



c **(i)** 222.5 min **(ii)** 140 min

d 5.125 kg

e approx 13.30

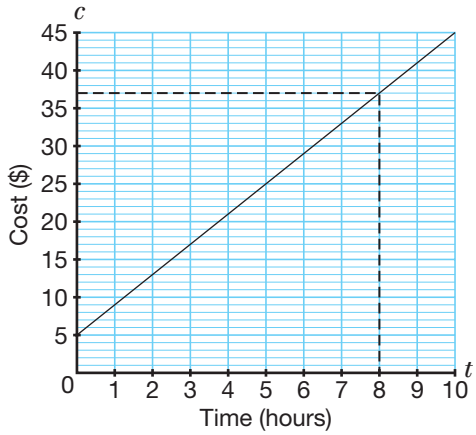
EXAM PRACTICE: GRAPHS 1

1 ▶ a 2 **b** –4

2 ▶ 45 m

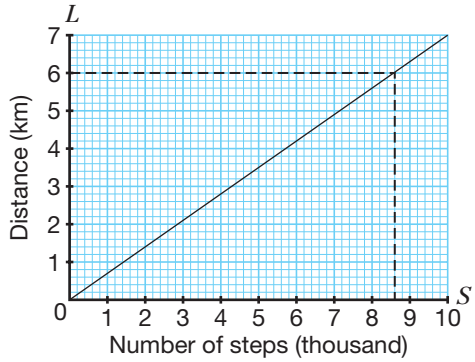
3 ▶ a

t	1	5	10
c	9	25	45



b 4 **c** $t = 8$

4 ▶ a



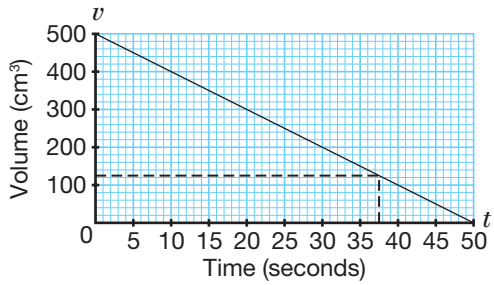
b around 6000 m

c around 8600 steps

5 ▶ a $v = 500 - 10t$

b

t	0	25	50
v	500	250	0



c $v = 125$, $t = 37.5$

UNIT 1: SHAPE AND SPACE 1

EXERCISE 1

1 ▶ $a = b = c = 60°$; $d = e = 45°$; $f = 135°$; $g = 33°$

2 ▶ a 75° **b** 68° **c** 68° **d** 7°

3 ▶ a $y = 103°$ **b** $y = 148°$

c $y = 111°$

4 ▶ 110°

5 ▶ ∠ACB = 94°

6 ▶ a $x = 110°$ **b** $y = 120°$

EXERCISE 1*

1 ▶ a 112° **b** 99° **c** 99° **d** 13°

2 ▶ a $y = 107°$ **b** $z = 51°$

c $x = 104°$ **d** $v = 120°$, $w = 120°$

3 ▶ ∠AED = 38° (alternate angles are equal)

$\angle ADE = \frac{180 - 38}{2} = 71°$ (the angle sum of a triangle is 180°)

∠EAD and ∠ADE are equal (base angles of an isosceles triangle)

∠ADC = 180 – 71 = 109° (angles on a straight line sum to 180°)

4 ▶ $2x - 20 + x + 5 = 2x + 35$ so $x = 50°$ (the exterior angle of a triangle is equal to the sum of the two interior angles at the other vertices)

5 ▶ 80°, 50°, 50° and 50°, 65°, 65°

6 ▶ 36°, 36°, 108°

EXERCISE 2

1 ▶ Parallelogram

2 ▶ 38°

3 ▶ **a** 92° **b** 71° **c** 55°

4 ▶ 174°

5 ▶ 128°

6 ▶ 84°

EXERCISE 2*

1 ▶ Kite

2 ▶ 35°

3 ▶ ∠BCE + ∠CBE = 132° (exterior angles of a triangle is equal to the sum of the two interior angles at the other two vertices)

∠BCE = ∠CBE (triangle BEC is isosceles)

$\angle BCE = \angle CBE = \frac{132}{2} = 66°$

∠CBA = 66° (alternate angles)

∠DAB = ∠CBA (trapezium is an isosceles trapezium)

∠DAB = 66°

4 ▶ ∠CBE = 110° (corresponding angles)

∠CBA = 70° (angles on a straight line sum to 180°)

∠ACB = 180 – (74 + 70) = 36° (angles in a triangle sum to 180°)

5 ▶ **a** Angle PSR $= \frac{4}{7}x = \frac{4}{7} \times 105 = 60°$

b Angle QPS $= \frac{6}{7}x = \frac{6}{7} \times 105 = 90°$

6 ▶ **a** 38° **b** $\frac{x}{2}$

EXERCISE 3

1 ▶ **a** **(i)** 360° **(ii)** 156° **b** **(i)** 540° **(ii)** 142°

c **(i)** 720° **(ii)** 146°

2 ▶ **a** **(i)** 720° **(ii)** 120° **b** **(i)** 540° **(ii)** 108°

c **(i)** 2880° **(ii)** 160°

3 ▶ **a** 11 sides **b** 14 sides

c 17 sides **d** 24 sides

4 ▶ 9 **5 ▶** 54° **6 ▶** 112.5°

EXERCISE 3*

1 ▶ n

2 ▶ No, the equation $180 - \frac{360}{n} = 145$ gives a number of sides that is not an integer.

3 ▶ 117° **4 ▶** 99°

5 ▶ 16 sides **6 ▶** 6

EXERCISE 4

1 ▶ **a** 20 m **b** 2.5 cm

2 ▶ **a** Accurate scale drawing of right-angled triangle with base 6 cm, hypotenuse 10 cm

b 36 m

3 ▶ **a** 072° **b** 255°

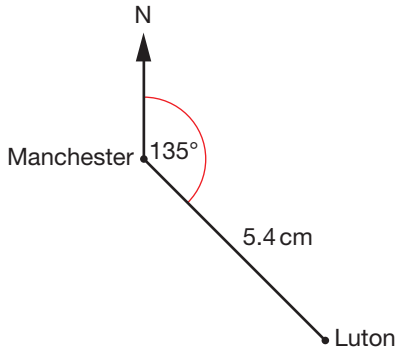
4 ▶ **a** 1 cm : 120 m

b **(i)** 360 m **(ii)** 600 m

c Answers between 4 and 4.24 minutes

EXERCISE 4*

1 ▶



2 ▶ **a** **(i)** 130 km **(ii)** 136 km

b Sligo

3 ▶ **a** 2.5 km **b** 16 cm

4 ▶ 323°

EXERCISE 5

1 ▶ Accurate construction of triangle with sides 6 cm, 7 cm and 10 cm

2 ▶ Accurate construction of triangle with sides 7 cm, 8 cm, 9 cm

3 ▶ Accurate construction of triangle with sides 4 cm, 5 cm, 7 cm

4 ▶ **a–c** Accurate drawings of the triangles

5 ▶ Accurate drawing of an equilateral triangle with sides 6.5 cm

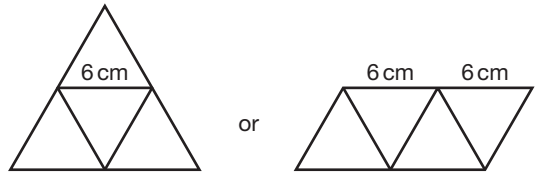
6 ▶ The sum of the two shorter sides is less than the longest side so the triangle will not be possible.

EXERCISE 5*

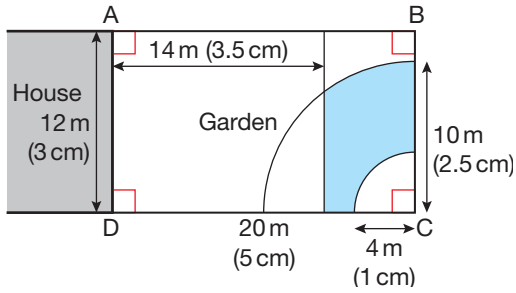
1 ▶ Accurate drawing of triangle with sides of length 5.5 cm, 5.5 cm and 10 cm (for real-life sides of 11 m, 11 m and 200 m respectively)

2 ▶ Accurate drawing of a triangle with sides of length 5 cm, 15 cm and 17 cm (for real-life sides of 100 cm, 300 cm and 340 cm respectively)

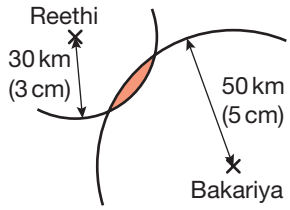
3 ▶ Accurate net with sides of length 6 cm



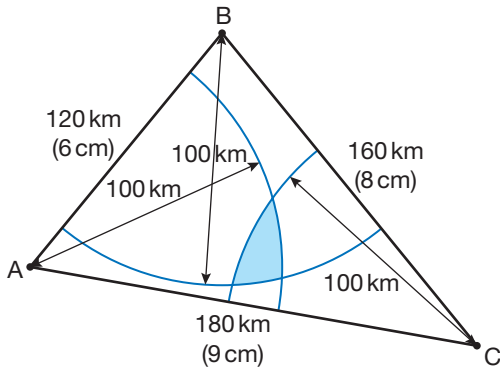
4 ▶



5 ▶



6 ▶



EXERCISE 6

1 ▶ Accurate construction of the perpendicular bisector of a line of length 12 cm

2 ▶ Accurate construction of the perpendicular bisector of a line of length 7 cm

3 ▶ Perpendicular bisector accurately constructed on a line of length 10 cm

4 ▶ **a**, **b** Perpendicular bisector of line segment AB of length 7 cm drawn accurately

c AP is the same distance as BP.

EXERCISE 6*

1 ▶ **a**, **b** Perpendicular bisector accurately constructed of 2 points, S and T, 10 cm apart. The perpendicular bisector shows possible positions of the lifeboat.

2 ▶ **a**, **b**, **c** Perpendicular bisector from point P to the line AB accurately constructed

3 ▶ **a**, **b**, **c** Perpendicular at point P on a line accurately constructed

4 ▶ **a** Shortest distances to sides accurately drawn

b 2.5 m **c** 10 seconds

EXERCISE 7

1 ▶ Accurate construction of angle bisector of 70° angle

2 ▶ Angles accurately drawn and bisected

3 ▶ **a** Accurate construction of 90° angle

b Accurate construction of 45° angle

4 ▶ **a** Accurate construction of 60° angle

b Accurate construction of 30° angle

EXERCISE 7*

1 ▶ **a** Accurate scale drawing with sides 3 cm and 5 cm

b Accurate construction of 30° angle

c 115 m^2

2 ▶ **a** Accurate construction of triangle

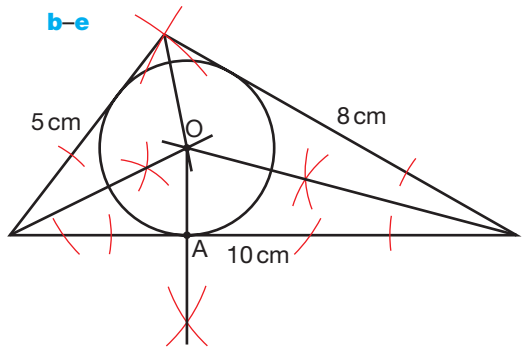
b Accurate construction of line perpendicular to AB that passes through C

c 16 cm^2

3 ▶ Accurate scale drawing

4 ▶ **a** Accurate construction of triangle

b–e



EXERCISE 8

1 ▶ **a** **(i)** AB and ED, DF and BC, AC and EF

(ii) ∠ABC = ∠EDF, ∠ACB = ∠EFD, ∠CAB = ∠FED

b **(i)** IK and IJ, GI and HI, GK and HJ

(ii) ∠IJH = ∠IKG, ∠KIG = ∠JIH, ∠IHJ = ∠IGK

c **(i)** LM and OP, MN and PQ, LN and OQ

(ii) ∠OPQ = ∠LMN, ∠POQ = ∠MLN, ∠PQO = ∠MNL

d **(i)** SR and WU, ST and WT, RT and UT

(ii) ∠RST = ∠UWT, ∠SRT = ∠WUT, ∠STR = ∠WTU

2 ▶ C and E

3 ▶ **a** 5 **b** 60 cm

4 ▶ a = 4 cm, b = 20 cm, c = 12 cm, d = 6 cm

5 ▶ **a** 7.0 cm **b** 13.2 cm

EXERCISE 8*

1 ▶ ∠EDC = ∠EBA (alternate); ∠DCE = ∠EAB (alternate); ∠CED = ∠AEB (vertically opposite). Therefore all angles are equal and the triangles are similar.

2 ▶ **a** ∠RPQ = ∠RTS (alternate); ∠PQR = ∠RST (alternate); ∠PRQ = ∠SRT (vertically opposite). Therefore all angles are equal and the triangles are similar.

b 10 cm

3 ▶ **a** ∠F is common; ∠FGH = ∠FJK (corresponding); ∠FHG = ∠FKJ (corresponding). Therefore all angles are equal and the triangles are similar.

b 60 mm

c 64 mm

4 ▶ 308 m tall

5 ▶ **a** ∠PQN = 52°; ∠LMN = 102°

b ∠L is common; ∠MNL = ∠PQL (corresponding); ∠LMN = ∠LPQ (corresponding). Therefore all angles are equal and the triangles are similar.

c 44 cm **d** 22 cm **e** 18 cm

EXERCISE 9 REVISION

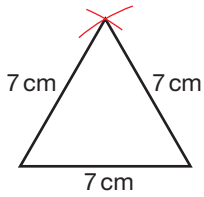
1 ▶ $a = 23°$, $b = 157°$, $c = 44°$, $d = 116°$

2 ▶ 68°

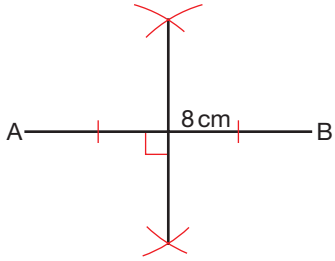
3 ▶ $a = 145°$

4 ▶ **a** 24 sides **b** 20°

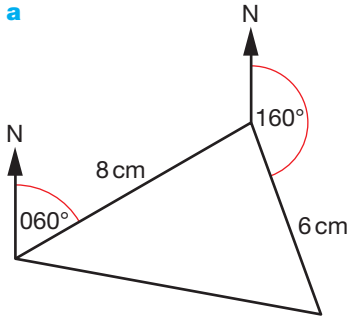
5 ▶



6 ▶



7 ▶ **a**



b 27 km

c 280°

8 ▶ **a** ∠A is common; ∠EBA = ∠DCA (corresponding); ∠ADC = ∠AEB (corresponding). All angles are equal so the triangles are similar.

b CD = 32 cm

EXERCISE 9* REVISION

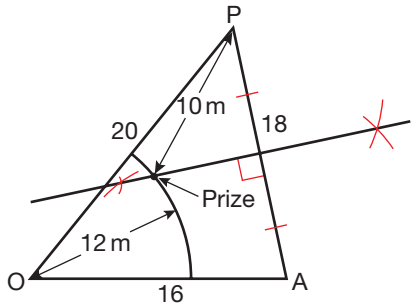
1 ▶ ∠CBD = ∠BCD = (180 – 2(x – 30)) ÷ 2 = 120 – x
120 – x + x + ∠BCA = 180°, ∠BCA = 60° and ∠ABC = 60°
∠EAC = 180 – 90 – x = 90 – x
∠BAC = 180 – (x + 30) – (90 – x) = 60°
∠ABC = ∠ACB = ∠BAC = 60° means triangle ABC is equilateral

2 ▶ Angle ABC = interior angle
Exterior angle of a regular octagon = 360° ÷ 8 = 45°
Interior angle = 180 – 45 = 135°
Angle BAC = angle BCA (triangle ABC is isosceles)
Angle BAC = (180 – 135) ÷ 2 = 22.5° (angles in a triangle)

3 ▶ $x = 50°$ giving exterior angles of 70°, 50°, 90°, 50° and 100°

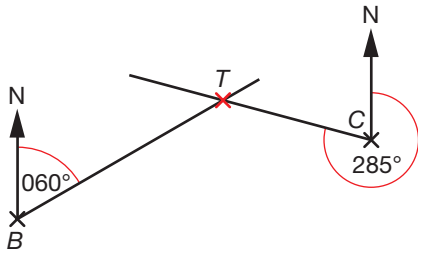
4 ▶ 8

5 ▶



6 ▶ 55 m approx

7 ▶



8 ▶ **a** ∠PQR = ∠RST (alternate); ∠QPR = ∠RTS (alternate)
∠PRQ = ∠SRT (vertically opposite). All angles are equal so the triangles are similar.

b $x = 40$ cm; $y = 19.5$ cm

EXAM PRACTICE: SHAPE AND SPACE 1

1 ▶ a 112° **b** 81° **c** 31°

2 ▶ 69°

3 ▶ 110°

4 ▶ 162°

5 ▶ a (i) 37.5 km **(ii)** 25 km

b St Peter's Port or Vale

6 ▶ a Accurate construction of an angle of 45°

b Accurate construction of the perpendicular bisector of an 8 cm line

7 ▶ 93 m

8 ▶ a ∠PQN = 65°, ∠LMN = 72°

b All corresponding angles are equal so the triangles are similar.

c 21 cm **d** 7 cm **e** 6.65 cm

UNIT 1: SETS 1

EXERCISE 1

1 ▶ a Any two vegetables

b Any two colours

c Any two letters

d Any two odd numbers

2 ▶ a {Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday}

b {1, 4, 9, 16, 25, 36, 49, 64, 81, 100}

c For example {Mathematics, Science, English, …}

d {2, 3, 5, 7, 11, 13, 17, 19}

3 ▶ a {first four letters of the alphabet}

b {days of the week beginning with T}

c {first four square numbers}

d {even numbers}

4 ▶ a False **b** False

c False **d** True

5 ▶ b and **c**

EXERCISE 1*

1 ▶ a Any two planets

b Any two polygons

c Any two elements

d Any two square numbers

2 ▶ a {2, 3, 4} **b** {1, 4, 6}

c {1, 5, 7, 35}

d {10, 100, 1000, 10 000, 100 000}

3 ▶ a {seasons of the year}

b {conic sections}

c {first 5 powers of 2}

d {Pythagorean triples}

4 ▶ a True **b** False **c** True **d** False

5 ▶ a and **d**

EXERCISE 2

1 ▶ a 16

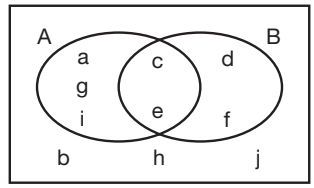
b $n(S) = 14$; 14 pupils like sweets.

c $n(C \cap S) = 12$; 12 pupils like both chocolate and sweets.

d 21

2 ▶ a 6 **b** 15 **c** 58 **d** 85

3 ▶ a



b {c, e}, 2 **c** Yes

d No, d ∈ B but d ∉ A for example.

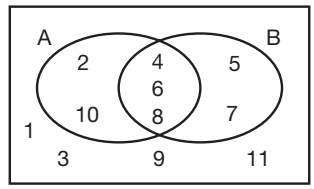
4 ▶ a Pink Rolls-Royce cars

b Cars that are not Rolls Royces

c There are no pink Rolls-Royce cars in the world.

EXERCISE 2*

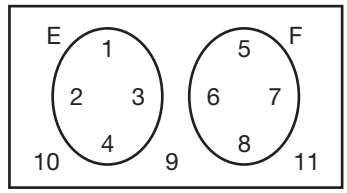
1 ▶ a



b {4, 6, 8}, 3 **c** Yes

d {1, 2, 3, 5, 7, 9, 10, 11} **e** Yes

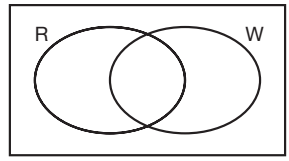
2 ▶ a



b { } or ∅

c The sets don't overlap (*disjoint*)

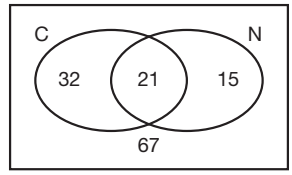
3 ▶ a



b White roses in the shop

c There are no white roses in the shop.

4 ▶ a



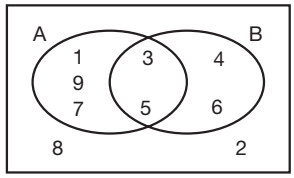
b 32 **c** 47 **d** 135

5 ▶ 2^n

6 ▶ A ∩ B ∩ C gives multiples of 30, so $\mathscr{E}$ must be a set that includes one and only one multiple of 30.

EXERCISE 3

1 ▶ a



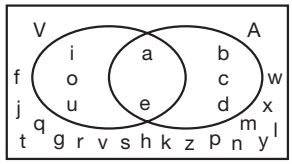
b {1, 3, 4, 5, 6, 7, 9}, 7

c Yes

d {2, 8}

e No

2 ▶ a

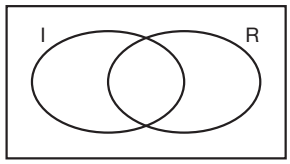


b {a, e}

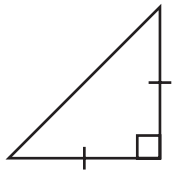
c Consonants

d {a, e, i, o, u, b, c, d}

3 ▶ a



b



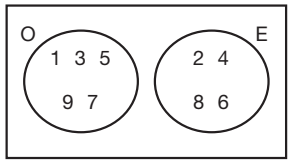
c Isosceles right-angled triangles

d Non-right-angled isosceles triangles

4 ▶ 21

EXERCISE 3*

1 ▶ a



b {1, 2, 3, 4, 5, 6, 7, 8, 9}

c E ∩ F = ∅

d E ∪ F = $\mathscr{E}$

2 ▶ a All pizzas containing olives or cheese or both

b All pizzas containing olives and cheese

c All pizzas contain either olives or cheese or both

3 ▶ 6

4 ▶ B is a subset of A

5 ▶ Yes

EXERCISE 4 REVISION

1 ▶ a {4, 9, 16, 25}

b {1, 2, 3, 4, 6, 8, 12, 24}

c {a, e, i}

d {April, June, September, November}

2 ▶ a {first four prime numbers}

b {even numbers between 31 and 39}

c {days of the week beginning with S} or {days of the weekend}

d {vowels}

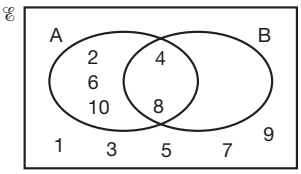
3 ▶ a False (51 = 3 × 17)

b False (2 ∉ O)

c True

d True

4 ▶ a

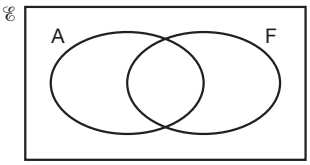


b {1, 3, 5, 7, 9}, odd integers between 1 and 9 inclusive

c 8

d Yes – all multiples of 4 are also multiples of 2

5 ▶ a



b All members of the expedition who were born in Africa or are female or both

c The leader is a female who was born in Africa.

6 ▶ 7

EXERCISE 4* REVISION

1 ▶ a {4, 8, 12, 16}

b {red, orange, yellow, green, blue, indigo, violet}

c {CAT, CTA, ACT, ATC, TCA, TAC}

d {2, 3, 6}

2 ▶ **a** {factors of 12}

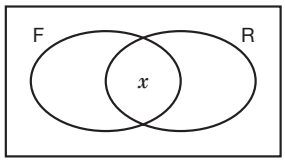
b {first five Fibonacci numbers}

c {suits in a pack of cards}

d {five regular solids}

3 ▶ 9

4 ▶ **a**, **d** $\mathscr{E}$



b All regular four-sided polygons

c All irregular four-sided polygons

5 ▶ 11

6 ▶ **a** {20}

b 12 or 24

c Yes. The first integer that is a multiple of both 5 and 6 is 30

EXAM PRACTICE: SETS 1

1 ▶ **b** and **c**

2 ▶ **a** Clothes that aren't yellow

b Yellow jeans

c There are no yellow jeans.

3 ▶ **a** 50 **b** 25

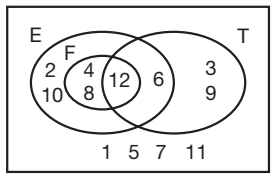
c 42; there are 42 animals that are either black or sheep or both in the field.

d 17

4 ▶ **a** $E' = \{1, 3, 5, 7, 9, 11\}$, $E \cap T = \{6, 12\}$ and $F \cap T = \{12\}$

b E' is odd numbers less than 13, $E \cap T$ is multiples of 6 less than 13, $F \cap T$ is multiples of 12 less than 13

$\mathscr{E}$



5 ▶ 8