Cambridge IGCSE® Mathematics Core and Extended Practice Book Answers

1 Number and language

Exercises 1.1–1.5

1 83, 89, 97
2 **(a)** 1, 2, 3, 4, 6, 8, 12, 16, 24, 48
(b) 1, 2, 4, 5, 10, 20, 40, 50, 100, 200
3 **(a)** 5^2 **(b)** $2^4 \times 3$
4 **(a)** 17 **(b)** 36
5 **(a)** 48 **(b)** 48

Exercise 1.6

1 **(a)** Rational
(b) Rational
(c) Irrational
(d) Rational
(e) Rational
(f) Irrational
(g) Rational
2 **(a)** Student's shapes e.g. cuboid, triangular prism, pyramid
3 **(a)** Student's shapes likely to include a circle/ semicircle
4 **(a)** Student's shapes e.g. sphere, cone, cylinder

Exercises 1.7–1.9

1 **(a)** 0.9 **(b)** $\frac{7}{3}$
2 **(a)** -6 **(b)** $\frac{5}{2}$

Exercise 1.10

1 **(a)** 570 m **(b)** 1080 m
2 1700 m

2 Accuracy

Exercises 2.1–2.3

1 **(a)** 50 **(b)** 1300 **(c)** 525 000
2 **(a)** 5.0 **(b)** 18.0 **(c)** 0.00
3 **(a)** 20 **(b)** 0.043 **(c)** 3.05

Exercise 2.4

Answers may vary
1 **(a)** ≈ 10 **(b)** ≈ 3
2 ≈ 119 cm²

Exercise 2.5

1 23.8 m
2 70.5×11.5
3 715 000 ÷ 1550

Exercise 2.6

1 **(a)** 355.25, 395.25 **(b)** 2741.25, 2891.25
(c) 4497.75, 5502.75 **(d)** $0.\dot{5}$, 1
(e) 1.98, 2.03 (2 d.p.)
2 **(a)** 16.4, 16.6 **(b)** 28.4375, 29.6475
(c) 484.7575, 495.2475 **(d)** 9.3, 9.5
(e) 0.04, 0.16
3 27.72, 29.13 (2 d.p.)

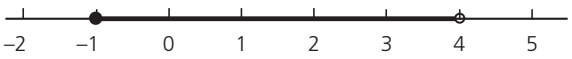
Exercise 2.7

1 18.7975, 19.6875 km²
2 **(a)** 0.17%, 1.7%
(b) A percentage error of 0.5 out of 30 is more significant than a percentage error of 0.5 out of 303
3 11.5 km, 12.070 125 km

3 Calculations and order

Exercises 3.1–3.2

1



2 $12.1 \leqslant t \leqslant 15.8$

3 0.055, 0.5, 0.505, 0.550, 5.005, 5.500

Exercises 3.3–3.5

1 **(a)** 234
(b) 9
(c) –3

2 **(a)** no brackets needed
(b) $15 \div (3 + 2 \div 2) = 3.75$
(c) $15 \div (3 + 2) \div 2 = 1.5$

3 1

4 Integers, fractions, decimals and percentages

Exercises 4.1–4.4

1 **(a)** 12
(b) 64
(c) 45.5

2 **(a)** $\frac{33}{5}$ **(b)** $\frac{53}{17}$

3 **(a)** $4\frac{2}{9}$ **(b)** $15\frac{2}{5}$

4 **(a)** 3.45 **(b)** 7.76 **(c)** 0.3125

5 **(a)** $\frac{3}{4}$ 75%
(b) 0.45 45%
(c) $\frac{13}{200}$ 0.065
(d) $3\frac{2}{25}$ 308%
(e) $0.\dot{6}$ $66.\dot{6}\%$
(f) $\frac{19}{18}$ $105.\dot{5}\%$

Exercise 4.5

1 **(a)** 380.75 **(b)** 961.54

Exercises 4.6–4.10

1 **(a)** $1\frac{17}{30}$ **(b)** $\frac{23}{72}$

2 **(a)** $\frac{22}{45}$ **(b)** $-2\frac{1}{30}$

3 **(a)** $3.\dot{4}$ **(b)** 5.375

Exercise 4.11

1 **(a)** $\frac{17}{30}$ **(b)** $1\frac{139}{450}$

2 $\frac{38}{99} - \frac{23}{90} = \frac{127}{990}$

5 Further percentages

Exercises 5.1–5.3

1 **(a)** 25% **(b)** 60%
(c) 37.5% **(d)** 87.5%

2 **(a)** 50 **(b)** 150
(c) 50 **(d)** \$390
(e) \$120 **(f)** 35

3 **(a)** 95% **(b)** 5%

4 **(a)** **(i)** $\frac{4}{5}$ **(ii)** 80%
(b) **(i)** $\frac{3}{5}$ **(ii)** 60%
(c) **(i)** $\frac{2}{3}$ **(ii)** $66.\dot{6}\%$

5 Ahmet = 30%, Jo = 45%, Anna = 25%

6 77.7% (1 d.p.)

7 **(a)** \$4.32 **(b)** 56.8%

Exercise 5.4

1 **(a)** 225 **(b)** 150 **(c)** 875

2 **(a)** 135 **(b)** 105 **(c)** 5

3 **(a)** \$38 **(b)** 262

4 £428 640

5 670 625

Exercise 5.5

1 **(a)** \$450 **(b)** \$620
(c) 340% **(d)** 160%

2 260

3 225

4 4 cm

6 Ratio and proportion

Exercise 6.1

1 50
2 240

Exercises 6.2–6.4

1 **(a)** $\frac{5}{9}$ **(b)** 1 kg
2 **(a)** 3 : 2 **(b)** $\frac{2}{5}$ **(c)** 18
3 2.5 kg
4 384 g
5 30°
6 64 cm and 36 cm
7 **(a)** $21\frac{1}{4}$ litres of petrol, $3\frac{3}{4}$ litres of oil
(b) $1416\frac{2}{3}$ ml
8 \$750, \$850, \$900
9 48°, 192°
10 \$480
11

Speed (km/h)	60	30	22.5	120	90	240
Time (h)	1.5	3	4	0.75	1	0.375

12 25
13 **(a)** **(i)** $22\frac{1}{2}$ hrs **(ii)** 18 hrs
(b) **(i)** 6 people **(ii)** 2 people
14 4 hrs
15 54 hours quicker

Exercise 6.5

1 **(a)** 400 **(b)** 625
2 **(a)** 187.5 **(b)** 187.5
3 **(a)** 80 **(b)** 30

Exercise 6.6

1 27×18 cm
2 5 : 2
3 **(a)** **(i)** 288 cm² **(ii)** 648 cm²
(b) 9 : 4
4 **(a)** **(i)** 156.25 cm³ **(ii)** 10 000 cm³
(b) 64 : 1

7 Indices and standard form

Exercises 7.1–7.4

1 **(a)** $2^3 \times 3^2 \times 4^3$ **(b)** $2^4 \times 4^5 \times 5^2$
(c) $3^2 \times 4^3 \times 5^3$ **(d)** $2 \times 7^4 \times 11^2$
2 **(a)** 196 **(b)** 3 359 232
(c) 25 088 **(d)** 8 870 472
3 **(a)** $11^7 \times 6^{12}$ **(b)** $5^{11} \times 6^{11}$
(c) 12^4 **(d)** 13^3
4 **(a)** 9^4 **(b)** 17^{10}
(c) 2^8 **(d)** 8^6
5 **(a)** 9^2 **(b)** 7
(c) 16^{-1} **(d)** 3^{-2}
6 **(a)** $\frac{1}{4}$ **(b)** 0.7
(c) 0.03 **(d)** 1
7 **(a)** 4 **(b)** 2
(c) 4 **(d)** 0.1
8 **(a)** 3 **(b)** 4
(c) 6 **(d)** 0
9 **(a)** 6 **(b)** 2
(c) 1.5 **(d)** 7

Exercises 7.5–7.6

1 **(a)** 3.7×10^7 **(b)** 4.63×10^8
2 8.64×10^3
3 **(a)** 6.75×10^3 km **(b)** 4.2×10^4 km
4 **(a)** 4.5×10^{-5} **(b)** 3.67×10^{-10}
5 **(a)** –5 **(b)** 5

Exercise 7.7

1 7
2 15
3 5
4 100
5 7
6 5
7 3
8 12

Exercise 7.8

1 $\frac{1}{4}$
2 1
3 $\frac{1}{2}$
4 $\frac{1}{8}$
5 $\frac{1}{2}$
6 1
7 11
8 1
9 $\frac{1}{32}$
10 $\frac{1}{3^7} = \frac{1}{2187}$

8 Money and finance

Exercise 8.1

1 **(a)** €57.69 **(b)** €6.17 **(c)** NZ $93.75

Exercises 8.2–8.4

1 **(a)** €103.50 **(b)** €84.87
2 **(a)** Option 1: $1275 extra
Option 2: $4180 extra
(b) e.g. The customer may not be able to afford the initial deposit
3 142%
4 5%

Exercise 8.5

1 1%
2 7 years

Exercise 8.6

1 $162 067.50
2 $66 550
3 $518.40
4 14.9%
5 20.6%
6 **(a)** $1.2^5 \neq 2$ **(b)** 4 years

9 Time

Exercise 9.1

1 1452
2 0551
3 **(a)** 126 hrs 40 mins **(b)** Monday **(c)** 2310

10 Set notation and Venn diagrams

Exercise 10.1

1 **(a)** Capital cities
(b) Student's two capital cities
2 **(a)** Currencies
(b) Student's two currencies
3 Student's coordinates which satisfy $y = x^2 + x$ e.g (1, 2)
4 **(a)** Numbers from –1 up to but not including 7
(b) Student's numbers

Exercise 10.2

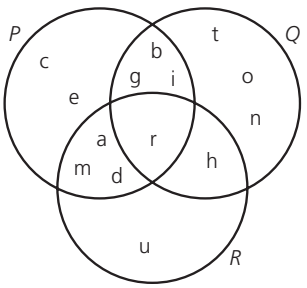
1 **(a)** $B = \{2,3,5,7\}$
(b) $C = \{1,4,9\}$
2 **(a)** $\{a, b, c\}, \{a, b\}, \{a, c\}, \{b, c\}, \{a\}, \{b\}, \{c\}, \{\varnothing\}$
(b) $\{a, b\}, \{a, c\}, \{b, c\}, \{a\}, \{b\}, \{c\}$

Exercise 10.3

1 Girl's names not beginning with the letter A
2 **(a)** **(i)** even numbers up to 30
(ii) multiples of 3 up to 30
(iii) multiples of 5 up to 30
(b) **(i)** 6, 12, 18, 24, 30
(ii) 3, 5, 6, 9, 10, 12, 15, 18, 20, 21, 24, 25, 27, 30
(iii) 30
(iv) 5, 15, 25
3 **(a)** **(i)** 2, 3, 4, 5, 6, 7, 8, 9, 10, 12
(ii) 3, 4, 9, 12
(b) Z

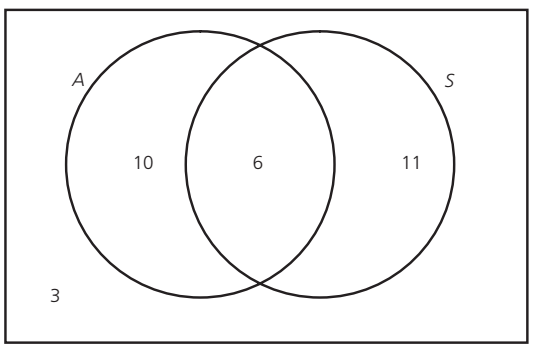
Exercise 10.4

1 **(a)**



(b) **(i)** {b,r,i,g,h,t,o,n,d,u,a,m}
(ii) {r}
(iii) {h,t,o,n}

2 **(a)**



(b) **(i)** 6 **(ii)** 3

Exercise 10.5

1 **(a)** **(i)** $z = 1$ **(ii)** $x = 6$ **(iii)** $y = 0$
(b) 14

Topic 1 Exam focus

1 Rational as $\sqrt{81} = 9$

2 **(a)** 225.5 cm² **(b)** 15.02 cm **(c)** 59.93 cm

3 **(a)** $\frac{16}{25}$ **(b)** 224

(c) 250 **(d)** 35

4 27 : 8

5 **(a)** $\frac{1}{25}$ **(b)** 1

6 **(a)** **(i)** 0.707 (3 d.p.)

(ii) 1.837 (3 d.p.)

(iii) 9.882 (3 d.p.)

(b) 4.6

7 2.6652×10^{-26} kg

8 **(a)** \$14 000 **(b)** \$10 500

(c) \$9500 **(d)** \$21 632

9 **(a)** **(i)** 2, 3, 7, 8

(ii) 2, 3, 7

(iii) 6, 9

(b) No, as 3 is an element in R but not P

11 Algebraic representation and manipulation

Exercises 11.1–11.3

1 $-5x - 20$

2 $-3y + 6$

3 $8ab + 16a$

4 $12c - 48$

5 $-6a^3 + 9a^2b$

6 48

7 $15a + 5$

8 $10x + 14$

9 $7x + 6y$

10 $6x - 23y$

11 $p - 21$

12 $6q + 6r + 29qr$

13 $-4xy + 6xz - 4yz + 4y^2$

14 $3a + 8ab$

15 $p - pq$

16 $a^2 + 12a + 32$

17 $b^2 - 9$

18 $c^2 - 18c + 81$

19 $1 - 2m + m^2$

20 $jk - jm + k^2 - km$

Exercise 11.4

1 $3(a + 2b)$

2 $-14(c + 2d)$

3 $21x(2x - y^2)$

4 $m(m^2 - mn - n^2)$

5 Cannot be factorised

Exercise 11.5

1 0

2 20

3 −12

4 24

5 −124

Exercise 11.6

1 $c = d - ab$

2 $b = \frac{d + c}{a}$

3 $m = 8(2r - 3)$

4 $q = r(p - s)$

5 $q = \frac{p}{r + s}$

Exercise 11.7

1 $4d^2 - 9$

2 $9e^2 - 42e + 49$

3 $4f^2 - 9g^2$

4 $16 - 25h^2$

5 $6x^2 + x - 1$

Exercise 11.8

1 $(a + b)(c + 1)$

2 $(3d + 4e)(c + 1)$

3 $(f - 6)(g - 4)$

4 $(p - 2r)(p - 2q)$

5 $(4m + 11)(4m + 11n)$

Exercise 11.9

1 $(4m - 11n)(4m + 11n)$

2 $(x^3 - y^3)(x^3 + y^3)$

3 $(3a^2 - 12b^2)(3a^2 + 12b^2)$

4 $(9m - 4n)(9m + 4n)$

Exercise 11.10

1 $(17 - 16)(17 + 16) = 33$

2 $(3^2 - 1)(3^2 + 1) = 8 \times 10 = 80$

3 $(98 - 2)(98 + 2) = 96 \times 100 = 9600$

Exercise 11.11

1 $(a + 3)(a + 2)$
2 $(b - 5)(b + 2)$
3 $(c - 8)(c - 2)$
4 $(d - 9)(d - 9)$ or $(d - 9)^2$
5 $(2e + 1)(e + 1)$
6 $(3f - 2)(f + 1)$
7 $(2g + 1)(g - 1)$
8 $(3h + 2)(3h - 2)$
9 $(j + 2k)(j + 2k)$ or $(j + 2k)^2$

Exercises 11.12–11.13

1 $a = \frac{pr}{2xq}$

2 $a = \sqrt{\frac{6}{m}}$

3 $a = \left(\frac{bt}{2r}\right)^2$

4 $a = \frac{2p\sqrt{b}}{t}$

5 $a = \left(\frac{3b^2}{2c}\right)^2$

Exercise 11.14

1 **(a)** $r = \frac{C}{2\pi}$
(b) $r = 3.0$ cm (1 d.p.)
2 **(a)** $r = \sqrt{\frac{A}{\pi}}$
(b) $r = 5.0$ cm (1 d.p.)
3 **(a)** $p = \frac{A}{l}$
(b) $p = 6$ cm
4 **(a)** $h = \frac{A}{2\pi r} - r$
(b) 7.0 cm (1 d.p.)
5 **(a)** $h = \frac{V}{\pi r^2}$
(b) 10.0 cm (1 d.p.)

Exercise 11.15

1 $4a$
2 $15de$
3 6
4 15
5 $4xy$

Exercises 11.16–11.17

1 $\frac{3a + 4b}{12}$

2 $\frac{c}{12}$

3 $\frac{5a}{6}$

4 $\frac{-5e}{21}$

5 $\frac{10f}{9}$

Exercise 11.18

1 $\frac{3p + 5}{(p + 3)(p - 1)}$

2 $\frac{a}{b}$

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

4 $\frac{a}{a + 3}$

5 a

12 Algebraic indices

Exercises 12.1–12.2

1 **(a)** $a^8 \times b^9 \times c^2$ **(b)** $p^7 \times q^7 \times r$
(c) m **(d)** $a^5 \times b^5 \times e$
2 **(a)** a^2c^8 **(b)** m^2
(c) b **(d)** $24b^9$

Exercise 12.3

1 **(a)** $a^{\frac{5}{4}}$ **(b)** $a^{\frac{7}{2}}$
2 **(a)** $\left(\sqrt[5]{b}\right)^{-3}$ **(b)** $\left(\sqrt[9]{b}\right)^{7}$
3 **(a)** $a^{-\frac{1}{12}}$ **(b)** $a^{-\frac{10}{3}}$
(c) $a^{-\frac{17}{6}}$

13 Equations and inequalities

Exercise 13.1

1 $a = 12$
2 $b = -3$
3 $c = -11$
4 $d = 14$
5 $e = 18$
6 $f = 10$
7 $g = 5$
8 $h = 4$
9 $j = 1$
10 $k = 5$

Exercise 13.2

1 50°, 50°, 80°
2 40°, 80°, 60°
3 $x = 25$ cm
4 130°, 50°
5 12 cm, 36 cm
6 105°, 150°, 45°, 60°
7 48°, 112°
8 85°, 85°
9 $j = 60°$
10 92°, 92°, 122°
11 15°, 75°
12 220°, 90°, 100°, 20°, 110°
13 35°

Exercises 13.3–13.5

1 $a = 7$ $b = 5$
2 $c = 3$ $d = 10$
3 $e = 4$ $f = 7$
4 $g = -5$ $h = -7$
5 $p = 3$ $q = 3$
6 $r = -3$ $s = -2$
7 $w = 5$ $x = -5$
8 $x = 1.5$ $y = 0.5$
9 $a = 3$ $b = 2$
10 $c = 5$ $d = 1$
11 $e = -1$ $f = -1$
12 $g = 1$ $y = 0.5$
13 $h = 2.5$ $j = 4$
14 $k = 0.2$ $l = 4$
15 $m = 4$ $n = -7$
16 $p = 2$ $q = 1$
17 $r = 10$ $s = 2$
18 $t = 1$ $w = 0.25$
19 24, 13
20 5, –7
21 10 and 8
22 $a = 7$ $b = 4$
23 **(a)** $x = 8$ $y = -3$
(a) 256 units^2
(b) 64 units
24 16 yrs and 64 yrs

Exercise 13.6

1 –7
2 –6
3 –68
4 ±15
5 **(a)** $x - 2$, $x + 3$
(b) Zach = 7 yrs, Leda = 5 yrs, Spot = 10 yrs
6 18°, 54°
7 160°, 140°, 60°
8 ±10

Exercise 13.7

1 3, –4
2 3, 6
3 –3, –7
4 –2, –1
5 –5, 7
6 7, 6
7 ±13
8 ±7

Exercise 13.8

1 –1, –3
2 $-1, -\frac{1}{3}$
3 $1, -\frac{1}{5}$
4 ±6
5 ±3
6 No solution
7 No solution
8 $\pm\frac{1}{2}$
9 $\pm\frac{1}{4}$
10 $\pm\frac{2}{3}$
11 $\pm\frac{8}{5}$
12 No solution

Exercise 13.9

1 $7
2 base = 12 cm, height = 10 cm
3 5 and 12
4 23 and 24
5 6 balls

Exercise 13.10

1 $-\frac{2}{3}, -3$
2 –0.27, –3.73
3 0.19, –2.69
4 0.85, –1.18
5 $\frac{3}{2}, -5$
6 $-\frac{1}{4}, -1$
7 –0.58, 2.58
8 $-4, \frac{3}{2}$
9 $-\frac{7}{2}, \frac{1}{5}$
10 –2

Exercises 13.11–13.12

1 $16 + 2x < 10$
Number line showing $x < -3$
2 $19 \geqslant 9x + 1$
Number line showing $x \leqslant 2$
3 $1 - 3x \geqslant 13$
Number line showing $x \leqslant -4$
4 $\frac{1}{2}x < 2$
Number line showing $x < 4$
5 $\frac{1}{3}x \geqslant 1$
Number line showing $x \geqslant 3$
6 $8 < 4x < 16$
Number line showing $2 < x < 4$
7 $9 < 9x < 45$
Number line showing $1 < x < 5$

8 $4 < 2x - 16 < 10$
Number line showing $5 < x < 8$

9 $3 \leqslant 2x + 1 < 9$
Number line showing $1 \leqslant x < 4$

10 $10 \leqslant 2x - 5 \leqslant 20$
Number line showing $7.5 \leqslant x \leqslant 12.5$

14 Linear programming

Exercise 14.1

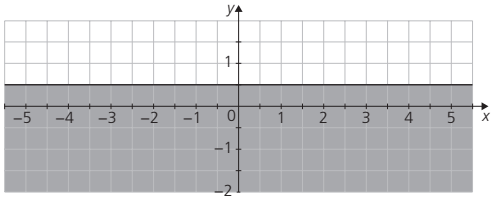
1 $x \geqslant 1\frac{1}{2}$

2 $x \leqslant 2$

3 $-9 \leqslant y < -7$

Exercise 14.2

1



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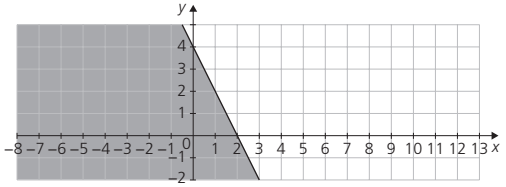

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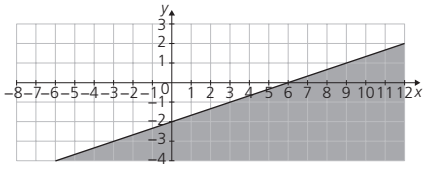
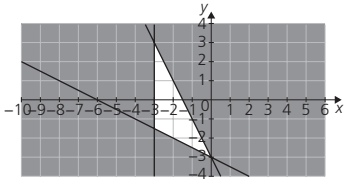


Exercise 14.3

1



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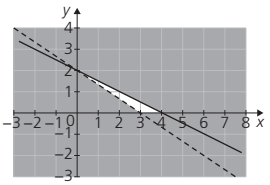
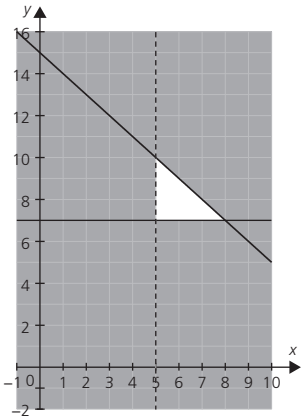


Exercise 14.4

1 **(a)** $x > 5$
$y > 7$
$x + y \leqslant 15$

(b)



(c) 6 male + 8 female
7 male + 8 female
6 male + 9 female

15 Sequences

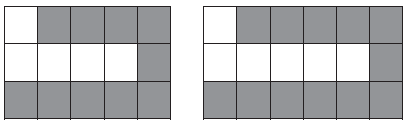
Exercises 15.1–15.2

1 29, 32

2 26, 37

3 37, 45

4 **(a)**



(b)

Number of white squares	2	3	4	5	6
Number of shaded squares	4	6	8	10	12

(c) $2n$

(d) 100

5 **(a)** **(i)** 49, 64
(ii) square numbers

(b) **(i)** 60, 72
(ii) term to term +12

(c) **(i)** 21, 34
(ii) add the two previous terms together (Fibonacci sequence)

6 **(a)** $4n + 3$

(b) $2n + 5$

(c) $n^2 + 2$

Exercise 15.3

1 **(a)** 215, 342
(b) $n^3 - 1$
2 **(a)** 218, 345
(b) $n^3 + 2$

Exercise 15.4

1 4, 2
2 0.5, 0.05
3 1, $\frac{1}{10}$
4 **(a)** $u_1 = 2$, $u_2 = 6$, $u_3 = 18$
(b) $n = 7$
5 **(a)** $\frac{1}{4}$
(b) 64
(c) $u_n = 64 \times \left(\frac{1}{4}\right)^{n-1}$
(d) $\frac{1}{4096}$

16 Variation

Exercise 16.1

1 **(a)** $d = kp$
(b) $k = 2$
(c) 40
(d) 1
2 **(a)** $a = \frac{k}{b}$
(b) $a = \frac{1}{2}$
3 **(a)** $p = \frac{0.5}{q^2}$ or $p = \frac{1}{2q^2}$
(b) 0.02
(c) ± 10
4 $p = \frac{k}{r^{\frac{3}{2}}}$

Exercise 16.2

1 500

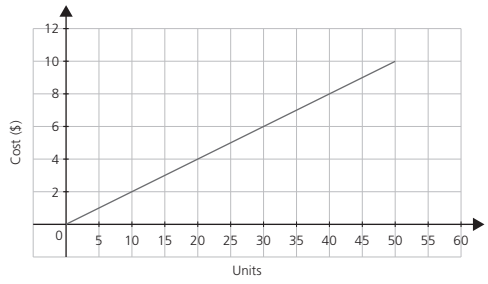
Exercise 16.3

1 **(a)** 1800 b.h.p.
(b) 50 kg
2 330 m/s
3 2 N

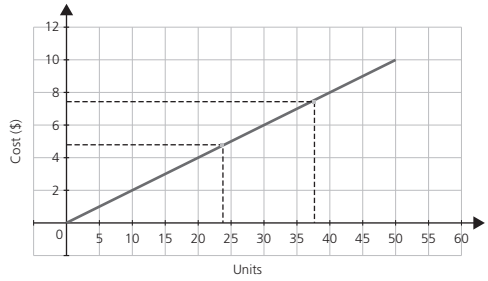
17 Graphs in practical situations

Exercise 17.1

1 **(a)**

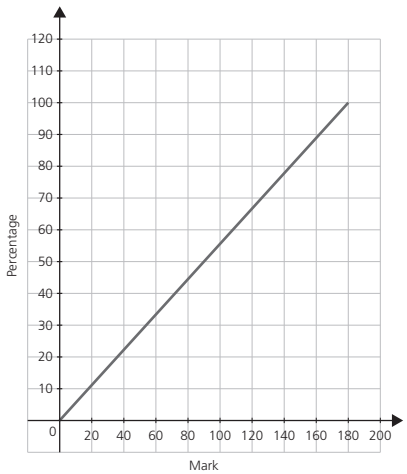


(b), (c) The following method should be clearly seen in student's work.

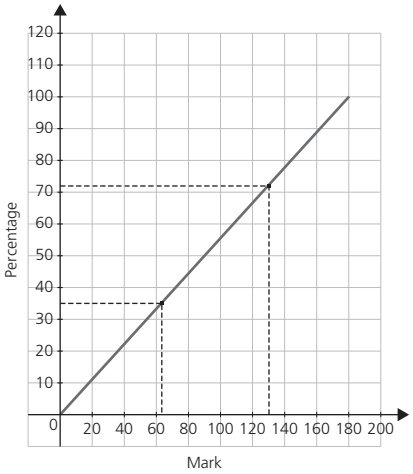


(b) ≈ $4.60
(c) ≈ 37.5 units

2 **(a)**



(b), (c) The following method should be clearly seen in student's work.



(b) ≈ 72%
(c) ≈ 63 marks

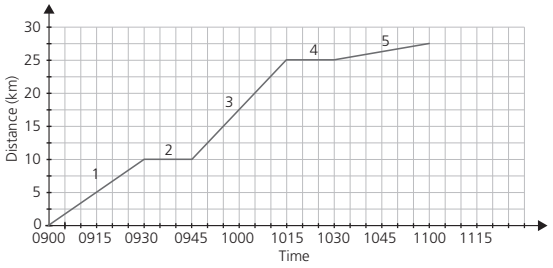
Exercise 17.2

1 (a) 5 m/s
(b) 105 km/h
2 (a) 800 m
(b) 124 200 m or 124.2 km
3 (a) 0.125 h or 7.5 min
(b) 100 s

Exercises 17.3–17.4

1 (a) 2 m/s
(b) 12.5 m/s
(c) ≈ 175 m
(d) stationary
(e) $8\frac{1}{3}$ m/s

2 (a) 1100
(b) 10 km
(c)



(d) 13.75 km/h

Exercises 17.5–17.6

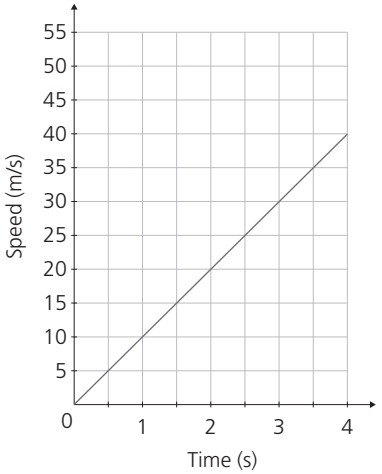
1 (a) acceleration of $\frac{5}{8}$ m/s^2
(b) deceleration of $\frac{1}{4}$ m/s^2
2 (a) Running at a constant speed of 8 m/s
(b) acceleration of 4 m/s^2
(c) deceleration of $\frac{4}{3}$ m/s^2

Exercise 17.7

1 (a)

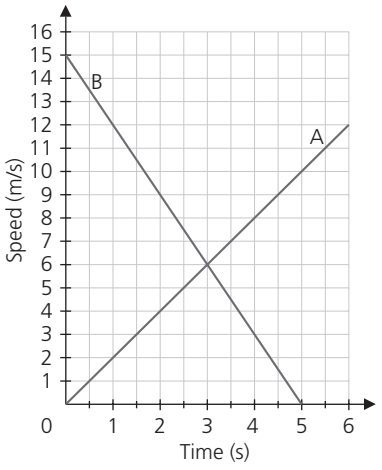
Time (s)	0	1	2	3	4
Speed (m/s)	0	10	20	30	40

(b)



(c) 20 m
(d) 80 m

2 (a)

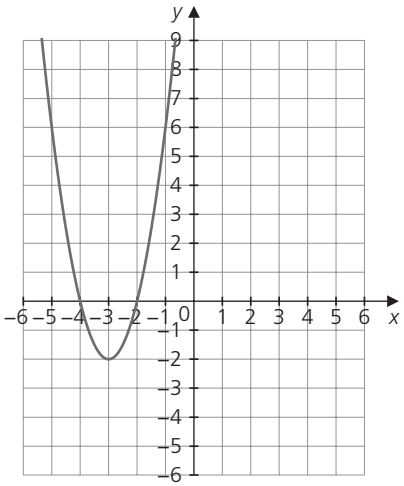


(b) 3 seconds
(c) 20 m

18 Graphs of functions

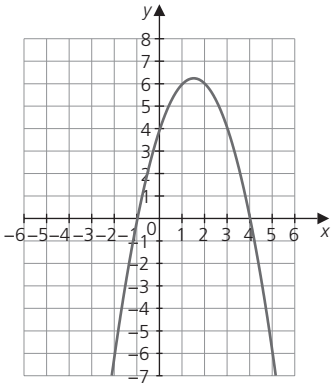
Exercise 18.1

1



x	−5	−4	−3	−2	−1
y	6	0	−2	0	6

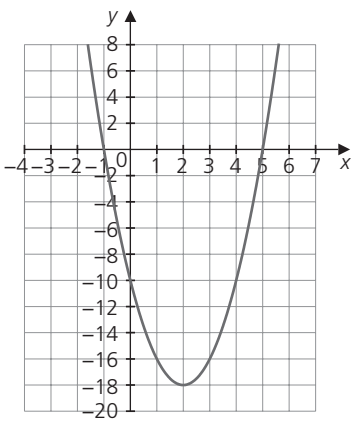
2



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

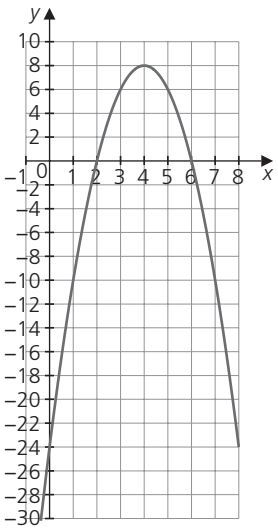
Exercise 18.2

1



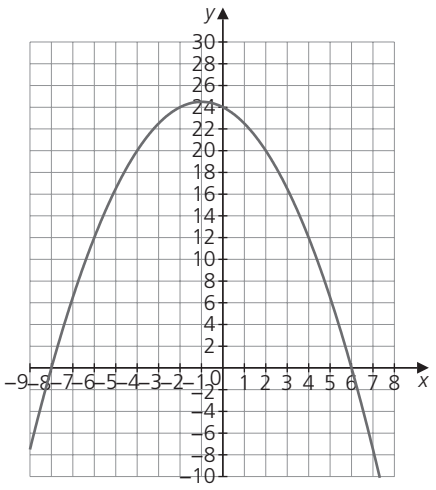
$x = -1$ and 5

2



$x = 2$ and 6

3



$x = -8$ and 6

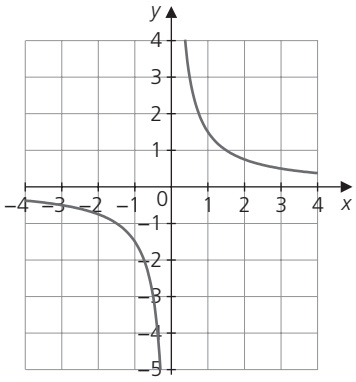
Exercise 18.3

1 $x = 1$ and 3
2 $x = 3$ and 5
3 $x = -6$ and 4

Exercise 18.4

1

x	−4	−3	−2	−1	0	1	2	3	4
y	−0.375	−0.5	−0.75	−1.5	∞	1.5	0.75	0.5	0.375

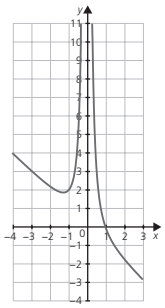


Exercises 18.5–18.6

1 (a)

x	−4	−3	−2	−1	0	1	2	3
f(x)	4.1	3.1	2.3	2	–	0	−1.8	−2.9

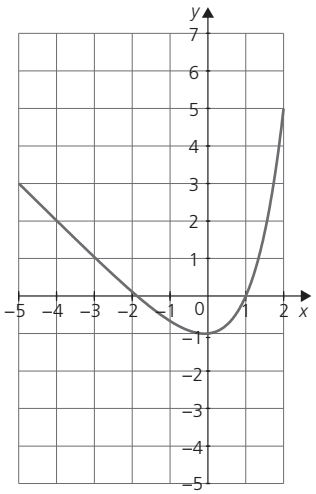
(b)



2 **(a)**

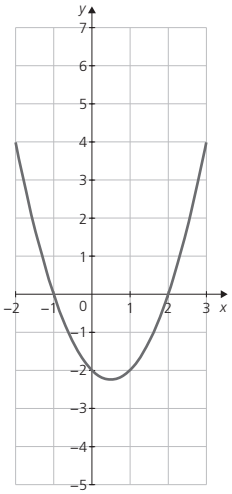
x	−5	−4	−3	−2	−1	0	1	2
f(x)	3.0	2.0	1.0	0.1	−0.7	−1	0	5

(b)



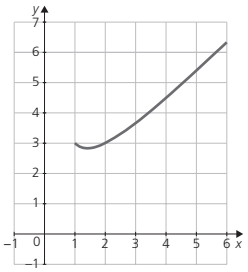
Exercise 18.7

1 **(a)**



(b) Gradient = 3

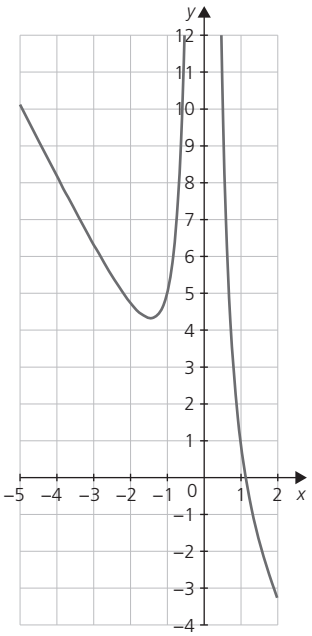
2 **(a)**



(b) Gradient = $\frac{1}{2}$

Exercise 18.8

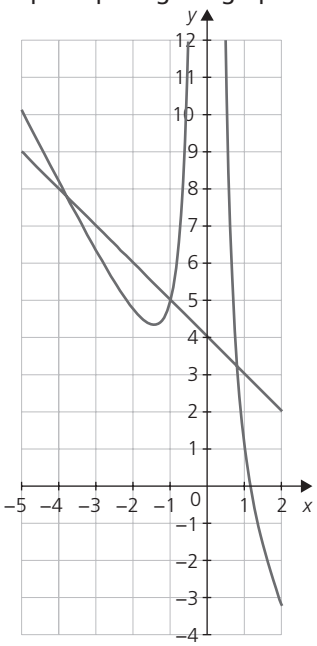
1 **(a)**



(b)

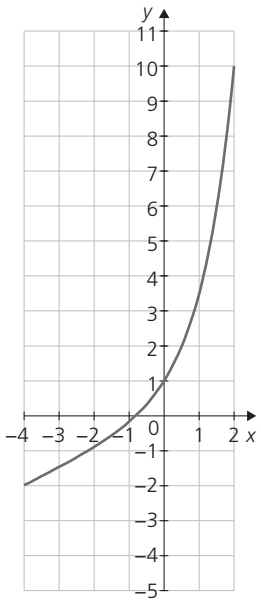
Rearrange the equation to give $\frac{3}{x^2} - 2x = -x + 4$

Superimposing the graph of $y = -x + 4$ gives



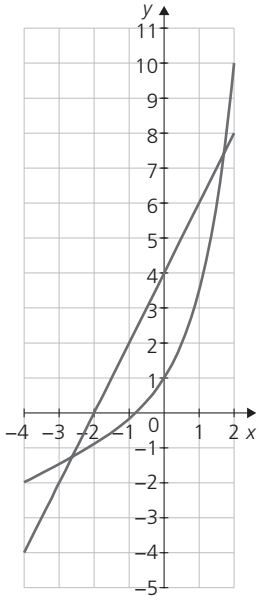
Therefore $x \approx -3.8$, -1 and 0.8

2 (a)



(b) Rearrange the equation to give $3^x + \frac{1}{2}x = 2x + 4$

Superimposing the graph of $y = 2x + 4$ gives



Therefore $x \approx -2.6$ and 1.7

19 Functions

Exercise 19.1

1 (a) 9 **(b)** 15
(c) $4\frac{1}{2}$ **(d)** -3
(e) -15 **(f)** $1\frac{1}{2}$

2 (a) 3 **(b)** 9
(c) 2 **(d)** -13.5

3 (a) 6 **(b)** 1.5
(c) 12.5 **(d)** 8.3

Exercise 19.2

1 (a) 6 **(b)** 10
(c) 3.4 **(d)** 3.2

2 (a) 4 **(b)** -3
(c) -17 **(d)** -3.7

3 (a) -2.5 **(b)** -25
(c) 20 **(d)** 5.6

Exercise 19.3

1 **(a)** 128 **(b)** 8.21
(c) 176 **(d)** $7\frac{1}{4}$
(e) 9

2 **(a)** 49 **(b)** 287
(c) 5 **(d)** $-\frac{7}{9}$

3 **(a)** $-\frac{1}{4}$ **(b)** −79
(c) −24 **(d)** $-10\frac{1}{4}$

Exercise 19.4

1 **(a)** $3x + 7$ **(b)** $6x - 2$
(c) $6x^2 + 1$ **(d)** $\frac{3x}{2} + 7$

2 **(a)** $18x^2 - 1$ **(b)** $\frac{x^2}{8} - 1$
(c) $4x - 1$ **(d)** $2x^2 - 20x + 49$

Exercise 19.5

1 **(a)** $f^{-1}(x) = x - 4$ **(b)** $f^{-1}(x) = \frac{x}{5}$

2 **(a)** $g^{-1}(x) = \frac{x+5}{3}$ **(b)** $g^{-1}(x) = \frac{2(x+1)}{5}$
(c) $g^{-1}(x) = \frac{5x+6}{4}$

Exercise 19.6

1 **(a)** 3 **(b)** 1
2 **(a)** 1 **(b)** −2
3 6
4 −1

Exercise 19.7

1 **(a)** $fg(x) = 2(x + 4)$ **(b)** $fg(x) = x$
2 **(a)** $pq(x) = 2(x + 1)$ **(b)** $pq(x) = 2x + 1$
3 **(a)** $jk(x) = \frac{x-1}{2}$ **(b)** $jk(x) = 3x - 7$
4 **(a)** 6 **(b)** no solution

Topic 2 Exam focus

1 **(a)** $9(a + 2b)(a - 2b)$ **(b)** $(d + 4)(d - 3)$
(c) $a = 3c - \frac{mb}{n}$ **(d)** $\frac{a}{a-3}$

2 $r = 6.0$ cm (1 d.p.)

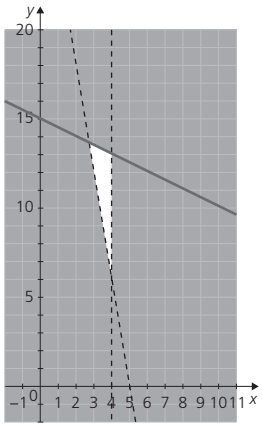
3 **(a)** $12a^5$ **(b)** $8a^5b^3$
(c) a^2 **(d)** a^5

4 **(a)** $x^2 + 6x = 40$ **(b)** $x = 4$

5 **(a)** $4(x - 3)^2 - 7 = 0$ **(b)** $x = 4.3$ and 1.7

6 **(a)** $x + 2y \leqslant 30$
$3x + \frac{1}{2}y > 15$
$x < 4$

(b)



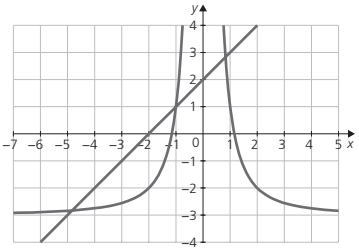
(c) 3 chickens and 13 ducks

7 **(a)** **(i)** 55, 66 **(ii)** $u_n = 11n$
(b) **(i)** 35, 28 **(ii)** $u_n = -7n + 70$
(c) **(i)** $2\frac{1}{2}, -1\frac{1}{4}$ **(ii)** $u_n = 40 \times \left(-\frac{1}{2}\right)^{n-1}$
(d) **(i)** $\frac{1}{81}, \frac{1}{243}$ **(ii)** $u_n = \left(\frac{1}{3}\right)^{n-1}$

8 $y = 8$

9 **(a)** Stage *A*
(b) 120 km/h²
(c) Stage *D*. As deceleration in stage *B* is 40 km/h², whilst deceleration in stage *D* is 51.4 km/h² (1 d.p.). The graph of stage *D* is steeper than that of *B*.
(d) 120 km
(e) 360 + 135 + 120 + 315 = 930 km

10 $x^3 + 5x^2 - 4 = 0$ can be rearranged to form
$\frac{4}{x^2} - 3 = x + 2$
Superimposing the two graphs gives



$x \approx -4.8, -1$ and 0.8

11 $7\frac{1}{2}$

12 **(a)** $gh(x) = 12x - 10$
(b) −58

20 Geometrical vocabulary

Exercise 20.1

1 **(a)** Definitely congruent as all three angles the same and 1 corresponding side
(b) Not necessarily congruent e.g. the side opposite the 40° angle could be drawn in a different position and still be 7 cm long

Exercise 20.2

1

	Rhombus	Parallelogram	Kite
Opposite sides equal in length	Yes	Yes	No
All sides equal in length	Yes	No	No
All angles right angles	No	No	No
Both pairs of opposite sides parallel	Yes	Yes	No
Diagonals equal in length	No	No	No
Diagonals intersect at right angles	Yes	No	Yes
All angles equal	No	No	No

Exercise 20.3

1 A and B can be folded to form a cube. Diagram C has 7 squares so is not a net of a cube.

21 Geometrical constructions and scale drawings

Exercises 21.1–21.3

1 Student's construction
2 Student's construction
3 **(a)** Student's construction
(b) Circle passing through A, B and C, with its centre at the point of intersection of the three perpendicular bisectors constructed in (a)

Exercise 21.4

1 **(a)** 2.4 km **(b)** 40 cm
2 **(a)** 1 : 25 **(b)** 19.6 cm

22 Similarity

Exercise 22.1

1 **(a)** Angles in both triangles are the same: 28°, 90° and 62°
(b) 2.5
(c) $x = 37.5$ cm
(d) $y = 20$ cm
2 **(a)** $a = 9.5$ cm (1 d.p.)
(b) $b = 15.2$ cm (1 d.p.)

Exercise 22.2

1 **(a)** **(i)** 144 cm^2 **(ii)** 33.5 cm^2
(b) Rectangle H
2 24.5 cm^2

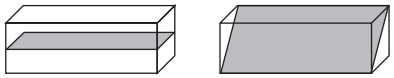
Exercises 22.3–22.4

1 **(a)** 121.5 cm^2 **(b)** 3
(c) 2460.4 cm^3 (1 d.p.)
2 **(a)** 5.4 **(b)** 1.75
(c) 14.2 cm
3 **(a)** 3 **(b)** 50 cm^3
4 155 m^2

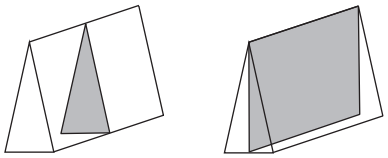
23 Symmetry

Exercise 23.1

1 **(a)** Several answers possible. Two are given below:



(b)



2 Rotational symmetry of order 4

Exercise 23.2

1 **(a)** AB = CD (given). OA = OB = OC = OD (all radii of the circle)
All three corresponding sides the same length, therefore congruent.
(b) Isosceles
(c) 110°

Exercise 23.3

1 $p = 52°$
Angle OXZ = 90° as it's the angle between a tangent and a radius at a point.
Angle XOZ = 180 – 90 – 38 = 52°
Triangles OXZ and OYZ are congruent, therefore angle YOZ = XOZ.
Therefore $p = 52°$

24 Angle properties

Exercises 24.1–24.3

1 $a = 78°$
$b = 102°$
$c = 143°$
$d = 37°$
$e = 65°$
2 $p = 72°$
$q = 118°$

Exercise 24.4

1 **(a)** 15°
(b) 24
2 **(a)** 168°
(b) 162°
3 10

Exercise 24.5

1 $x = 58°$
2 $x = 20°$

Exercise 24.6

1 $x = 51°$
2 $x = 42°$

Exercise 24.7

1 **(a)** 540°
(b) 30°
(c) 30°, 240°, 120°, 60°, 90°
2 **(a)** $y = 360 - x$
(b) $1080 = x + \frac{7}{2}x + \frac{5}{2}x + \frac{5}{2}x + \frac{7}{2}x + 3x + 3x + 360 - x$
or $360 + 18x = 1080$
(c) 40°
(d) 320°

Exercise 24.8

1 $x = 110°$
2 $x = 96°$ $y = 48°$

Exercise 24.9

1 $x = 46°$ $y = 56°$
2 $x = 32°$ $y = 22°$ $z = 22°$

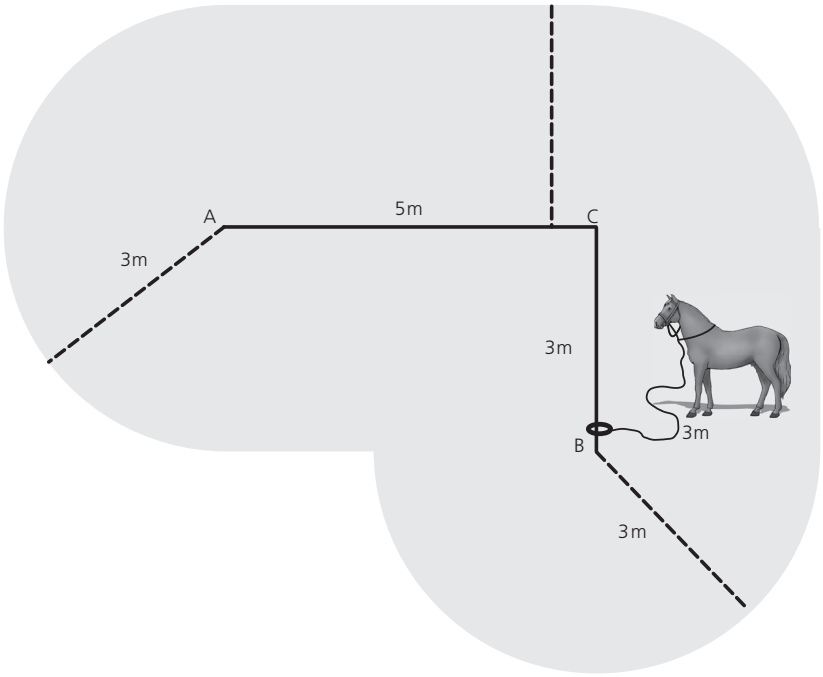
Exercise 24.10

1 $p = 116°$ $q = 95°$
2 $x = 55°$ $y = z = 90°$

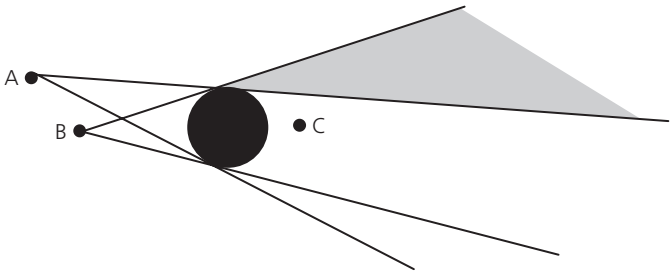
25 Loci

Exercises 25.1–25.3

1

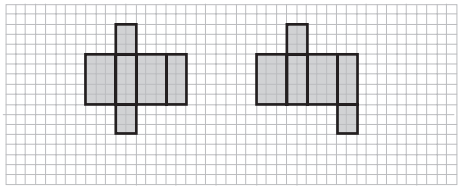


2



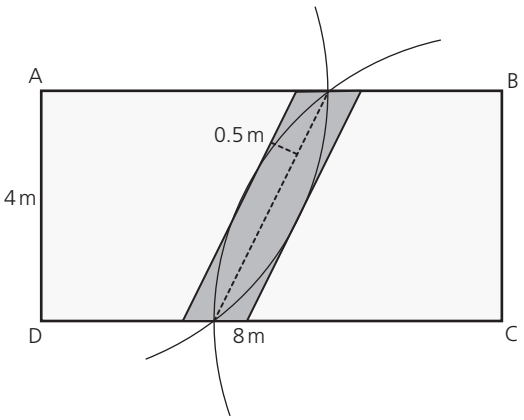
Topic 3 Exam focus

1 There are several possible solutions. Two are shown below:



2 **(a)** 4100 m **(b)** 40 cm
3 **(a)** 1.331 **(b)** 2000 cm³
4 **(a)** 2.2 **(b)** 4.84
(c) 10.65 (2 d.p.) **(d)** 469.6 cm³ (1 d.p.)
5 $x = 226°$
6 90 sides
7 **(a)** 24° **(b)** 8.8 cm (1 d.p.)
8 **(a)** $x = 48°$ **(b)** $y = 24°$
9 **(a)** $n = 127°$ **(b)** $m = 53°$

10



Note: the centre of the path is the perpendicular bisector of *AC*. As the path is 1 m wide, the edges of the path are 0.5 m from its central line measured at right–angles.

26 Measures

Exercises 26.1–26.5

1 **(a)** 72 mm **(b)** 20.4 km
2 **(a)** 0.42 kg **(b)** 1040 kg
3 **(a)** 0.012 litres **(b)** 240 ml
4 0.105 km^2
5 **(a)** 3 600 000 cm^3
(b) **(i)** 3 250 000 mm^3
(ii) 0.003 25 m^3

27 Perimeter, area and volume

Exercises 27.1–27.5

1 circumference = 25.4 cm
area = 51.5 cm^2
2 **(a)** 7 cm
(b) 22.0 cm
3 35.0 cm^2
4 1.9 cm
5 **(a)** 13 cm **(b)** 10.6 cm^2
(c) 14.5 cm^2
6 5.3 cm

Exercises 27.6–27.9

1 4.2 cm
2 0.8 cm
3 **(a)** $10h + 12$ **(b)** $8\pi + 4\pi h$
(c) 0.15 cm (2 d.p.)
4 1426 cm^3
5 **(a)** 763.4 cm^3
(b) $270\pi x - 30\pi x^2$ or $30\pi x(9 - x)$
(c) 1.0 cm (1 d.p.)

Exercises 27.10–27.11

1 27.4°
2 5.1 cm
3 **(a)** $x = 2r$ **(b)** 85.9°

Exercise 27.12–27.13

1 **(a)** 55.9 cm^2 **(b)** 1 : 1.5625
2 **(a)** 39.0° **(b)** 212.7 cm^2
(c) 827 cm^2 **(d)** 1275 cm^3

Exercises 27.14–27.15

1 49.2 cm
2 **(a)** Volume of outer hemisphere – volume of inner hemisphere. Radius of inner hemisphere = $(20 - x)$ cm
(b) $\frac{4}{3}\pi(20 - x)^3$
(c) Student's proof
(d) 6.1 cm

Exercise 27.16

1 **(a)** 78.5 cm^2 **(b)** 235.6 cm^2
2 **(a)** 100.5 cm^2 **(b)** 389.6 cm^2

Exercises 27.17–27.19

1 **(a)** 168 cm^3 **(b)** 205.8 cm^2
2 **(a)** 108 cm^3 **(b)** 4.5 cm
(c) 178.7 cm^2

Exercises 27.20–27.23

1 **(a)** 3 cm **(b)** 50.3 cm^3
(c) 113.1 cm^2
2 **(a)** 4.6 cm **(b)** 5.7 cm
(c) 25.9 cm^3 **(d)** 57.3 cm^2
3 **(a)** 1047.2 cm^3 **(b)** 1047.2 cm^3
(c) 1146.8 cm^2

Topic 4 Exam focus

1 0.0087 km^2
2 8×10^8 cm^3
3 **(a)** 414.7 cm^2 **(b)** 8.2 cm
(c) 1 : 2.96
4 **(a)** 6.9 cm^2 **(b)** 39.6°
5 **(a)** 1767.1 cm^3 **(b)** 52.4%
6 **(a)** 10 cm
(b) **(i)** 130.9 cm^3
(ii) 785.4 cm^3
(c) **(i)** 111.1 cm^2
(ii) 425.2 cm^2

28 Straight-line graphs

Exercises 28.1–28.3

1 **(a)** gradient = 1 **(b)** $y = x - 2$

2 **(a)** gradient = 2 **(b)** $y = 2x - 1$

3 **(a)** gradient = 0 **(b)** $y = 1$

4 **(a)** gradient is infinite **(b)** $x = -3$

5 **(a)** gradient $= -\frac{1}{2}$ **(b)** $y = -\frac{1}{2}x + 1$

6 $y = \frac{1}{3}x + 1$

7 $y = \frac{1}{4}x - 1$

8 $y = -2x - 3$

9 $y = -\frac{1}{5}x$

10 $y = \frac{2}{3}x + 1$

11 m represents the gradient of the straight line. c represents the intercept of the line with the y axis.

Exercise 28.4

1 **(a)** gradient = 4 y–intercept = –2

(b) gradient = –2 y–intercept = –6

2 **(a)** gradient $= -\frac{1}{2}$ y–intercept = 3

(b) gradient = –3 y–intercept = 4

3 **(a)** gradient = –2 y–intercept = 4

(b) gradient = –2 y–intercept $= -\frac{1}{5}$

4 **(a)** gradient $= \frac{3}{2}$ y–intercept = –3

(b) gradient $= \frac{3}{2}$ y–intercept $= \frac{15}{2}$

5 **(a)** gradient $= \frac{4}{5}$ y–intercept = 0

(b) gradient = 1 y–intercept $= -\frac{2}{3}$

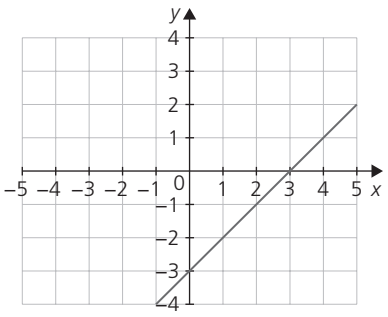
Exercise 28.5

1 $y = -2x + 9$

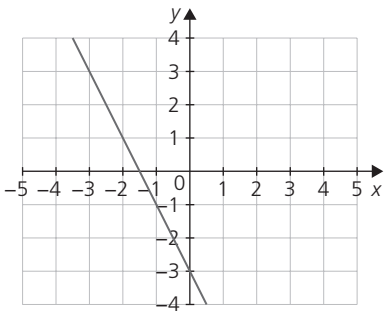
2 $6x - 14y + 35 = 0$

Exercise 28.6

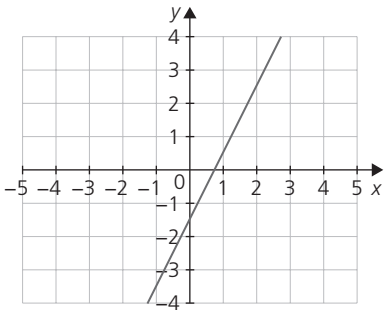
1



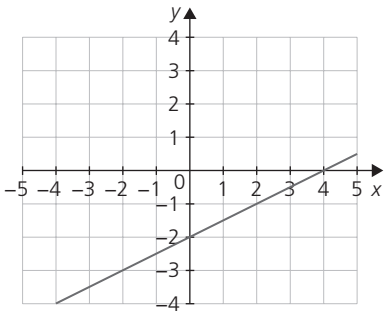
2



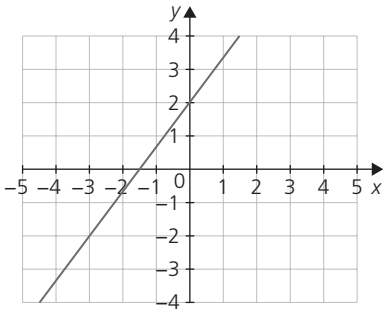
3



4

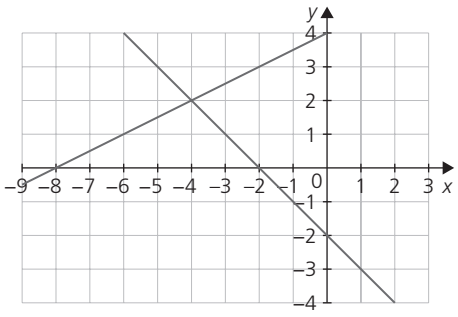


5



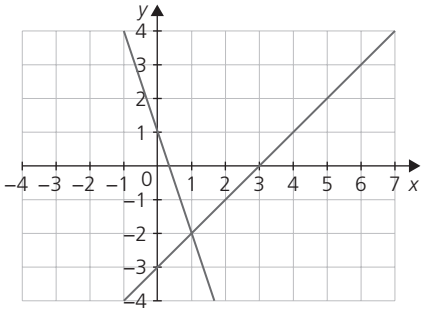
Exercise 28.7

1



$x = -4$ and $y = 2$

2



$x = 1$ and $y = -2$

Exercise 28.8

1 **(a)** 6.0 **(b)** (7, 6)

2 **(a)** 5.4 **(b)** $\left(\frac{1}{2}, 6\right)$

3 **(a)** 7.2 **(b)** (1, –2)

4 **(a)** 9.1 **(b)** $\left(0, 1\frac{1}{2}\right)$

5 **(a)** 1.6 **(b)** $\left(-\frac{1}{2}, -\frac{1}{4}\right)$

Exercise 28.9

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

2 $y = -2x + 6$

3 $y = 7$

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

5 $x = \frac{1}{2}$

6 $y = \frac{2}{5}x + 4$

7 $y = -\frac{1}{3}x - 4$

Exercise 28.10

1 **(a)** 2 **(b)** $-\frac{1}{2}$ **(c)** $y = -\frac{1}{2}x + 7$

2 **(a)** –1 **(b)** 1 **(c)** $y = x + 2$

3 **(a)** $\frac{5}{2}$ **(b)** $-\frac{2}{5}$ **(c)** $y = -\frac{2}{5}x - \frac{11}{5}$

4 **(a)** 0 **(b)** infinite **(c)** $x = 4$

5 **(a)** $-\frac{3}{2}$ **(b)** $\frac{2}{3}$ **(c)** $y = \frac{2}{3}x + \frac{13}{6}$

6 **(a)** infinite **(b)** 0 **(c)** $y = \frac{1}{7}$

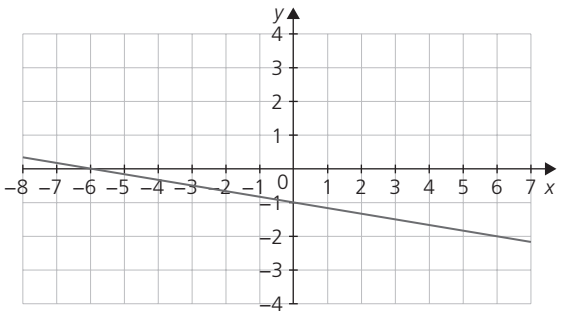
Topic 5 Exam focus

1 $y = -\frac{1}{4}x + 1$

2 **(a)** gradient = –3 *y*–intercept = 5

(b) gradient = $\frac{5}{3}$ *y*–intercept = 2

3



4 **(a)** 5

(b) (13, –2)

5 $y = -6x + 8$

6 **(a)** $-\frac{3}{2}$

(b) $2x - 3y + 24 = 0$

29 Bearings

Exercise 29.1

1 **(a)** Student's scale drawing

(b) **(i)** ≈ 6.8 km

(ii) ≈ 026°

30 Trigonometry

Exercises 30.1–30.3

1 5.6 cm
2 17.3 cm
3 55.0°
4 12.7 cm
5 60.5°
6 9.5 cm
7 40.3°
8 7.5 cm

Exercises 30.4–30.5

1 $a = 10.3$ cm
2 $b = 11.3$ cm
3 $c = 8.9$ cm
4 $d = 12.2$ cm
5 **(a)** 68.0 km **(b)** 96.2 km
6 **(a)** 7.1 km **(b)** 27.1 km
(c) 34.9 km **(d)** 039°
7 **(a)** 6.4 m **(b)** 18.2 m
(c) 41.4°

Exercise 30.6

1 **(a)** 58.9 m **(b)** 40° **(c)** 1 : 1.7
2 **(a)** 14.0 m **(b)** 16.6° **(c)** 47.1 m

Exercises 30.7–30.8

1 **(a)** sin 94° **(b)** sin 22°
2 **(a)** –cos 142° **(b)** –cos 42°
3 **(a)** 22°, 158° **(b)** 58°, 122°
4 **(a)** cos 18° **(b)** cos 44°

31 Further trigonometry

Exercises 31.1–31.2

1 6.6 cm
2 8.1 cm
3 11.5 cm
4 23°
5 36°
6 148°

Exercise 31.3

1 **(a)** 44° **(b)** 87.5 m

Exercise 31.4

1 43.3 cm²
2 7 cm

Exercise 31.5–31.6

1 **(a)** 11.4 cm **(b)** 23.3 cm
2 **(a)** 8.5 cm **(b)** 30°
(c) 8.9 cm **(d)** 33°
3 **(a)** 5 cm **(b)** 59°
(c) 7.8 cm **(d)** 31°
4 **(a)** 3.2 cm **(b)** 65°
(c) 3.8 cm

Topic 6 Exam focus

1 307°
2 41°
3 39°
4 2.3 m
5 131°
6 **(a)** 15.0 m **(b)** 7.6 m **(c)** 193 m²
7 **(a)** 8 cm **(b)** 26°

32 Vectors

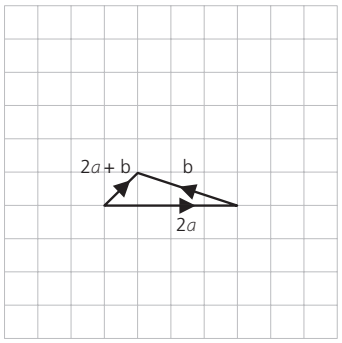
Exercise 32.1

1 **(a)** $\begin{pmatrix} 8 \\ -1 \end{pmatrix}$ **(b)** $\begin{pmatrix} -1 \\ 5 \end{pmatrix}$
(c) $\begin{pmatrix} -5 \\ 2 \end{pmatrix}$ **(d)** $\begin{pmatrix} 0 \\ -4 \end{pmatrix}$
(e) $\begin{pmatrix} -2 \\ -2 \end{pmatrix}$

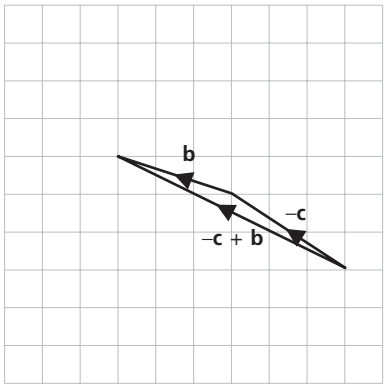
Exercise 32.2–32.3

1 **(a)** $\begin{pmatrix} 6 \\ 0 \end{pmatrix}$ **(b)** $\begin{pmatrix} 9 \\ -5 \end{pmatrix}$
(c) $\begin{pmatrix} \frac{5}{2} \\ -\frac{1}{2} \end{pmatrix}$ **(d)** $\begin{pmatrix} 6 \\ -2 \end{pmatrix}$

2 **(a)**



(b)



Exercise 32.4

1 **(a)** $\begin{pmatrix}-1\\-2\end{pmatrix}$ therefore magnitude is 2.2

(b) $\begin{pmatrix}-10\\8\end{pmatrix}$ therefore magnitude is 12.8

Exercises 32.5–32.7

1 **(a)** $\frac{1}{2}\mathbf{a}$ **(b)** $\frac{3}{2}\mathbf{b}$

(c) $\frac{1}{2}\mathbf{a}+\frac{3}{4}\mathbf{b}$ **(d)** $\frac{1}{2}\mathbf{b}-\frac{1}{2}\mathbf{a}$

2 **(a)** $\mathbf{a}+\mathbf{b}$ **(b)** $\frac{1}{2}\mathbf{b}$

(c) $\mathbf{a}+\frac{3}{2}\mathbf{b}$ **(d)** $\frac{1}{2}\mathbf{a}+\frac{1}{4}\mathbf{b}$

33 Matrices

Exercise 33.1

1 **(a)** 2×4 **(b)** 4×1

2

	Class 1	Class 2
Black	6	8
Brown	6	3
Blonde	4	5
Ginger	2	0

Exercise 33.2

1 $\begin{pmatrix}3&-1&1\\0&-7&10\end{pmatrix}$

2 $\begin{pmatrix}4&-4\\0&4\\1&-1\end{pmatrix}$

3 **(a)** $\begin{pmatrix}6&0&2\end{pmatrix}+\begin{pmatrix}8&0&0\end{pmatrix}+\begin{pmatrix}4&2&0\end{pmatrix}$

(b) $\begin{pmatrix}18&2&2\end{pmatrix}$

Exercises 33.3–33.5

1 **(a)** $\begin{pmatrix}4&12\\-8&0\\8&2\end{pmatrix}$ **(b)** $\begin{pmatrix}0&12&-6\\-3&9&1\end{pmatrix}$

2 **(a)** $\begin{pmatrix}12\end{pmatrix}$ **(b)** $\begin{pmatrix}20&-14\\-56&41\end{pmatrix}$

3 **(a)** Examples of possible multiplications are **AC**, **BA** or **CB**

(b) Examples of multiplications not possible are **CA**, **AB** or **BC**

Exercises 33.6–33.7

1 **(a)** $\mathbf{B}=\begin{pmatrix}1&0\\0&1\end{pmatrix}$ **(b)** The identity matrix

2 **(a)** 12 **(b)** 5

3 **(a)** $\begin{pmatrix}7&-5\\35&-5\end{pmatrix}$ **(b)** 1260

Exercise 33.8

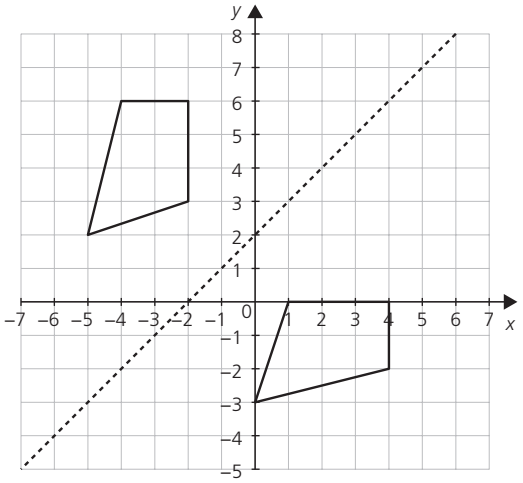
1 $\begin{pmatrix}\frac{1}{8}&\frac{1}{8}\\-\frac{1}{4}&\frac{1}{4}\end{pmatrix}$

2 **(a)** $\begin{pmatrix}\frac{1}{2}&0\\-\frac{1}{4}&\frac{1}{2}\end{pmatrix}$ **(b)** $\begin{pmatrix}1&0\\0&1\end{pmatrix}$

34 Transformations

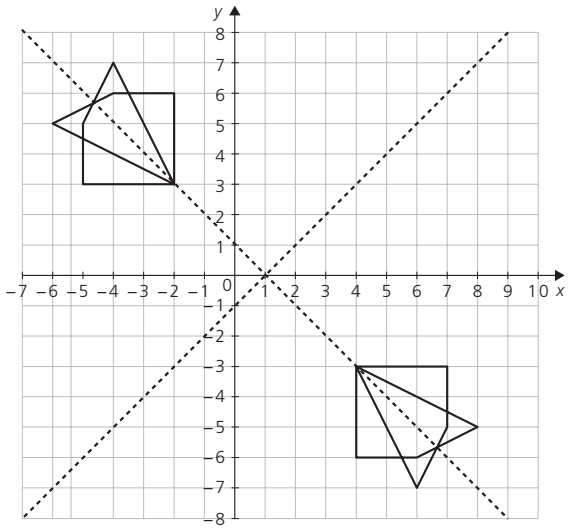
Exercises 34.1–34.2

1 (a) (i)



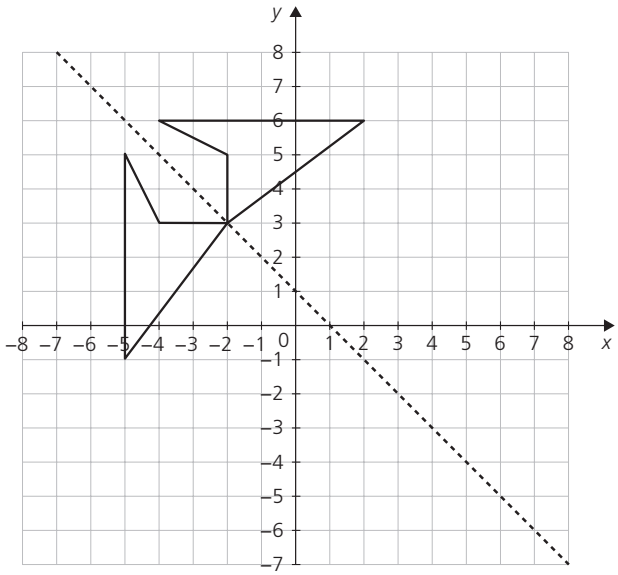
(ii) $y = x + 2$

(b) (i)



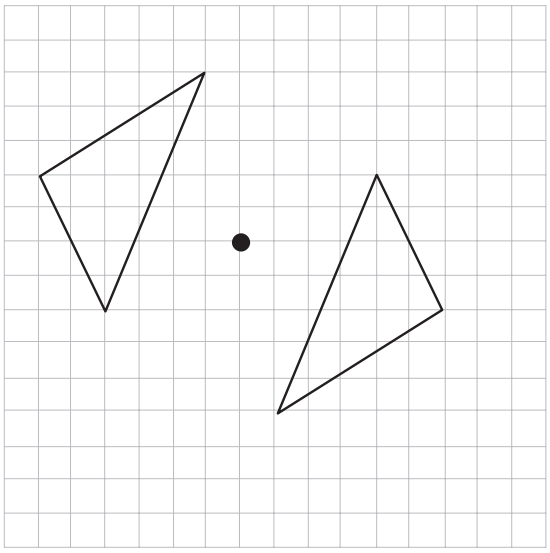
(ii) $y = x - 1$ $y = -x + 1$

2

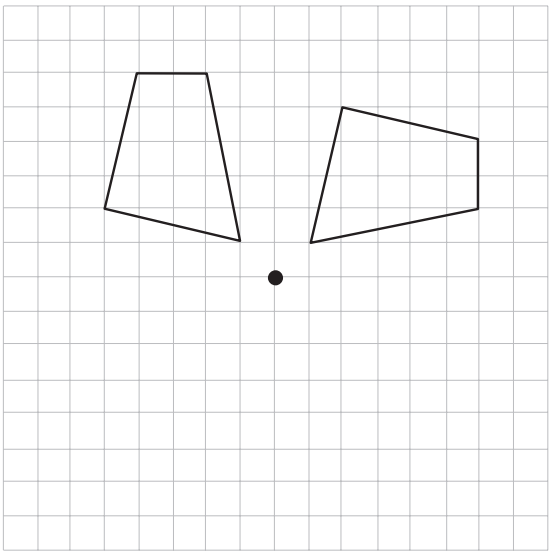


Exercises 34.3–34.4

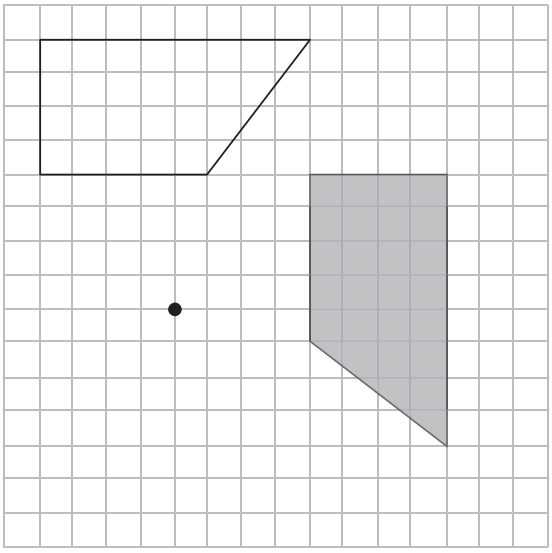
1 (a)



(b)

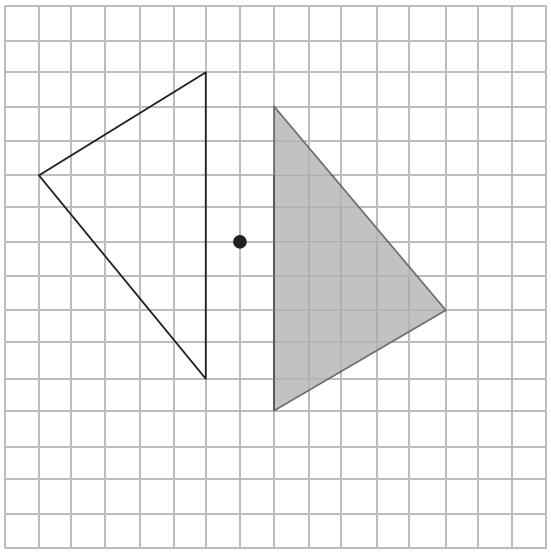


2 (a)



Rotation 90° clockwise or 270° anticlockwise

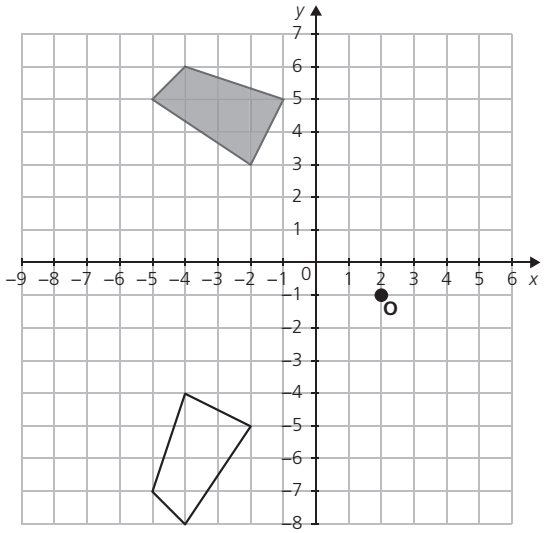
(b)



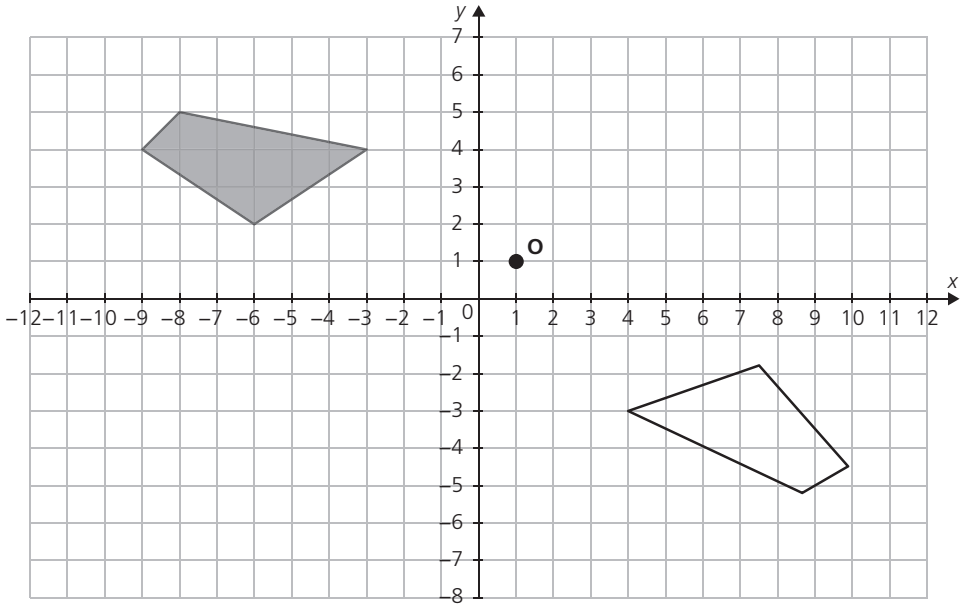
Rotation 180° clockwise / anticlockwise

Exercise 34.5

1 **(a)** Centre of rotation (2, –1)
(b) 90° anticlockwise about O



2 **(a)** Centre of rotation (1, 1)
(b) 165° anticlockwise about O



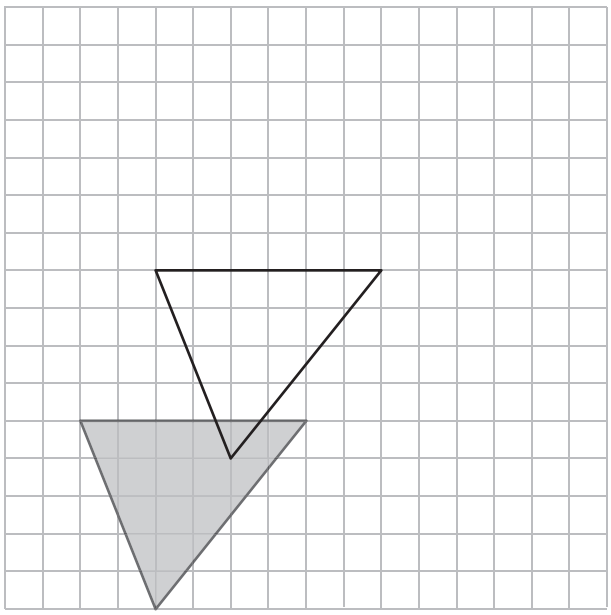
Exercises 34.6–34.7

1 $B = \begin{pmatrix} 0 \\ -6 \end{pmatrix}$

$C = \begin{pmatrix} -6 \\ -7 \end{pmatrix}$

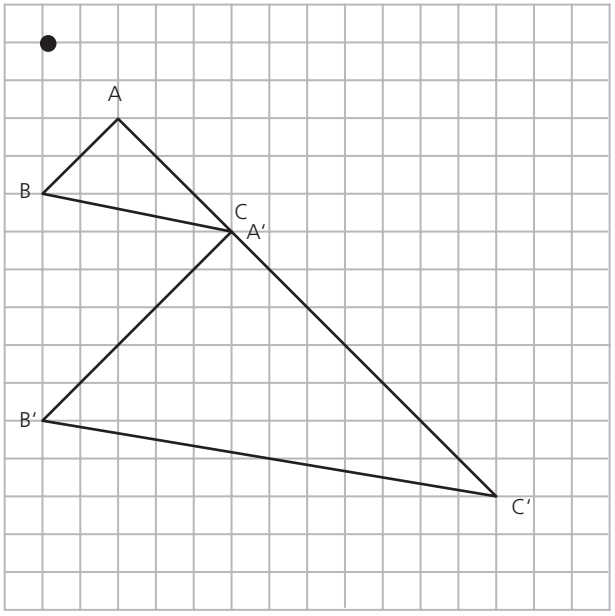
$D = \begin{pmatrix} -6 \\ 1 \end{pmatrix}$

2



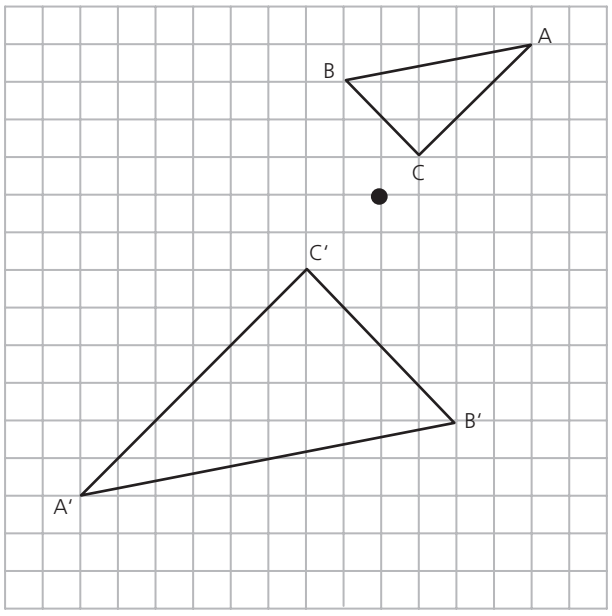
Exercises 34.8–34.9

1 **(a)**



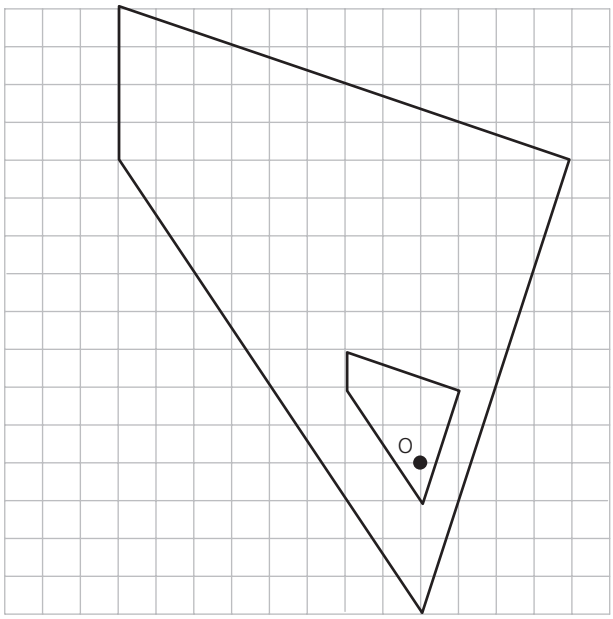
Scale factor of enlargement = 2.5

(b)



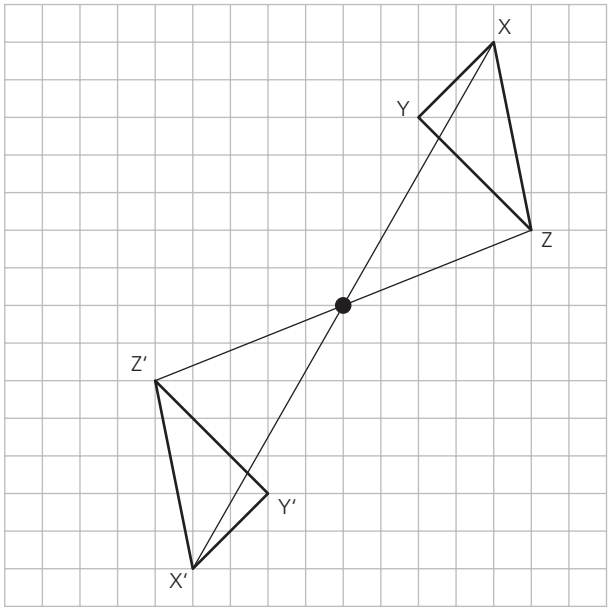
Scale factor of enlargement = –2

2



Exercise 34.10

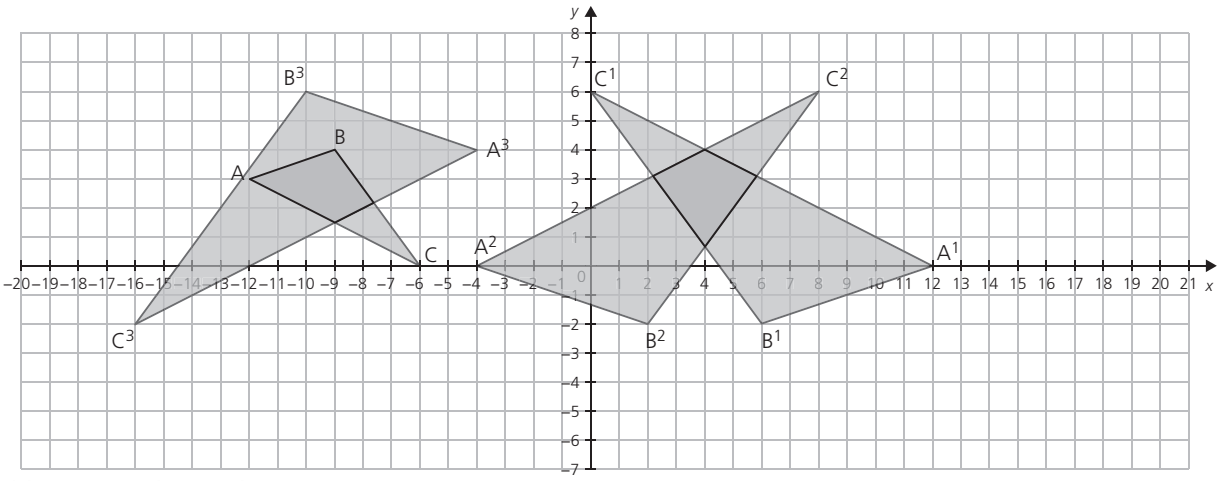
1



Scale factor of enlargement = –1

Exercise 34.11

1

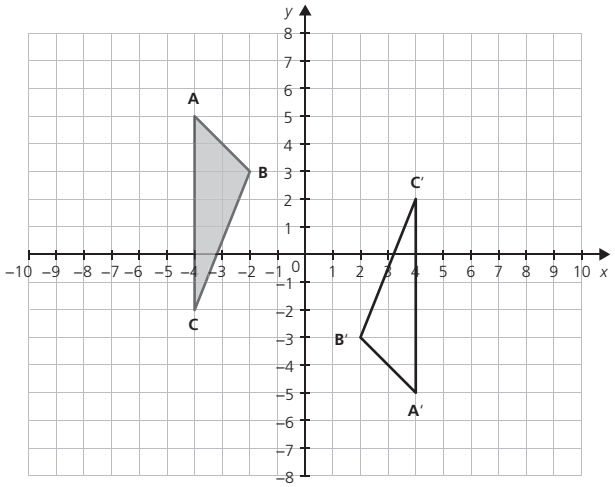


Exercises 34.12–34.13

1 (a)
$$\begin{matrix} & \text{A} & \text{B} & \text{C} \end{matrix}\begin{pmatrix} -4 & -2 & -4 \\ 5 & 3 & -2 \end{pmatrix}$$

(b) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} -4 & -2 & -4 \\ 5 & 3 & -2 \end{pmatrix} = \begin{pmatrix} 4 & 2 & 4 \\ -5 & -3 & 2 \end{pmatrix}$

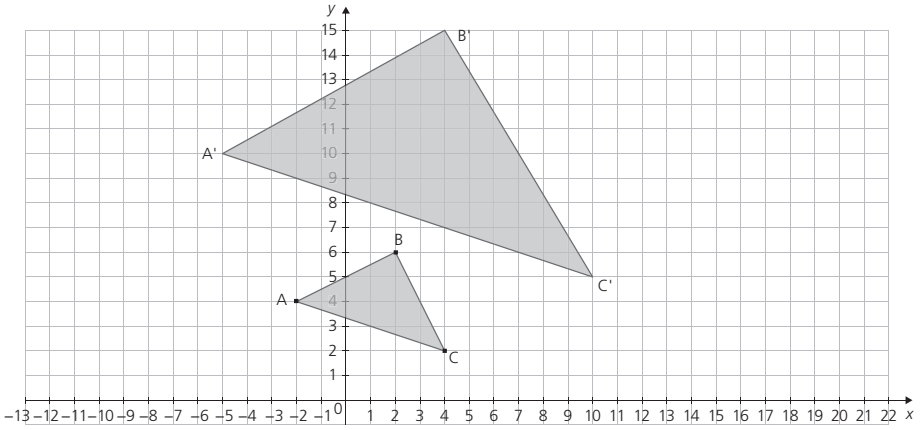
(c)



(d) (i) Enlargement of scale factor –1 with centre of enlargement at the origin
(ii) Rotation of 180° with centre of rotation at the origin

2 (a) 10 units²

(b)



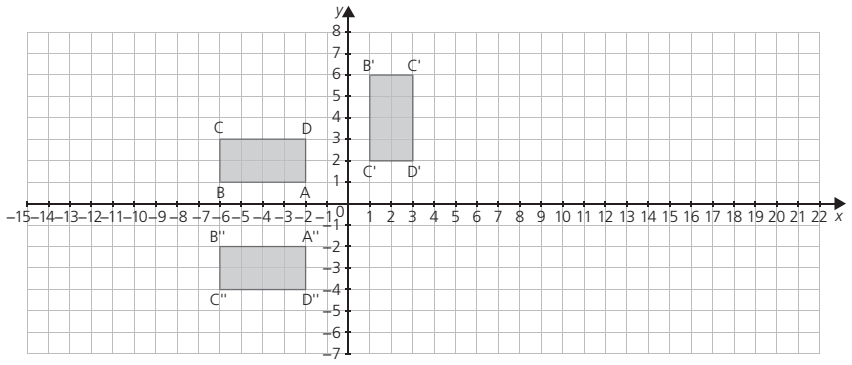
(c) 6.25

(d) $6.25 \times 10 = 62.5$ units²

(e) $\begin{pmatrix} \frac{2}{5} & 0 \\ 0 & \frac{2}{5} \end{pmatrix}$

Exercise 34.14

1 (a)(b)



(c) $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ **(d)** $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$

Topic 7 Exam focus

1 **(a)** $\begin{pmatrix} 11 \\ -8 \end{pmatrix}$ **(b)** $\begin{pmatrix} -3 \\ 3 \end{pmatrix}$

2 **(a)** $\begin{pmatrix} -5 \\ -4 \end{pmatrix}$ **(b)** 6.4 (1 d.p.)

3 **(a)** $\mathbf{b}$ **(b)** $\mathbf{a}+\frac{1}{4}\mathbf{b}$

(c) $\frac{1}{3}\mathbf{a}+\mathbf{b}$ **(d)** $\frac{2}{3}\mathbf{a}-\frac{3}{4}\mathbf{b}$

4

2007	35	25	12	30
2008	40	15	10	24
2009	24	31	8	20
2010	15	20	5	32
2011	18	22	18	28
2012	15	18	15	25

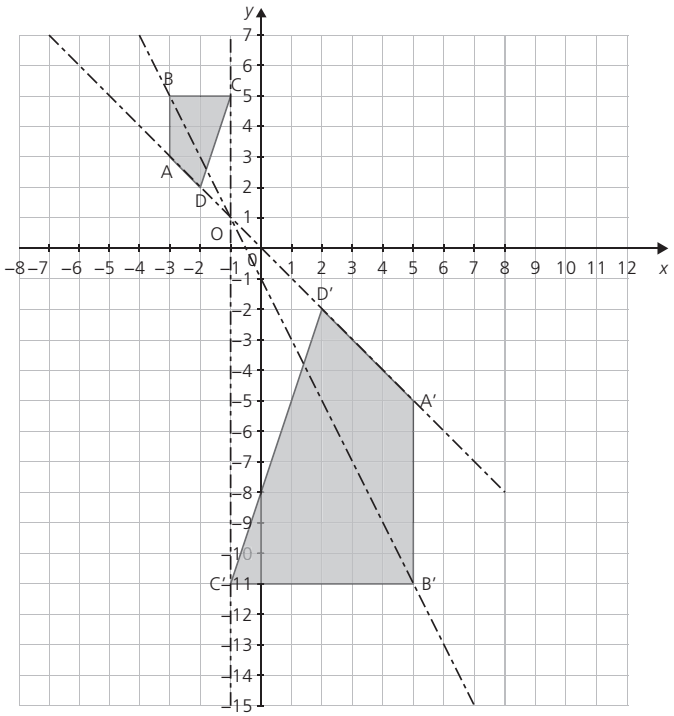
5 **(a)** **QP** is possible as the number of columns in **Q** is the same as the number of rows in **P**.

(b) $\begin{pmatrix} -3 & -6 & 1 \\ 6 & 12 & -2 \\ 1 & 18 & 1 \\ 16 & 0 & -18 \end{pmatrix}$

6 **(a)** -1

(b) $\begin{pmatrix} -1 & -2 \\ -2 & -3 \end{pmatrix}$

7 **(a)**

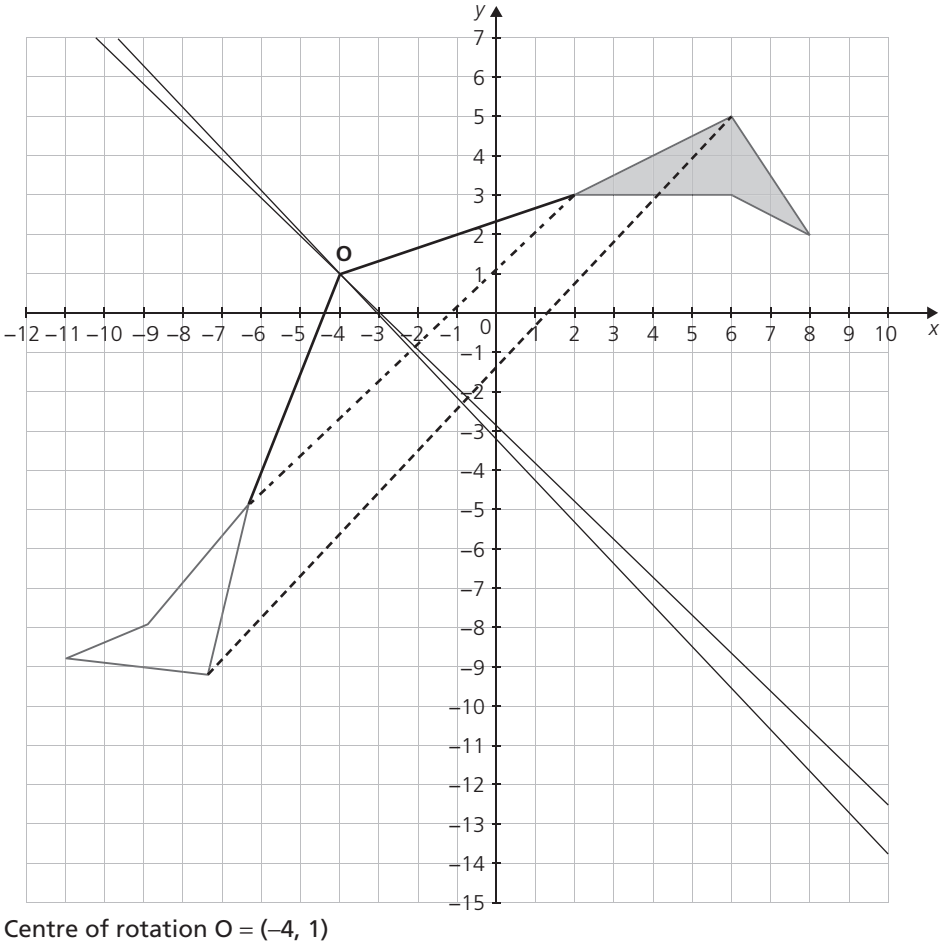


O = (–1, 1)

(b) Scale factor = –3

(c) $3^2 \times 8 = 72$ units^2

8 **(a)**

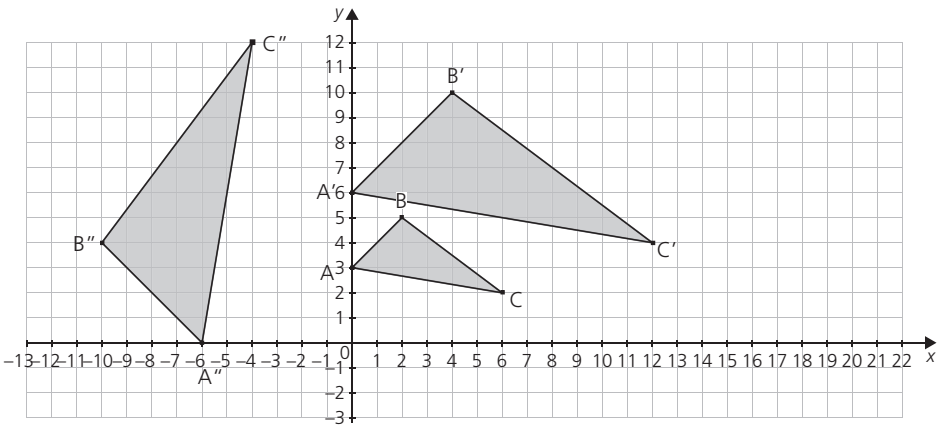


Centre of rotation O = (–4, 1)

(b) 230° anticlockwise about O (or 130° clockwise)

9 (a) (i)
$$\begin{matrix} A' & B' & C' \end{matrix}$$
$$\begin{pmatrix} 0 & 4 & 12 \\ 6 & 10 & 4 \end{pmatrix}$$

(a) (ii), (b)



(c) $\begin{pmatrix} 0 & -2 \\ 2 & 0 \end{pmatrix}$

(d) $4x$ units²

(e) $\begin{pmatrix} 0 & \frac{1}{2} \\ -\frac{1}{2} & 0 \end{pmatrix}$

35 Probability

Exercises 35.1–35.4

1 (a) $\frac{1}{8}$ **(b)** $\frac{1}{4}$
(c) $\frac{1}{2}$ **(d)** 0
(e) $\frac{7}{8}$ **(f)** $\frac{7}{8}$

2 (a) $\frac{30}{365} = \frac{6}{73}$
(b) Not every month has the same number of days
(c) $\frac{67}{73}$

3 (a) $\frac{1}{750}$ **(b)** $\frac{2}{3}$
(c) $\frac{1}{5}$ **(d)** 1

4 (a) $\frac{23}{40}$ **(b)** $\frac{17}{40}$

5 (a) $\frac{6}{11}$ **(b)** $\frac{4}{11}$
(c) 1 **(d)** Student's answer

6 (a) (i) $\frac{7}{52}$ **(ii)** $\frac{27}{52}$
(b) (i) $\frac{45}{51}$ **(ii)** $\frac{3}{51}$

7 (a) $\frac{4}{121}$ **(b)** $\frac{2}{121}$

8 (a) $\frac{1}{27}$ **(b)** $\frac{1}{9}$

9 (a) 200
(b) (i) $\frac{4}{25}$ **(ii)** $\frac{107}{200}$ **(iii)** $\frac{9}{100}$

10 225

36 Further probability

Exercise 36.1

1 (a) $\frac{1}{6}$ **(b)** $\frac{5}{24}$

2 (a) $\frac{1}{8}$ **(b)** $\frac{1}{16}$
(c) 0 **(d)** $\frac{3}{4}$

Exercise 36.2

1 (a) (i) $\frac{1}{27}$ **(ii)** $\frac{4}{27}$
(b) It will depend on how good the opposition is.

2 (a) $\frac{1}{25}$ **(b)** $\frac{1}{5}$

Exercise 36.3

1 **(a)** $\frac{1}{8}$ **(b)** $\frac{3}{4}$
(c) $\frac{1}{8}$ **(d)** $\frac{7}{8}$
(e) Within the first three throws it is certain that a player will either start or not start
2 **(a)** 0.36 **(b)** 0.288 **(c)** 0.648
3 **(a)** 0.0025 **(b)** $0.95^{20} = 0.358$ (3 d.p.)

Topic 8 Exam focus

1 **(a)** $\frac{1}{12}$ **(b)** $\frac{5}{12}$
(c) $\frac{1}{144}$ **(d)** $\frac{143}{144}$
2 **(a)** $\frac{3}{20}$ **(b)** $\frac{1}{5}$
3 **(a)** $\frac{1}{27}$ **(b)** $\frac{4}{27}$
4 **(a)** 0.8% **(b)** 51.2%
5 **(a)** $\frac{r}{r+b}$ **(b)** $\frac{r(r-1)}{(r+b)(r+b-1)}$
(c) $\frac{2rb}{(r+b)(r+b-1)}$

37 Mean, median, mode and range

Exercises 37.1–37.2

1 **(a)** 6.1 **(b)** 6
(c) 8 **(d)** 6
2 94.5 kg
3 **(a)** 40 **(b)** 46
(c) 44.8 (1 d.p.) **(d)** 45
(e) 6

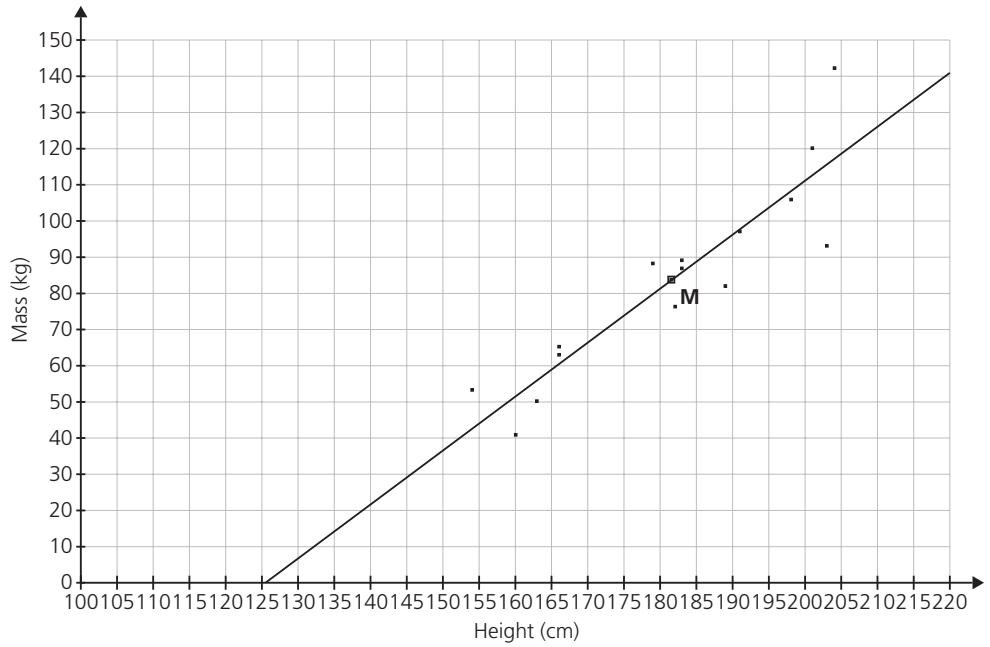
Exercise 37.3

1 **(a)** 22 **(b)** 6 mins 44 s

38 Collecting and displaying data

Exercises 38.1–38.3

1 **(a)** Moderate positive correlation as taller people tend to be heavier.
(b)



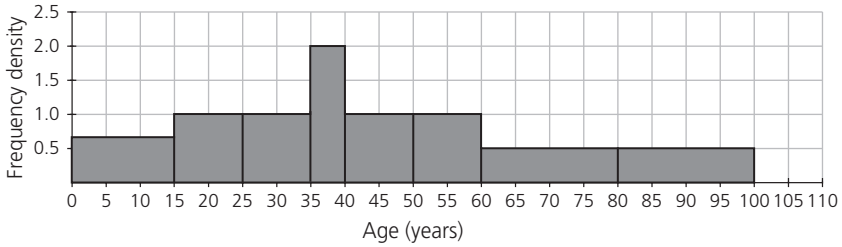
(c) **(i)** 181.5 cm
(ii) 83.5 kg
(iii) see graph for position of M
(d) See graph for line of best fit
(e) **(i)** Moderate positive correlation
(ii) Student's comparison

Exercises 38.4–38.5

1 (a)

Age (years)	0–	15–	25–	35–	40–	50–	60–	80–100
Frequency	10	10	10	10	10	10	10	10
Frequency density	0.67	1	1	2	1	1	0.5	0.5

(b)



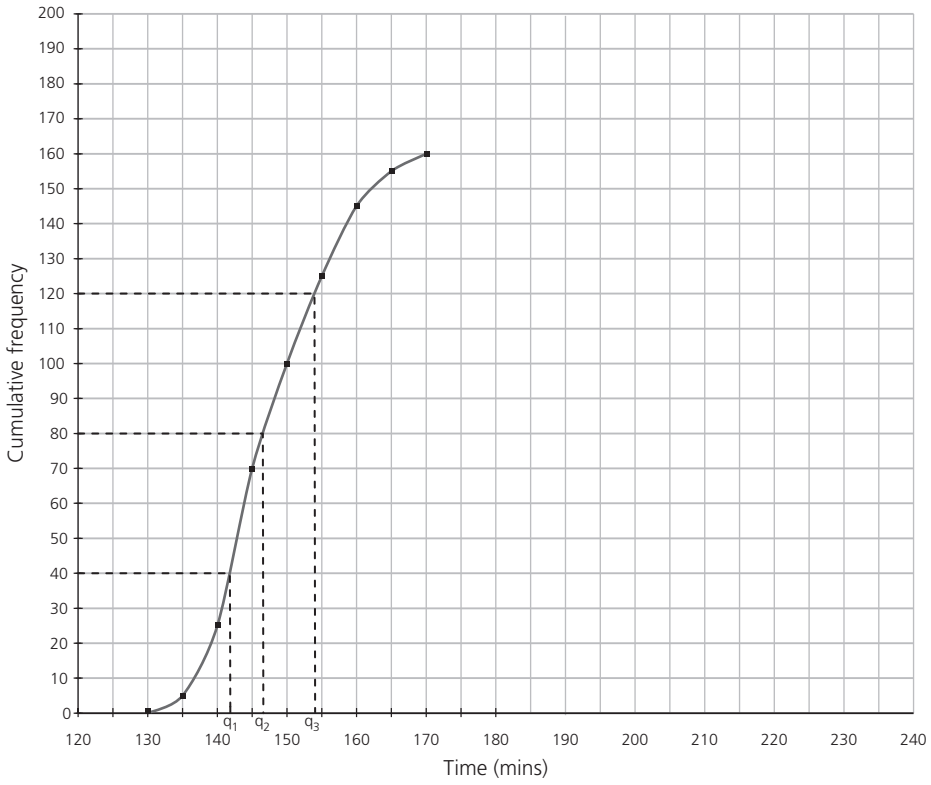
39 Cumulative frequency

Exercises 39.1–39.2

1 (a)

Time (mins)	140–	150–	160–	170–	180–	190–	200–	210–220
Frequency	5	20	45	30	25	20	10	5
Cumulative frequency	5	25	70	100	125	145	155	160

(b)



(c) Median ≈ 173 minutes (see graph)

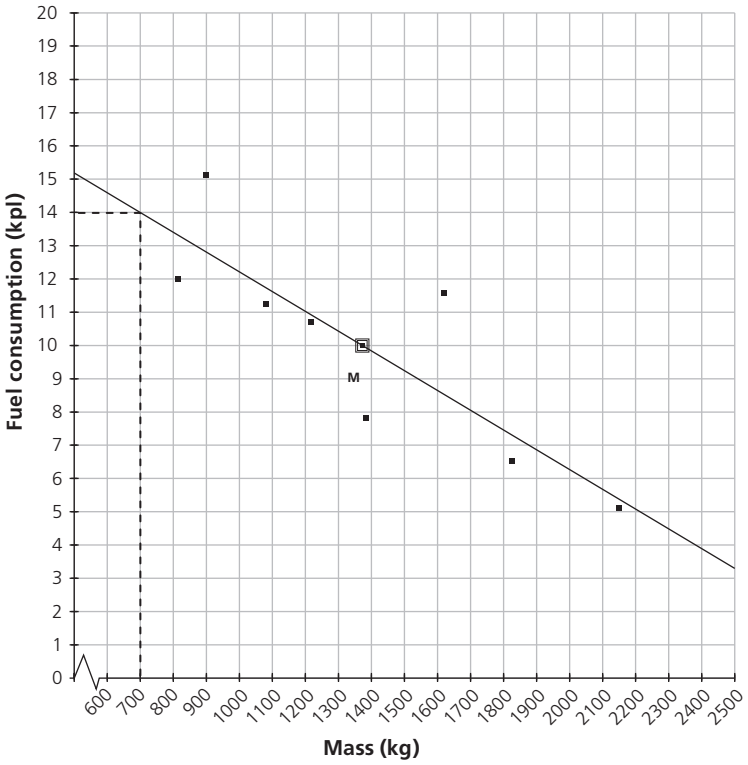
(d) **(i)** Upper quartile ≈ 187 minutes (see graph)
(ii) Lower quartile ≈ 163 minutes (see graph)
(iii) Interquartile range ≈ 24 minutes

(e) Yes the data does support his aim, as the middle 50% corresponds to the interquartile range. The IQR < 30 mins.

Topic 9 Exam focus

1 Several answers are possible
Check $x + y = 127$ kg, median = 73 kg and range = 51 kg
e.g. $x = 59$ kg and $y = 68$ kg

2 (a)



(b) Moderate negative correlation

(c) **(i)** 1373 kg

(ii) 10 kpl

(d) See graph above for M

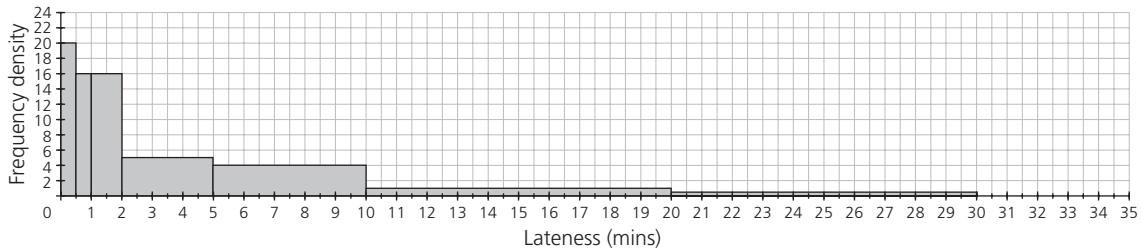
(e) See graph above for line of best fit

(f) Average fuel consumption ≈ 14 kpl (see graph above)

3 (a)

Bus lateness (mins)	0–	0.5–	1–	2–	5–	10–	20–30
Frequency	10	8	16	15	20	10	5
Frequency density	20	16	16	5	4	1	0.5

(b)

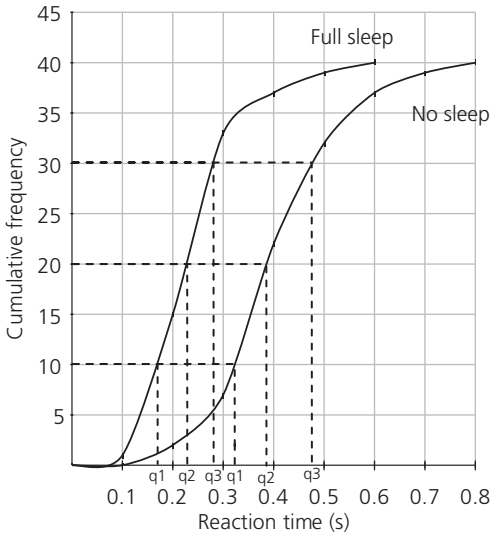


4 (a)

Reaction time (s)	0–	0.1–	0.2–	0.3–	0.4–	0.5–0.6
Frequency	1	14	18	4	2	1
Cumulative frequency	1	15	33	37	39	40

Reaction time (s)	0–	0.1–	0.2–	0.3–	0.4–	0.5–	0.6–	0.7–0.8
Frequency	0	2	5	15	10	5	2	1
Cumulative frequency	0	2	7	22	32	37	39	40

(b)



(c) Full sleep median reaction time ≈ 0.23 s
No sleep median reaction time ≈ 0.39 s

(d) Full sleep IQR ≈ 0.11 s
No sleep IQR ≈ 0.16 s

(e) Student's conclusions may vary.
Median reaction time is greater with no sleep.
Greater spread of results with no sleep.