

Answers

Exercise 1

- | | | | | |
|------------------|-------------------|-----------------------|--------------------|-------------------------|
| 1 $\frac{1}{3}$ | 2 $\frac{2}{7}$ | 3 $\frac{1}{5}$ | 4 $\frac{1}{8}$ | 5 $\frac{1}{2}$ |
| 6 $\frac{1}{4}$ | 7 $\frac{1}{5}$ | 8 $\frac{3}{4}$ | 9 $\frac{1}{10}$ | 10 $\frac{3}{10}$ |
| 11 $\frac{2}{5}$ | 12 $\frac{3}{4}$ | 13 50 | 14 60 | 15 300 |
| 16 8 | 17 -16 | 18 -48 | 19 $-\frac{1}{3}$ | 20 48 |
| 21 $\frac{1}{4}$ | 22 $\frac{1}{10}$ | 23 $\frac{3}{4}$ | 24 $\frac{3}{5}$ | 25 $\frac{7}{20}$ |
| 26 150 m | 27 \$360 | 28 1650 m | 29 £2040 | 30 \$90 |
| 31 \$897 | 32 £56.25 | 33 6×10^{10} | 34 4×10^2 | 35 5.6×10^{16} |
| 36 1230 | 37 1240 | 38 1240 | 39 54 300 | 40 54 400 |
| 41 1.234 | 42 1.235 | 43 1.231 | 44 1.204 | 45 1.201 |

Exercise 1*

- | | | | | |
|-------------------------|--------------------|----------------------|--|-------------------------|
| 1 $\frac{1}{11}$ | 2 $\frac{3}{20}$ | 3 $\frac{9}{10}$ | 4 $\frac{1}{8}$ | 5 42 g |
| 6 37.5% | 7 12% | 8 a 56.7 s | b 19% | |
| 9 a 154 m | b 23.2% | 10 a €118 800 | b €120 000 $\left(1 - \frac{x^2}{10^4}\right)$ | |
| 11 7450 | 12 0.0745 | 13 74 500 | 14 74 500 000 | 15 5.3×10^6 |
| 16 8.8×10^{14} | 17 5.0×10 | 18 3.7×10^8 | 19 3.5×10^8 | 20 6.3×10^{10} |
| 21 0.201 | 22 0.00201 | 23 3080 | 24 47 600 | 25 0.079 |
| 26 0.072 | 27 0.063 | 28 0.111 | | |

Exercise 2

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

49 1

53 1

57 2

50 -3

54 3

58 4

51 3

55 1

59 3

52 3

56 11

60 3

Exercise 2*

1 $5ab$

5 $3x + 3$

9 $10xy$

13 $24x^3$

17 $5x + 10y$

21 $-4x - 4y + 4z$

25 9

29 -2

33 10

37 3

41 $\frac{1}{2}$

45 2

49 2

53 1

57 4

2 $2xy + 2xz$

6 $10a + 5$

10 $9ab$

14 $5a^6$

18 $12a - 6b$

22 $-a - b$

26 5

30 -3

34 49

38 -2

42 $\frac{3}{2}$

46 -1

50 3

54 2

58 3

3 $4xy - 2xz$

7 $3y + 2z$

11 $12x^5$

15 $4x^4$

19 $6x - 15y$

23 $6 - 3x + 3y$

27 -1

31 $2\frac{1}{2}$

35 3

39 1

43 $2\frac{1}{3}$

47 4

51 -1

55 2

59 1

4 $2xy$

8 $7b$

12 $7a^5$

16 $72a^5$

20 $12a + 16b$

24 $6b - 2a$

28 -2

32 $\frac{4}{3}$

36 1

40 -1

44 1.8

48 2

52 -1

56 -1

60 2

Exercise 3

1 1

5 1 m

9 1, 1

13 $y = 2x + 1$

17 $y = x + 2$

21 $(5, 0), (0, 5)$

2 2

6 30 m

10 2, -1

14 $y = \frac{1}{2}x + 3$

18 $y = \frac{1}{2}x + 1$

22 $(4, 0), (0, 2)$

3 -1

7 10 m

11 $\frac{1}{2}, 4$

15 $y = -x + 2$

19 $y = -2x - 1$

23 $(2, 0), (0, 6)$

4 -3

8 1 m

12 3, 0

16 $y = -\frac{1}{2}x - 1$

20 $y = -\frac{1}{4}x - 2$

24 $(3, 0), (0, -3)$

Exercise 3*

1 $\frac{1}{3}$

5 42 m

9 3, 2

13 $y = 3x - 1$

17 $y = \frac{1}{3}x + 4$

21 $(3, 0), (0, 12)$

2 2

6 5.6 m

10 $\frac{1}{4}, -1$

14 $y = -\frac{1}{4}x + 2$

18 $y = 4x - 2$

22 $(15, 0), (0, 5)$

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

7 5 m

11 $-2, 0$

15 $y = x$

19 $y = -0.4x + 1$

23 $(10, 0), (0, -2)$

4 -1

8 6 m

12 $-1, 2$

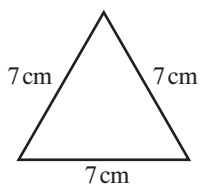
16 $y = 2x - 5$

20 $y = 0.2x$

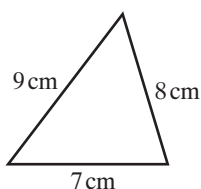
24 $(7, 0), (0, -2)$

Exercise 4

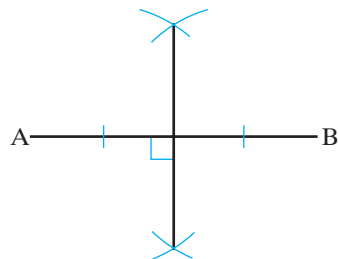
1



2

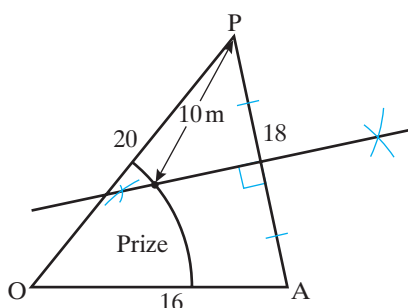


3



4 Measure and check arcs are included.

5



6 $x = 143^\circ$, $y = 37^\circ$

7 $x = 30^\circ$, $y = 60^\circ$

8 $x = 69^\circ$, $y = 42^\circ$

9 $x = 65^\circ$, $y = 115^\circ$

10 $x = 40^\circ$, $y = 140^\circ$

11 $x = 77^\circ$, $y = 103^\circ$

12 $x = 60^\circ$, $y = 120^\circ$

13 $x = 25^\circ$, $y = 115^\circ$

14 $x = 100^\circ$, $y = 75^\circ$, $z = 135^\circ$

Exercise 4*

1 a 36 b 144° c 1440°

2 a 22 sides b $16\frac{4}{11}^\circ$

3 b 30 m approx

4 $x = 46\frac{2}{3}^\circ$, $y = 133\frac{1}{3}^\circ$

5 $x = 66^\circ$

6 $x = 160^\circ$

7 $x = 36^\circ$, $y = 106^\circ$, $z = 38^\circ$

8 $x = 70^\circ$, $y = 60^\circ$

9 $x = 60^\circ$, $y = 30^\circ$

10 $x = 30^\circ$, $y = 120^\circ$

11 $x = 36^\circ$

12 $x = 20^\circ$

13 $x = y = 33^\circ$, $z = 83^\circ$

14 $x = 150^\circ$

15 $x = 36^\circ$

Exercise 5

1 a Any multiples of 3

b Any negative integers

c Any sport

d Any make of car

2 a {multiples of 3}

b {negative integers}

c {sports}

d {makes of car}

3 a 2, 4, 6, 8

b 4, 9, 16

c January, June, July

d Red, Amber, Green

4 a True

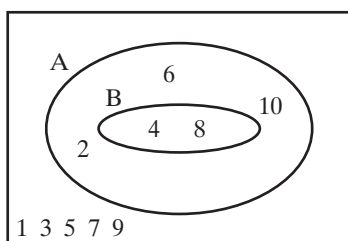
b False

c False

d True

5 a, b and d

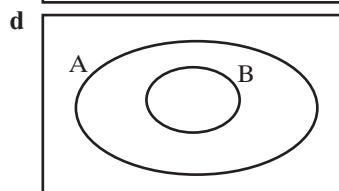
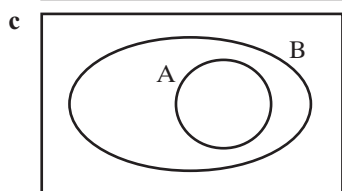
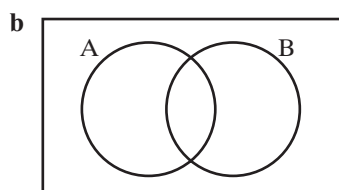
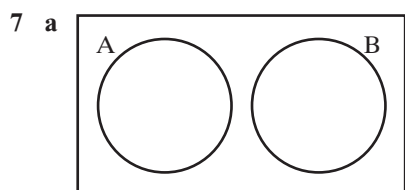
6 a



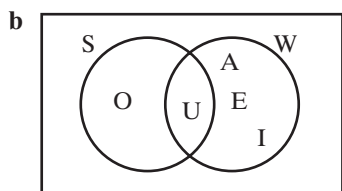
b 1, 3, 5, 7, 9. Odd numbers less than 11

c 8

d Yes. All multiples of 4 are also multiples of 2



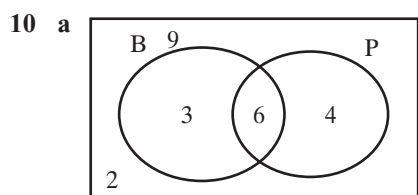
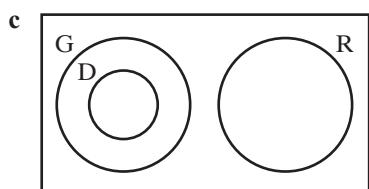
8 a $W = \{A, E, I, U\}$, $W' = \{O\}$, $S = \{O, U\}$, $S' = \{A, E, I\}$



c i $\{A, E, I, O, U\}$ or ξ ii $\{U\}$

9 a Suzy has no red dresses.

b All Suzy's dresses are green.



b 15

Exercise 5*

1 a Any multiple of 4

c Any animal

2 a $\{\text{multiples of 4}\}$

c $\{\text{animals}\}$

3 a 2, 3

c Red, Orange, Yellow, Green
Blue, Indigo, Violet

4 a False

c False

b Any integer power of 10

d Any tree

b $\{\text{integer powers of 10}\}$

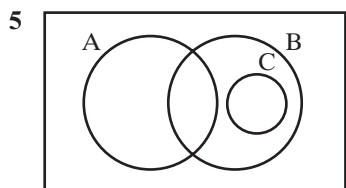
d $\{\text{trees}\}$

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

d Spring, Summer, Autumn, Winter

b True

d False



6 a Because 10 is not a member of ξ

c 1, 5

b 5, 15

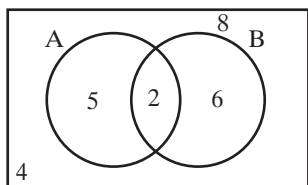
d 5

7 ξ

8 a 8

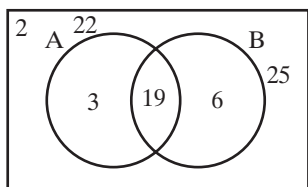
c $\xi = 17$

b 2

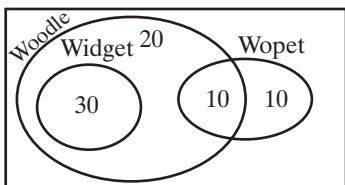


9 a $\xi = 30$

b 19



10



b 20

Examination practice 1

1 a 3.85×10^5

b 3250

2 a 36.58

b 37

3 a 4.00×10^2

b 4.81×10^5

4 a 1.20×10^6

b 2.60×10^3

5 a £4.62

b £42.77

6 a $8ab$

b $3xy + 3x$

c $3a^3b$

7 a $x = 3$

b $a = 3.5$

c $x = 3$

8 a $x + 1$

b $x + x + 1 + x + 2 = 525$

c $x = 174$

9 $x - 3y = 12$ and $6y - 2x = 7$

10 a 2

b -4

11 a 400 m

b $q = 7$

12 b AC = 8.6 cm

13 c $RS = 7.9 \text{ cm}$, area = 31.6 cm^2

14 $p = 80$

15 d $x = 0.6$, $y = 3.71$

16 A gradient = $\frac{1}{2}$ intercept = 4 equation is $y = \frac{1}{2}x + 4$
 B gradient = -2 intercept = 8 equation is $y = -2x + 8$

17 a $A \cap C = \emptyset$

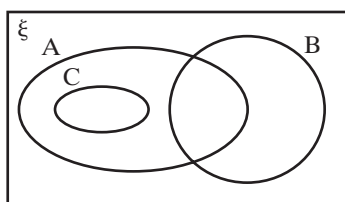
b $C \cup D = C$

c $A \cap B \neq \emptyset$

18 a 13

b 7

19 a and c



b $90^\circ, 45^\circ, 45^\circ$

20 a $\{6, 12, 18\}$

b $\{\text{multiples of 6}\}$

c $\{\text{odd numbers}\}$

d $\{3, 9, 15\}$

e $\{\text{odd multiples of 3}\}$

Exercise 6

1 $2^5 = 32$

2 $3^6 = 729$

3 $4^6 = 4096$

4 $5^7 = 78\,125$

5 $10^9 = 1\,000\,000\,000$

6 $2^4 = 16$

7 $3^3 = 27$

8 $4^3 = 64$

9 $5^3 = 125$

10 $10^6 = 1\,000\,000$

11 $2^6 = 64$

12 $3^6 = 729$

13 $4^8 = 65\,536$

14 $5^8 = 390\,625$

15 $10^{12} = 1\,000\,000\,000\,000$

16 $\frac{29}{35}$

17 $\frac{1}{35}$

18 $\frac{6}{35}$

19 $1\frac{1}{14}$

20 $3\frac{26}{35}$

21 $1\frac{16}{35}$

22 $2\frac{34}{35}$

23 $2\frac{11}{40}$

24 12 m : 24 m

25 45 kg : 60 kg

26 \$160 : \$240

27 160 mins : 200 mins

28 £19 : £38 : £76

29 64 km : 96 km : 192 km

30 1.23×10^{-2}

31 1.24×10^{-2}

32 1.60×10^{-4}

33 8.89×10^{-3}

34 4.31×10^3

35 1.02×10^8

36 2.50×10^{-12}

37 2.93×10^{-8}

38 3.62×10^{-8}

39 5.61×10^{-17}

40 2.10×10^7

41 2.46×10^{-5}

42 a \$150 b \$1650 c \$75

43 a €1.20 b €6 c €14.40

44 a 162 b 180 c 12 960

45 a i 46.7 km ii 17 056 km

b i 0.214 days ii 0.0749 days

c $5.41 \times 10 \text{ mm/sec}$

Exercise 6*

- 1 $7^3 = 343$ 2 $8^5 = 32\,768$ 3 $5^2 = 25$ 4 $11^2 = 121$
 5 $8^3 = 512$ 6 $11^2 = 121$ 7 $2^4 = 16$ 8 $6^8 = 1\,679\,616$
 9 $5^5 = 3125$ 10 $2^0 = 1$ 11 $\frac{3}{44}$ 12 $\frac{27}{35}$
 13 $\frac{3}{5}$ 14 $\frac{25}{63}$ 15 4 16 $2\frac{89}{100}$
 17 10 18 $\frac{2m}{5}$ 19 $X:Y:Z = \text{£}3000:\text{£}6000:\text{£}2000$
 20 a 500 mm b 20 m^2 21 1.85×10^{-6} 22 2.66×10^{-22}
 23 2.41×10^{-6} 24 1.62×10^{-3}
 25 a 4.08×10^{-7} b 1.76×10^{-9} c 3.87×10^{-11} d 4.83×10^{-4}
 26 $2.90 \times 10^{-5}\text{ km}$
 27 a $3.02 \times 10^{30}\text{ mm}^2$ b $1.69 \times 10^{-8}\%$
 28 $6.32 \times 10^{-13}\text{ km/s}$

Exercise 7

- 1 x 2 $2z$ 3 5 4 2
 5 $\frac{x}{2}$ 6 $3x$ 7 $\frac{2}{y}$ 8 a
 9 $\frac{x}{3}$ 10 $\frac{3}{4}$ 11 2 12 xy
 13 x 14 2 15 $\frac{2}{x}$ 16 1
 17 $\frac{3x}{4}$ 18 $\frac{5x}{6}$ 19 $\frac{5x}{4}$ 20 $\frac{13x}{15}$
 21 $\frac{x}{4}$ 22 $\frac{x}{6}$ 23 $\frac{5x}{12}$ 24 $\frac{(x-y)}{2}$
 25 ± 1 26 ± 3 27 ± 5 28 ± 4
 29 16 30 1 31 3 32 4
 33 4 cm 34 3.50 cm 35 5 cm 36 4.92 cm
 37 a 2^8 b a^6 38 a 2^{12} b a^9
 39 a 3^4 b a^4 40 a 2^8 b a^{12}
 41 $x < 1$ 42 $x \leq 4$ 43 $x \geq 1$ 44 $x < 3$

Exercise 7*

- 1 $\frac{x}{3}$ 2 $\frac{4}{x}$ 3 2 4 $2a$
 5 $3y$ 6 $\frac{2x}{y}$ 7 abc 8 $4x^2$
 9 $\frac{x^2}{6}$ 10 4 11 $\frac{a}{2}$ 12 z
 13 $\frac{1}{6}$ 14 1 15 $\frac{x^2}{5z}$ 16 $4bc$
 17 $\frac{13x}{12}$ 18 $\frac{19x}{15}$ 19 $\frac{3}{x}$ 20 $\frac{7}{6x}$

21 $\frac{a}{10}$

25 ± 5

29 4

33 5.95 cm

37 **a** 3^{10} **b** a^6

39 **a** 4^6 **b** y^{18}

41 $x \leq 2$

22 $\frac{14z}{15}$

26 ± 4

30 9

34 5.73 m, 103 m²

42 $x > 4$

23 $\frac{(3x-1)}{2}$

27 ± 4

31 4

35 5.05 s

38 **a** 5^7 **b** x^2

40 **a** 7^4 **b** z^3

43 $x < 2$

24 $\frac{3}{5x}$

28 ± 3

32 99

36 2.39 cm, 15.0 cm

44 $x \leq -2$

Exercise 8

1 (2, 3)

2 (2, 1)

3 (4, 4)

4 (0.67, 0.33)

5 (2, 2)

6 (1.2, 0.4)

7 $x \geq 1$

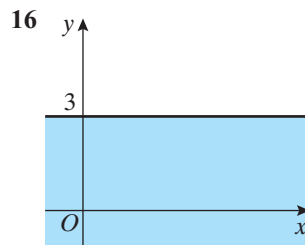
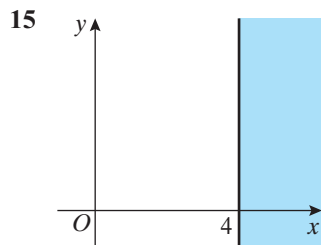
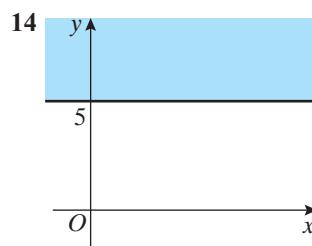
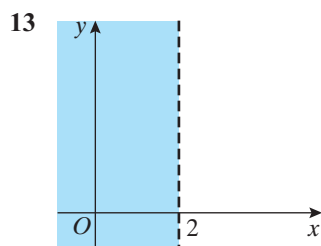
8 $x < 3$

9 $y \geq 2$

10 $y < 1$

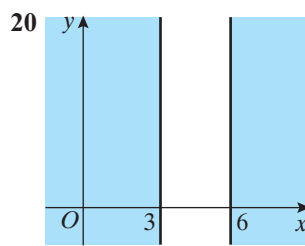
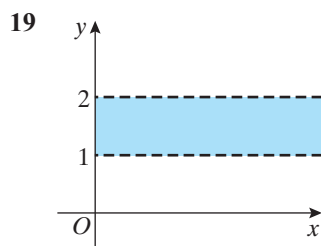
11 $x + y \leq 4$

12 $y > x + 1$



17 $x < 1$ or $x \geq 3$

18 $-1 \leq y \leq 2$



Exercise 8*

1 (1.5, 4.5)

2 (2.3, -0.7)

3 (2, 1)

4 (4, 2)

5 (5.3, 3.3)

6 (3.2, -0.4)

7 $x \leq -1$

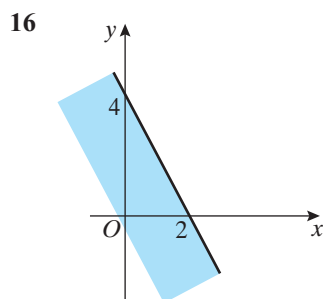
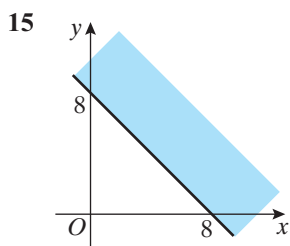
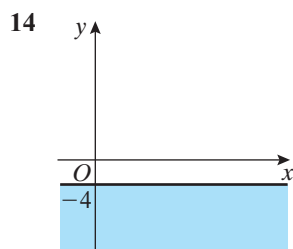
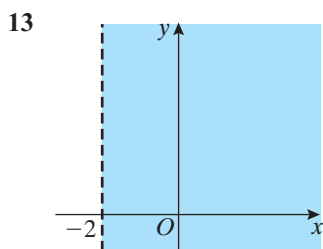
8 $y < 3$

9 $x > -2$

10 $y \leq -1$

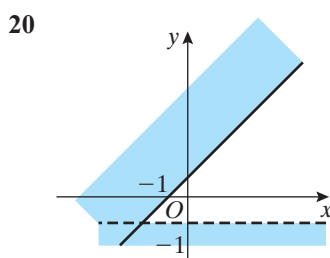
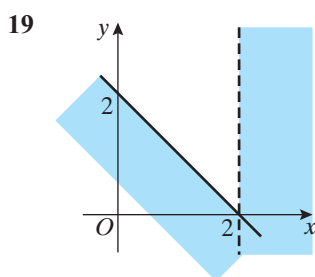
11 $x + 2y > 6$

12 $y \leq 2x - 1$



17 $x + y \leq 5$ and $y \geq 0$

18 $y < x + 4$ and $x \geq 0$



Exercise 9

- | | | | |
|----------------|-----------------|---------------------------------|------------------------|
| 1 17.3 cm | 2 14.3 cm | 3 5.46 cm | 4 9.33 m |
| 5 15.0 m | 6 4.56 m | 7 51.3° | 8 32.0° |
| 9 53.1° | 10 56.3° | 11 35.5° | 12 48.0° |
| 13 36.4 m | 14 21.4 m | 15 a 243° b 63.4° | 16 173.2 cm^2 |

Exercise 9*

- | | |
|---|---|
| 1 $x = 8.39\text{ m}$, $y = 3.53\text{ m}$ | 2 $x = 12.1\text{ cm}$, $y = 5.12\text{ cm}$ |
| 3 $x = 6.53\text{ cm}$, $y = 1.55\text{ cm}$ | 4 $x = 34.6\text{ cm}$, $y = 29.1\text{ cm}$ |
| 5 $\theta = 46.3^\circ$ | 6 $\theta = 5.20^\circ$ |
| 7 $\theta = 59.6^\circ$ | 8 $\theta = 16.1^\circ$ |
| 9 18.4° | 10 71.6° |
| 11 56.3° | 12 144 cm |
| 13 23.3 m | 14 50.4 m |

Exercise 10

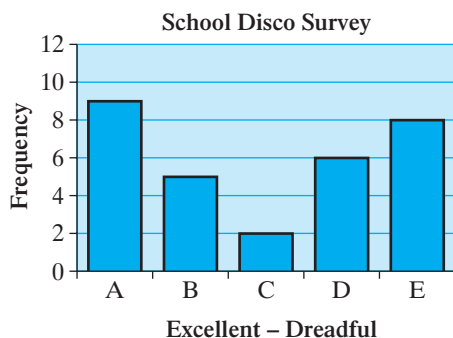
1 mean = 21, median = 21, mode = 20

2 a mean = 1.69, median = 1.72

b new mean 1.76

3 a

A	9
B	5
C	2
D	6
E	8

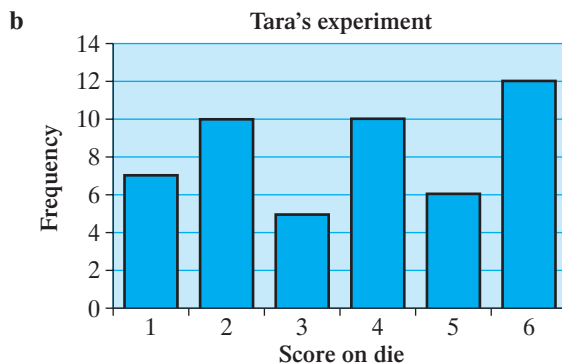


b Most felt strongly one way or the other, not so many thought it was average.

4 Strawberries 125°, bananas 75°, yoghurt 100°, iced water 60°.

5 a

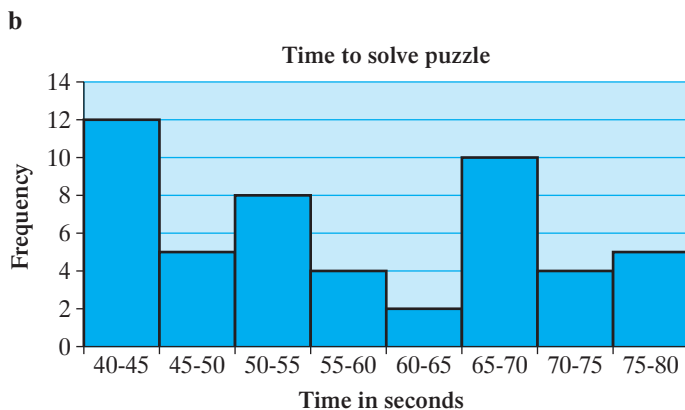
Score	Frequency
1	7
2	10
3	5
4	10
5	6
6	12



c No clear bias. (Sample is too small to draw conclusions from.)

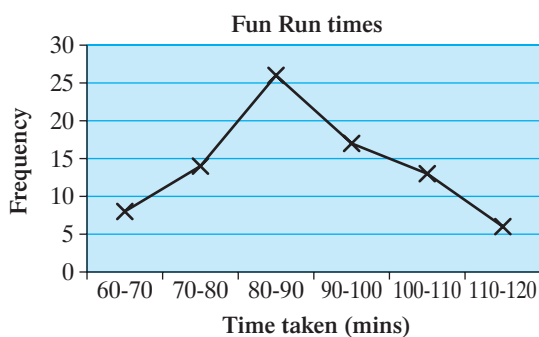
6 a

Times	Frequency
40–45	12
45–50	5
50–55	8
55–60	4
60–65	2
65–70	10
70–75	4
75–80	5



7 a 85

b



c 23.5%

8 a 14.2 m

b 1.40 m

9 a mean = 0.8, median = 0.5, mode = 0

b 0.909

Exercise 10*

1 mean = 4.83, median = 5.5, mode = 7

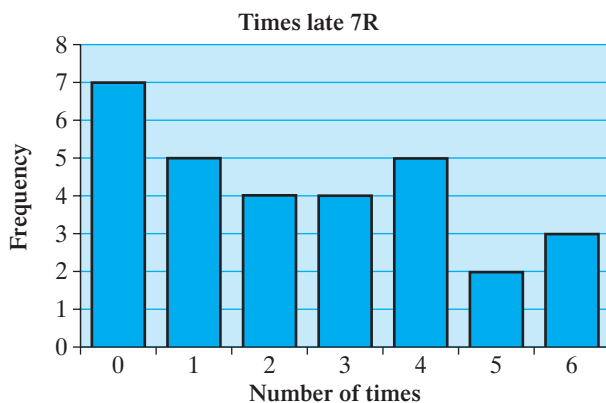
2 a mean = 7.45, median = 7.45

b new mean = 8.2

3 a Mean = 2.43, median = 2, mode = 0

b The mode as it is the most flattering figure.

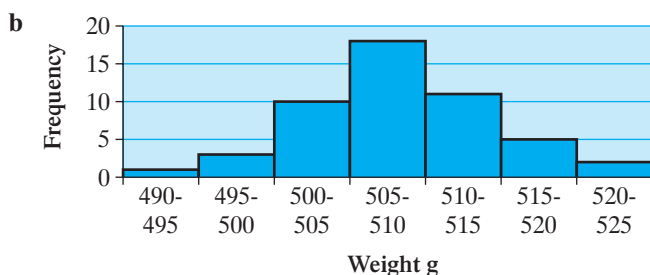
c



4 540

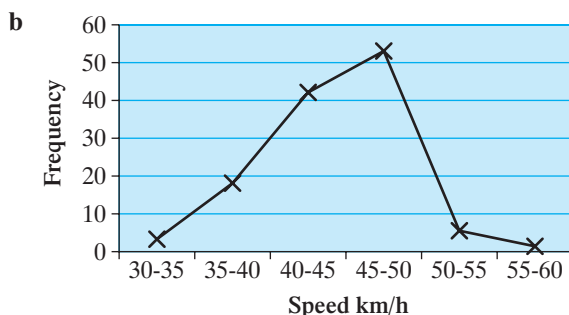
5 a

Weight g	$490 \leq w < 495$	$495 \leq w < 500$	$500 \leq w < 505$	$505 \leq w < 510$	$510 \leq w < 515$	$515 \leq w < 520$	$520 \leq w < 525$
Frequency	1	3	10	18	1	5	2



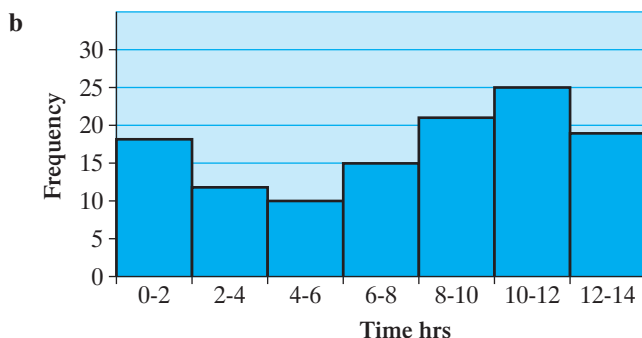
c Evidence suggests the mean is between 505 and 510 so 500 is probably minimum weight.

6 a 126



c Speed limit is probably 50 km/h as there is a sharp cut off at that speed.

7 a 15



c 46.7%

8 1.74 m

9 a 83 cm

b 9.37 cm

Examination practice 2

1 a 0.0504

b 0.00002

2 a $\frac{1}{2} \times \frac{15^3}{21} = \frac{3}{7}$

b $\frac{39}{12} + \frac{28}{12} = \frac{67}{12} = 5\frac{7}{12}$

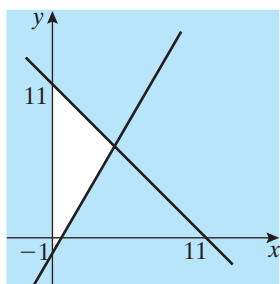
c $\frac{214}{315} \times \frac{25^5}{7} = \frac{10}{3} = 3\frac{1}{3}$

3 a 295 kg : 472 kg

b \$0.64 : \$2.24 : \$1.60

4 108

- 5 78.4 km/h
 6 27.8 seconds
 7 a $3a^2$ b $\frac{1}{2x}$ c $3b^2$
 8 $\frac{7a+2b}{14}$ b $\frac{y}{10}$ c $\frac{35x-12y-81}{20}$
 9 a ± 5 b 16 c ± 6
 10 a 68°F b 37.8°C c -40°
 11 a y^{13} b b^9 c $16a^2b^8$
 12 a b^9 b $49a^8$ c p^8
 13 a $\frac{7d}{16b}$ b $\frac{7a^2c^3}{b}$ c 3
 14 a $x > 12$ b $x \leq 7$
 15 -5, -4, -3, -2, -1, 0, 1, 2
 16 a, b, d c (4, 7)



- 17 a $x = 4.37$ b $y = 2.33$ c $z = 67.4^\circ$
 18 125°
 19 a mean = 23.4, median = 23, mode = 27 b 23
 20 $p = 80, q = 48, r = 56, s = 64, t = 50$

Exercise 11

- 1 1.12, 1.25, 75%, 99%
 2 0.88, 0.75, 75%, 99%
 3 a \$535 b \$572.45 c \$612.52 d \$655.40
 4 a £104 b £108.16 c £121.67 d £148.02
 5 a €26 250 b €27 562.50 c €31 907.04 d €66 332.44
 6 a £41 400 b £38 088 c £29 658.67 d £19 547.48
 7 a 2 b 5 c 8 d 2
 8 a 12 b 42 c 120 d 630
 9 2.64 10 4.37 11 0.245 12 6.75
 13 5.94 14 0.314 15 27.3 16 2 400 000
 17 26 200 18 15.6 19 755 000 20 25.5

Exercise 11*

- 1 a €3345.56 b 12 years
 2 a \$134 391.64 b 14 years
 3 £7366.96
 4 a \$425 570.14 b \$597 895.41
 5 €652.70
 6 a £16 769.97 b £13 887.21
 7 a HCF = 10, LCM = 420
 b HCF = 28, LCM = 420
 c HCF = 14, LCM = 210
 8 a HCF = $2xyz$, LCM = $12x^2y^2z^2$
 b HCF = $5pq$, LCM = $140pq$
 c HCF = $6a^2b^2c^2$, LCM = $36a^4b^3c^4$
 9 862 000 10 2.79 11 2.31
 12 5.68 13 14.7 14 0.104

Exercise 12

- 1 $2(a + b)$ 2 $3(x - 2y)$ 3 $a(a + 2)$ 4 $x(5 - x)$
 5 $2x(x - 2)$ 6 $5a(1 + 2a)$ 7 $x + y$ 8 $x + 2y$
 9 $1 + a$ 10 2 11 10 12 6
 13 $\frac{3}{2}$ 14 $\frac{1}{4}$ 15 0 16 $\frac{4}{3}$
 17 2 18 3 19 $-\frac{1}{2}$ 20 6
 21 $\frac{8}{3}$ 22 ± 4 23 (2, 1) 24 (3, 1)
 25 (4, 1) 26 (1.5, 3.5) 27 (1, 3) 28 (1, 1)
 29 (2, 2) 30 $(-1, 1)$ 31 (2, 1) 32 (2, 1)
 33 (1, 2) 34 (3, 1) 35 26 and 46
 36 apple 30 pence, banana 50 pence

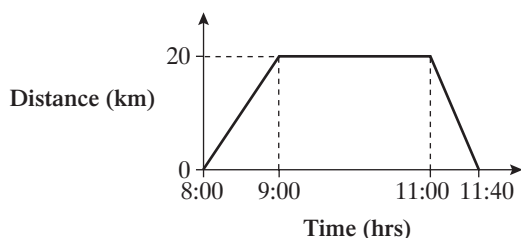
Exercise 12*

- 1 $x(x + 5)$ 2 $a(7 - a)$ 3 $2x(x + 3)$ 4 $3x(1 - 4x)$
 5 $ab(a + b)$ 6 $4xy(1 - 2xy)$ 7 $x + 2y$ 8 $x + 2$
 9 $1 + a$ 10 $2x$ 11 6 12 $\frac{3}{5}$
 13 11 14 4 15 14 16 15
 17 2 18 $\frac{1}{5}$ 19 -49 20 $\frac{3}{4}$
 21 ± 4 22 ± 8 23 (4, 1) 24 (3, 2)
 25 (1, 2) 26 (1, 1) 27 (2, 1) 28 (1, 2)

- 29 (1, 4) 30 (1, 8) 31 (3, 1) 32 (6, 2)
 33 (-1, 5) 34 (2, 1)
 35 Ash \$5, beech \$7
 36 A one minute phone call costs 20 pence, one text message costs 10 pence.

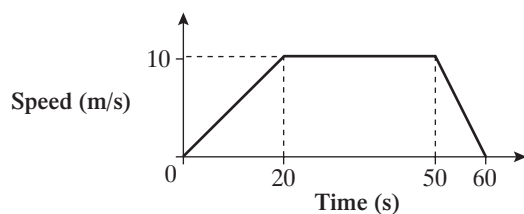
Exercise 13

- 1 8 m/s 2 -4 m/s 3 a 15 m/s b 4 s c -9 m/s
 4 a b 11:40



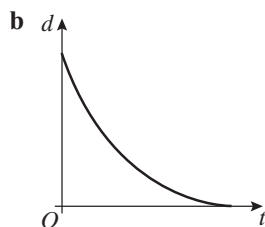
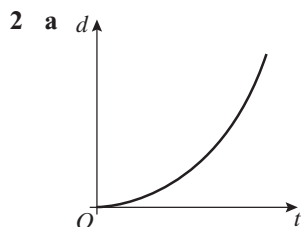
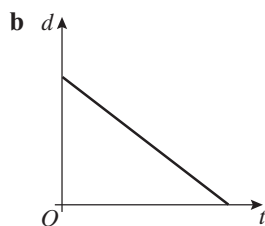
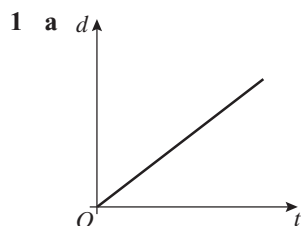
- 5 5 m/s² 6 -5 m/s² 7 a 3 m/s² b 0 m/s² c 2 m/s² d 43.3 m/s

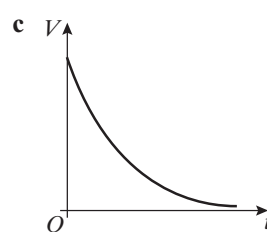
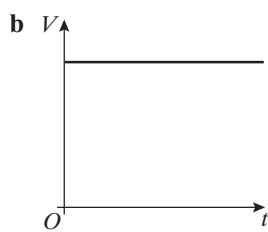
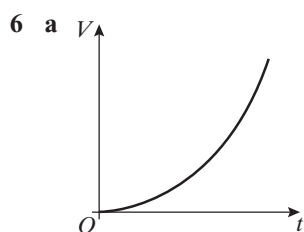
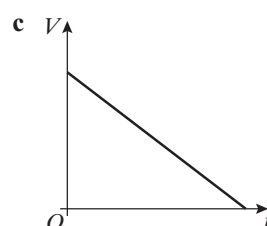
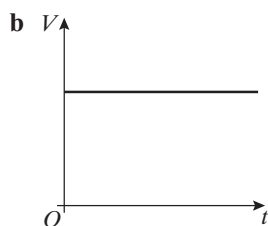
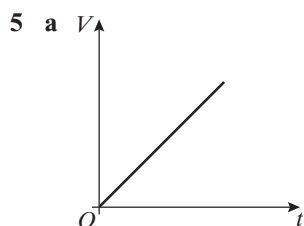
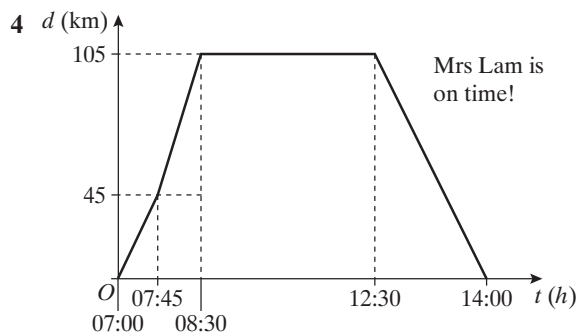
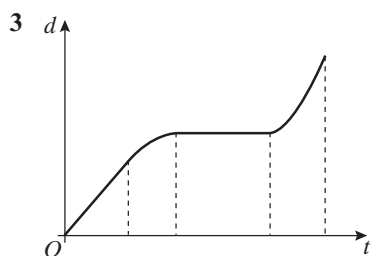
- 8 a



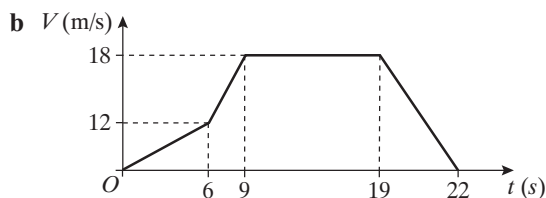
- b i 0.5 m/s² ii -1 m/s² iii 7.5 m/s

Exercise 13*





7 a $x = 6$



c i 2 m/s^2
ii 6 m/s^2
iii 13.1 m/s

8 a i 6.4 m/s

ii 23.0 km/h

b 7.08 m/s

c 0.590 m/s^2

Exercise 14

- | | | | |
|-----------------|---|-----------------------|-----------------|
| 1 7.71 cm | 2 7.50 cm | 3 21.3 cm | 4 33.1 cm |
| 5 26.0 m | 6 46.2 m | 7 53.1° | 8 64.6° |
| 9 41.8° | 10 56.6° | 11 32.6° | 12 32.9° |
| 13 1.44 m | 14 a 2250 m | b 3897 m | |
| 15 10.8° | 16 a $75.5^\circ, 75.5^\circ, 29.0^\circ$ | b 34.9 cm^2 | |

Exercise 14*

- | | | |
|------------------------|-------------------------|-------------------------|
| 1 $x = 7.71, y = 7.96$ | 2 $x = 14.3, y = 24.9$ | 3 $x = 17.3, y = 34.6$ |
| 4 $x = 17.3, y = 6$ | 5 $\theta = 16.8^\circ$ | 6 $\theta = 59.5^\circ$ |

- 7 $\theta = 50.2^\circ$ 8 $\theta = 11.0^\circ$
 9 a 13.9 km b 279.7° c 17:56, yes he does
 10 30.39 m 11 3.13 m/s 12 2.5 km
 13 1.79 m 14 82.7%

Exercise 15

- 1 a 20 b 1 c 0 d 1.4
 2 a 40 b 2 c 1 d 2.05
 3 a 50 b $16 - 20$ c 15.3
 4 a 24 b $4 < w \leq 6$ c 4.75
 5 a 25 b $17.5 < t \leq 20.5$ c 17.92 mins
 6 a 32 b $14 \leq a < 15$ c 14.3 d Decrease as below the mean

Exercise 15*

- 1 a 8 b 73 c 74 d 73.2
 2 a 7 b 2 c 26.7%
 3 a 28 days $\Rightarrow$ February b $16 - 20$ c 15.3
 4 a 1000 b $601 - 800$ c 770.5
 5 a 540 b $3000 - 3300$ c 3360
 6 a $22 - x$ b 9

Examination practice 3

- 1 a £466.19 b £473.89
 2 20.2 yrs
 3 £10 675
 4 9.45×10^{12} km = a light year.
 5 a 0.09215784314 b 9.22×10^{-2}
 6 HCF = 6, LCM = 60
 7 a $\frac{5}{xy}$ b $\frac{2x+6}{21}$
 8 $x = \frac{1}{9}$
 9 $x = -0.4, y = -9.2$
 10 a 6.43 cm b 7.66 cm c 3.66 cm d 60.3° e 120° f 12.9 cm^2
 11 a 5 m b 30.0° c 14.1 m
 12 $x = 25.8^\circ, y = 10.3 \text{ cm}$
 13 2.6 goals/game
 14 a $\Sigma fx = 72$ goals b 1.44 goals/game
 15 a 60 trains b 73 minutes c Estimate as mid-points are used.

Exercise 16

- | | | | |
|--------------------------------------|-----------------------|--------------------------------------|-----------------------|
| 1 \$120 | 2 \$20 | 3 £2500 | 4 80 seconds |
| 5 $w_{\max} = 3.52, w_{\min} = 2.93$ | | 6 $x_{\max} = 4.08, x_{\min} = 3.15$ | |
| 7 $y_{\max} = 2.33, y_{\min} = 1.73$ | | 8 $z_{\max} = 1.71, z_{\min} = 1.50$ | |
| 9 1×10^8 | 10 4×10^{13} | 11 6×10^{15} | 12 1×10^{11} |
| 13 2×10^2 | 14 2×10^3 | 15 5×10^7 | 16 5×10^8 |
| 17 4×10^{14} | 18 3×10^{15} | 19 1×10^3 | 20 2×10^{10} |

Exercise 16*

- | | | | |
|---|-----------------------|--|------------|
| 1 \$4329 | 2 €1811.59 | 3 £409.36 | 4 £2573.53 |
| 5 \$1283.76 | 6 \$888 889 | 7 €6863.56 | 8 £2326.24 |
| 9 $w_{\max} = 2.29, w_{\min} = 2.15$ | | 10 $w_{\max} = 0.159, w_{\min} = 0.125$ | |
| 11 $y_{\max} = 3.38, y_{\min} = 2.59$ | | b $P_{\max} = 14.1 \text{ m}, P_{\min} = 11.0 \text{ m}$ | |
| 12 a $A_{\max} = 15.9 \text{ m}^2, A_{\min} = 9.62 \text{ m}^2$ | | 15 2×10^{-12} | |
| 13 2×10^6 | 14 4×10^{-3} | 18 8×10^{-3} | |
| 16 7×10^4 | 17 2×10 | | |

Exercise 17

- | | | | |
|-------------------------------------|-------------------------------|-------------------------------|---------------------------------|
| 1 $x = a - 1$ | 2 $x = 1 + a$ | 3 $x = b - a$ | 4 $x = \frac{a}{3}$ |
| 5 $x = \frac{a}{b}$ | 6 $x = \frac{(a-b)}{2}$ | 7 $x = \frac{(a-2)}{b}$ | 8 $x = \frac{(a-b)}{3}$ |
| 9 $x = \frac{b}{3} - a$ | 10 $x = \frac{2b}{a}$ | 11 $x = \sqrt{\frac{a}{3}}$ | 12 $x = \sqrt{3a}$ |
| 13 $x = \sqrt{a-3}$ | 14 $x = \sqrt{a+3}$ | 15 $x = \sqrt{\frac{a-3}{2}}$ | 16 $x = \sqrt{\frac{a}{2} - 3}$ |
| 17 $x = \left(\frac{a}{3}\right)^2$ | 18 $x = (a+3)^2$ | 19 $x = (3a)^2$ | 20 $x = b + a$ |
| 21 a 45 m/s | b $t = \frac{(v-20)}{5}$ | c 2 seconds | |
| 22 a 205 | b $T = \frac{N-150}{2.5}$ | c 28 °C | |
| 23 a 1385 cm ² | b $r = \sqrt{\frac{A}{4\pi}}$ | c 4 cm | |
| 24 a $A = 4n + 2$ | b 402 cm ² | c $n = \frac{A-2}{4}$ | d 53 |

Exercise 17*

- | | | | |
|---------------------------------|-------------------------|-----------------------------|---------------------------------------|
| 1 $x = a + b$ | 2 $x = \frac{b+c}{a}$ | 3 $x = \frac{b}{a}$ | 4 $x = \frac{bc}{a}$ |
| 5 $x = \frac{c}{a} + b$ | 6 $x = b - \frac{c}{a}$ | 7 $x = a(c-b)$ | 8 $x = ac - b$ |
| 9 $x = \frac{a-b}{c}$ | 10 $x = \frac{a}{c-b}$ | 11 $x = \sqrt{\frac{b}{a}}$ | 12 $x = \sqrt{ab}$ |
| 13 $x = \sqrt{\frac{c}{a} + b}$ | 14 $x = \sqrt{a(b+c)}$ | 15 $x = \sqrt{\frac{a}{b}}$ | 16 $x = \left(\frac{b+c}{a}\right)^2$ |

17 $x = \left(\frac{c}{a} + b\right)^2$

18 $x = \frac{b}{a-1}$

19 $x = \frac{b-a}{a+b}$

20 $x = a - 2b$

21 a 20

b $A = \frac{N-2}{0.4}$

c 70 m^2

22 a 2.81 seconds

b $l = 10\left(\frac{t}{2\pi}\right)^2$

c 1.58 m

23 a £14

b $n = \frac{200}{C-10}$

c 160

24 a 291 cm^2

b $h = \frac{A}{2\pi r} - r$

c 15.9 cm

Exercise 18

1

x	-3	-2	-1	0	1	2	3
y	10	5	2	1	2	5	10

2

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

3

x	-3	-2	-1	0	1	2	3
y	19	9	3	1	3	9	19

4

x	-3	-2	-1	0	1	2	3
y	17	7	1	-1	1	7	17

5

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

6

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

7

x	-2	-1	0	1	2	3
y	5	3	3	5	9	15

8

x	-2	-1	0	1	2	3
y	-3	-5	-5	-3	1	7

9

x	-3	-2	-1	0	1	2	3	4
y	10	7	6	7	10	15	22	31

10

x	-3	-2	-1	0	1	2	3	4
y	-4	-6	-6	-4	0	6	14	24

11

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

$$x = -1 \text{ or } 2$$

12

x	-4	-3	-2	-1	0	1	2	3	4
y	6	0	-4	-6	-6	-4	0	6	14

$$x = -3 \text{ or } 2$$

13

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

$$x = -2 \text{ or } 4$$

14 a

t	0	1	2	3	4	5
y	0	5	20	45	80	125

b i 61 m **ii** 2.2 s

Exercise 18*

1

x	-3	-2	-1	0	1	2	3
y	23	10	1	-4	-5	-2	5

2

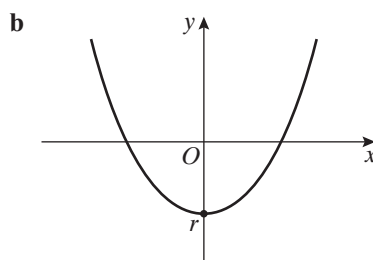
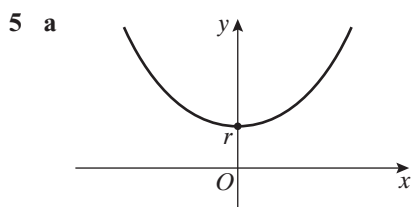
x	-3	-2	-1	0	1	2	3
y	-23	-10	-1	4	5	2	-5

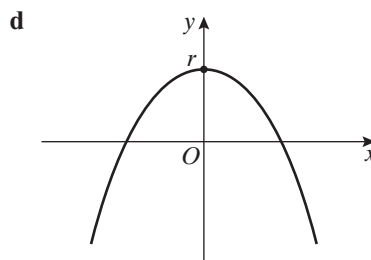
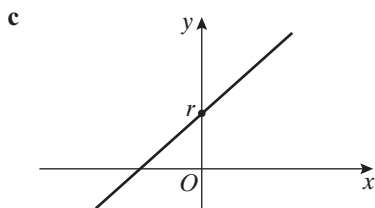
3

x	-4	-3	-2	-1	0	1	2	3	4
y	13	0	-9	-14	-15	-12	-5	6	21

4

x	0	1	2	3	4
y	9	1	1	9	25





6 a $p = 5$

b

x	0	1	2	3	4	5
y	5	0	-1	2	9	20

c $x = 1$ or 2.5

7 a $p = -4, q = -3$

b

x	-2	-1	0	1	2	3	4
y	13	3	-3	-5	-3	3	13

c $x \approx -0.6$ or 2.6

8 a $k = 3$

t	0	1	2	3	4
p	0	7	8	3	-8

c i £8333 @ $t = 1.7$ months **ii** $t > 3.3$ months

Exercise 19

- | | |
|---|---|
| 1 $a = 50^\circ, b = 280^\circ$ | 2 $a = 90^\circ, b = 30^\circ$ |
| 3 $a = 70^\circ, b = 20^\circ$ | 4 $a = 55^\circ, b = 70^\circ$ |
| 5 $a = 60^\circ$ | 6 $a = 140^\circ$ |
| 7 $a = 50^\circ$ | 8 $a = 140^\circ$ |
| 9 $a = 40^\circ, b = 20^\circ$ | 10 $a = 120^\circ, b = 30^\circ$ |
| 11 $a = 65^\circ, b = 115^\circ$ | 12 $a = 50^\circ, b = 130^\circ$ |
| 13 $a = 18, b = 14$ | 14 $a = 10.5$ |
| 15 $a = 12, b = 12$ | 16 $a = 16, b = 3$ |
| 17 $a = 6.40$ | 18 $b = 4.47$ |
| 19 $c = 15.0$ | 20 $AC = 36.6$ cm |

Exercise 19*

- | | |
|---|--|
| 1 $a = 60^\circ, b = 300^\circ$ | 2 $a = 90^\circ, b = 45^\circ$ |
| 3 $2a = 36^\circ, 3a = 54^\circ$ | 4 $a = 55^\circ, b = 35^\circ$ |
| 5 $a = 100^\circ$ | 6 $a = 80^\circ$ |
| 7 $a = 290^\circ$ | 8 $a = 102^\circ$ |
| 9 $a = 40^\circ, b = 60^\circ$ | 10 $a = 35^\circ, b = 25^\circ$ |
| 11 $a = 110^\circ, b = 70^\circ$ | 12 $a = 60^\circ, b = 60^\circ$ |

13 $a = 4.5$

14 $a = 6, b = 4.5$

15 $a = 4.5, b = 2.5$

16 **a** The angles of both triangles are the same: $55^\circ, 60^\circ, 65^\circ$

b $a = 3.61, b = 2.87$

17 $a = 5.39$

18 $a = 5.20$

19 **a** $r = 11.7$ **b** $a = 18.7$

20 **a** $XC = 2$ **b** $AC = 4.47$

Exercise 20

1 $\frac{3}{5}$

2 0.8

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

b $\frac{5}{6}$

c 1

d 0

4 **a** $\frac{3}{29}$

b $\frac{5}{29}$

c $\frac{17}{29}$

d 0

5 **a** 0

b $\frac{9}{25}$

c $\frac{16}{25}$

d $\frac{9}{25}$

6 **a** $\frac{1}{13}$

b $\frac{2}{13}$

c $\frac{3}{4}$

d $\frac{3}{26}$

7 **a** $\frac{1}{8}$

b $\frac{1}{2}$

c $\frac{3}{4}$

d $\frac{5}{8}$

8 40

9 **a** RG GR GG

b $\frac{2}{3}$

10 5

Exercise 20*

1 a	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

b **i** $\frac{1}{36}$

ii 0

iii $\frac{11}{36}$

iv $\frac{2}{9}$

2 a	10	30	50
9	10	30	50
16	16	30	50
25	25	30	50
36	36	36	50

b **i** $\frac{1}{12}$

ii 0

iii $\frac{11}{12}$

iv $\frac{1}{3}$

3 a $\frac{25}{28}$

b $\frac{1}{6}$

c 102

4 a

		Pink Box		
		$\triangle$	$\circ$	$\star$
Blue Box	$\square$	$\square\triangle$	$\square\circ$	$\square\star$
	$\square$	$\square\triangle$	$\square\circ$	$\square\star$
	$\star$	$\star\triangle$	$\star\circ$	$\star\star$

b i $\frac{5}{9}$

ii $\frac{4}{9}$

5 10

6 $\frac{8}{245}$

Examination practice 4

1 \$14 286

2 €22 727

3 a $\approx 625\,000$

b ≈ 500

4 $r_{\max} = 3.83\text{ cm}$, $C_{\min} = 23.8\text{ cm}$

5 $x = ab - Vg$

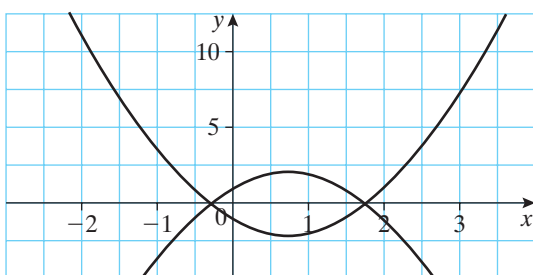
6 $x = \frac{cd + ab}{a + c}$

7 $x = (PR)^2 - Q$

8 a let $p = \sqrt{\frac{h}{5}}$, $e = \frac{t-p}{p+t}$

b $e = \frac{2}{3}$

9 a, b $x \approx -0.3$ or 1.8 for both equations.



10 a $x = 13$

b $y = 13.2$

11 12.0 units

12 $x = 6\frac{2}{3}$, $y = 12$

13 $x = 15$, $y = 9$

14 $x = 130^\circ$, $y = 25^\circ$, $z = 65^\circ$

15 $x = 70^\circ$, $y = 55^\circ$, $z = 35^\circ$

16 $x = 130^\circ$, $y = 65^\circ$, $z = 115^\circ$

17 $x = 124^\circ$, $y = 34^\circ$, $z = 62^\circ$

18 a

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

b i $\frac{1}{12}$

ii $\frac{7}{36}$

iii $\frac{5}{6}$

iv 0

- 19 a $\frac{3}{26}$ b $\frac{3}{26}$ c $\frac{11}{26}$ d $\frac{8}{13}$
 20 a HHH HHT HTH THH TTH THT HTT TTT
 b i $\frac{1}{8}$ ii $\frac{3}{8}$ iii $\frac{7}{8}$

Exercise 21

- 1 $\frac{1}{9}$ 2 $\frac{2}{9}$ 3 $\frac{1}{3}$ 4 $\frac{4}{11}$
 5 $\frac{7}{11}$ 6 $\frac{17}{99}$ 7 $\frac{71}{99}$ 8 1
 9 $\frac{4}{33}$ 10 $\frac{34}{99}$ 11 $\frac{56}{99}$ 12 $\frac{67}{99}$
 13 $\frac{26}{33}$ 14 $\frac{89}{990}$ 15 $\frac{91}{990}$ 16 36 km/h
 17 2.78 m/s 18 A: 33.3 g/£, B: 33.3 g/£ same!
 19 Square: €25/m², Octagonal: €24/m², Octagonal are better value
 20 Everamp: 20 hrs/£, Dynamo: 24 hrs/£, Dynamo is better value
 21 Tangerine: £529, Aardvark: £472, Aardvark gives better value
 22 9.45×10^{18} mm $\approx$ 1 light year.
 23 69.3 kg
 24 50 000 kg
 25 £20 397.50

Exercise 21*

- 1 $\frac{1}{45}$ 2 $\frac{7}{90}$ 3 $\frac{25}{333}$ 4 $\frac{41}{333}$
 5 $\frac{1234}{9999}$ 6 $\frac{2468}{9999}$ 7 $\frac{11}{15}$ 8 $\frac{17}{45}$
 9 $\frac{2}{1125}$ 10 $\frac{211}{9000}$
 11 £19.19 12 Aus \$28.94
 13 224.80 Ringitts
 14 4122 Ringitts, 104 064 Rupees, 27 504 Yuan.
 15 Aus: £1500, Braz: £1400, USA £1250. USA cheapest.
 16 a +73 285 608 b +2.32 people/s c +4.12 babies/s d 1.80 people/s

Exercise 22

- 1 $x + 7x + 12$ 2 $x^2 + 8x + 7$ 3 $x^2 - 8x - 6$
 4 $x^2 + 5x - 6$ 5 $x^2 - 6x + 8$ 6 $x^2 + 2x + 1$
 7 $x^2 - 4x + 4$ 8 $x^2 - 4$ 9 $2x^2 + 5x + 2$
 10 $3x^2 + 8x - 3$ 11 $x(x + 3)$ 12 $x(x - 2)$
 13 $x(x + 1)$ 14 $x(x - 4)$ 15 $(x - 2)(x + 2)$
 16 $(x - 6)(x + 6)$ 17 $(x + 3)(x + 4)$ 18 $(x - 3)(x + 4)$
 19 $(x - 4)(x + 3)$ 20 $(x - 4)(x - 3)$ 21 $(x + 6)(x + 2)$

- 22 $(x - 6)(x + 2)$
 25 $(x + 12)(x + 1)$
 28 $(x + 1)(x - 12)$
 31 $-4, 3$
 34 -4
 37 $-2, 4$
 40 $-3, -1$
 43 $1, 5$
 46 $-6, 1$
 49 ± 2
 52 $0, 4$
 55 a $x^2 + 2x$ b 3

- 23 $(x + 6)(x - 2)$
 26 $(x + 12)(x - 1)$
 29 $-1, -3$
 32 $1, 2$
 35 $-7, 0$
 38 $-5, 3$
 41 $-4, 1$
 44 $-3, 2$
 47 $2, 4$
 50 ± 5
 53 2 seconds

- 24 $(x - 6)(x - 2)$
 27 $(x - 1)(x - 12)$
 30 $-2, 1$
 33 2
 36 $0, 5$
 39 $-2, -1$
 42 $1, 3$
 45 $2, 3$
 48 -1
 51 $-2, 0$
 54 6

Exercise 22*

- 1 $x^2 + 11x + 24$
 4 $x^2 + 16x + 64$
 7 $6x^2 + 5x + 1$
 10 $25x^2 - 40x + 16$
 13 $(x - 7)(x + 7)$
 16 $3(x - 4)(x + 4)$
 19 $(x - 6)(x + 4)$
 22 $(x - 8)(x - 3)$
 25 $(x + 12)(x - 2)$
 28 $(x - 24)(x + 1)$
 31 5
 34 $-5, 2$
 37 $-2, 3$
 40 $-4, -2$
 43 $-5, 2$
 46 3
 49 $-13, 0$
 52 $-5, 4$
 54 4, 10

- 2 $x^2 - 3x - 10$
 5 $x^2 - 10x + 25$
 8 $8x^2 + 2x - 6$
 11 $x(x + 49)$
 14 $(x - 12)(x + 12)$
 17 $(x + 6)(x + 4)$
 20 $(x + 8)(x + 3)$
 23 $(x + 12)(x + 2)$
 26 $(x + 24)(x + 1)$
 29 $-5, 11$
 32 $0, 13$
 35 $-8, 7$
 38 $-\frac{1}{3}, -\frac{1}{2}$
 41 $-1, 7$
 44 $-9, 1$
 47 ± 9
 50 $0, 81$
 53 a $x^2 + 5x$ b 10 cm
 55 b 30

- 3 $x^2 - 49$
 6 $x^2 - 81$
 9 $9x^2 - 25$
 12 $x(x - 144)$
 15 $2(x + 6)(x - 6)$
 18 $(x - 6)(x - 4)$
 21 $(x - 8)(x + 3)$
 24 $(x - 12)(x - 2)$
 27 $(x + 24)(x - 1)$
 30 $-7, -2$
 33 $3, 6$
 36 $-1, 3$
 39 $-5, -1$
 42 $3, 4$
 45 -2
 48 ± 7
 51 $-3, 5$

Exercise 23

- 1 13, 16, 19
 4 2, $-1, -4$
 7 16, 32, 64
 2 $-3, -1, 1$
 5 25, 36, 49
 8 $10^4, 10^5, 10^6$
 3 4, 0, -4
 6 15, 17, 19
 9 64, 32, 16

- 10 15, 21, 28
 11 2, 3, 4
 12 -1, 0, 1
 13 5, 7, 9
 14 -2, 1, 4
 15 2, -1, -4
 16 0, -2, -4
 17 4, 7, 12
 18 -1, 2, 7
 19 $5, 4\frac{1}{2}, 4\frac{1}{3}$
 20 6, 3, 2
 21 12
 22 9
 23 7
 24 8
 25 5
 26 6
 27 10
 28 8
 29 4
 30 6
 31 4
 32 11
 33 9
 34 4
 35 $n + 4$
 36 $2n + 2$
 37 $4n + 3$
 38 $3n + 2$
 39 $n - 3$
 40 $3n - 8$
 41 $4 - n$
 42 $6 - 2n$
 43 $-1 - n$
 44 $-3 - 2n$
 45 a €42 b 10 months c €2 d €270
 46 a 220 b 8 c 10 d 3670

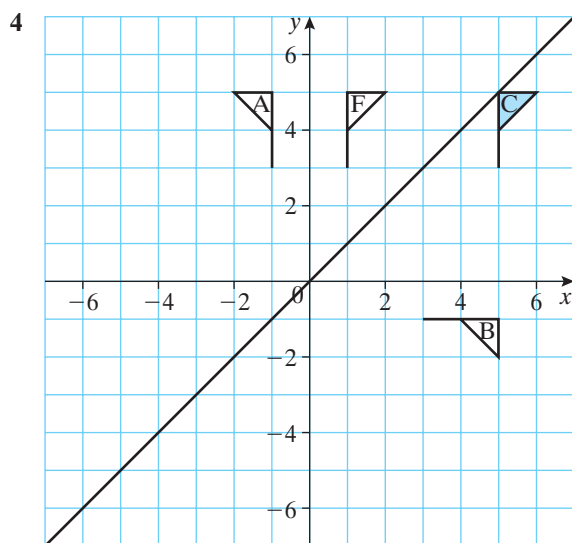
Exercise 23*

- 1 28, 33, 38
 2 5, -3, -11
 3 7, 8.5, 10
 4 1.3, 1.6, 1.9
 5 0, -2.5, -5
 6 81, 243, 729
 7 $4, 1, \frac{1}{4}$
 8 16, -32, 64
 9 $\frac{1}{8}, \frac{1}{16}, \frac{1}{32}$
 10 13, 21, 34
 11 8, 13, 18
 12 -3, 1, 5
 13 5, -1, -7
 14 $1\frac{1}{2}, 2, 2\frac{1}{2}$
 15 -3, 0, 5
 16 2, 9, 28
 17 2, 6, 12
 18 2, 4, 8
 19 $2, 2\frac{1}{2}, 3\frac{1}{3}$
 20 $3, 1, \frac{1}{3}$
 21 7
 22 9
 23 6
 24 3
 25 5
 26 8
 27 12
 28 9
 29 3
 30 5
 31 19
 32 5
 33 9
 34 100
 35 $2n + 3$
 36 $4n + 5$
 37 $3n - 8$
 38 $5n - 4$
 39 $26 + 4n$
 40 $13 + 5n$
 41 $7 - 2n$
 42 $5 - 4n$
 43 $-4 - 3n$
 44 $-5 - 6n$
 45 a 4000 kg b 150 days c 100 kg/day
 46 a 1.8×10^5 b 6.57×10^9 c 2778 days or 7.61 years

Exercise 24

- 1 a (3, -4) b (-3, 4) c (4, -3) d (10, -2)
 2 a (-3, -5) b (3, 5) c (-5, -3) d (-8, 8)

- 3 a $A'(1, -2), B'(1, -6), C'(8, -2)$
 b $A'(-2, 1), B'(-6, 1), C'(-2, 8)$
 c $A'(-4, 6), B'(-4, 10), C'(3, 6)$
 d $A'(2, 0), B'(2, 8), C'(16, 0)$



- c Rotation of 90° clockwise around O.
 e Translation along $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$
 5 $x = -11, y = -1$

Exercise 24*

- 1 $A(1, -5), B(-1, -5), C(1, -9)$
 2 d Translation along vector $\begin{pmatrix} -2 \\ 2 \end{pmatrix}$
 3 e Rotation of -90° about $(0, -1)$
 f Enlargement of scale factor +2 centre $(-1, -4)$

Exercise 25

Question	Median	Q_1	Q_3	Range	IQR
1	6	1	7	8	6
2	5	1	6	9	5
3	4	1.5	7	11	5.5
4	62	48	83	69	35
5	2	0	3	5	3

Note that answers to Q6 – 8 are approximate as they are read off graphs.

6 a

Time (t mins)	C.F.
$0 < t \leq 10$	3
$10 < t \leq 20$	10
$20 < t \leq 30$	25
$30 < t \leq 40$	52
$40 < t \leq 50$	71
$50 < t \leq 60$	80

c $Q_2 = 36$, $Q_1 = 27$, $Q_3 = 43$, $IQR = 16$ d 50 students

7 a

Speed (s m.p.h.)	C.F.
$s \leq 55$	0
$55 < s \leq 60$	6
$60 < s \leq 65$	25
$65 < s \leq 70$	71
$70 < s \leq 75$	85
$75 < s \leq 80$	90

c $Q_2 = 67$, $Q_1 = 64.5$, $Q_3 = 69.5$, $IQR = 5$ d 18%

8 a

Weight (w kilograms)	Country A C.F.	Country B C.F.
$w \leq 2.0$	0	0
$2.0 < w \leq 2.5$	14	0
$2.5 < w \leq 3.0$	43	3
$3.0 < w \leq 3.5$	66	23
$3.5 < w \leq 4.0$	80	74
$4.0 < w \leq 4.5$	80	80

c Country A: $Q_2 = 2.95$, $Q_1 = 2.62$, $Q_3 = 3.37$, $IQR = 0.75$
 Country B: $Q_2 = 3.65$, $Q_1 = 3.45$, $Q_3 = 3.78$, $IQR = 0.33$
 d Babies heavier in country B, more variation in weight in country A.

Exercise 25*

Question	Median	Q_1	Q_3	Range	IQR
1	6	5	8	9	3
2	3.9	2.1	9.0	9	6.9
3	67	42	77	84	35
4	0.56	0.46	0.68	0.7	0.22
5	2	1	2.5	5	1.5

6 a

Time (t mins)	C.F.
$0 < t \leq 20$	3
$20 < t \leq 40$	10
$40 < t \leq 60$	21
$60 < t \leq 80$	31
$80 < t \leq 100$	52
$100 < t \leq 120$	77
$120 < t \leq 140$	100

c $Q_2 = 98$, $Q_1 = 68$, $Q_3 = 119$, $IQR = 51$ **d** 35%

7 a

Time (t milliseconds)	C.F. before drink	C.F. after drink
$t \leq 160$	0	0
$160 < t \leq 180$	10	0
$180 < t \leq 200$	45	0
$200 < t \leq 220$	76	8
$220 < t \leq 240$	80	49
$240 < t \leq 260$	80	74
$260 < t \leq 280$	80	80

c Before drink $Q_2 = 197$, $Q_1 = 189$, $Q_3 = 206$, $IQR = 17$

After drink $Q_2 = 237$, $Q_1 = 229$, $Q_3 = 245$, $IQR = 16$

d Drink lengthens reaction times by approximately 40 milliseconds, but doesn't affect the spread. This possibly means that everybody is equally affected.

8 a

Diameter (d cm)	Frequency Short Wood	Frequency Waley Wood
$0 < d \leq 10$	6	2
$10 < d \leq 20$	15	5
$20 < d \leq 30$	27	12
$30 < d \leq 40$	50	50
$40 < d \leq 50$	71	92
$50 < d \leq 60$	85	98
$60 < d \leq 70$	95	100
$70 < d \leq 80$	100	100

c Short Wood $Q_2 = 40$, $Q_1 = 29$, $Q_3 = 53$, $IQR = 24$

Waley Wood $Q_2 = 40$, $Q_1 = 36$, $Q_3 = 46$, $IQR = 10$

d Waley Wood is much more uniform in size. This possibly means it is a plantation with all the trees having been planted at the same time. Short Wood is more diverse in size, possibly a wild wood.

Examination practice 5

- 1 a 1.8^9 , 198 b 13.2^6 , 5 290 000 c 1.24^9 , 6.93
 2 30 m
 3 38.6
 4 a 6000 b 3600 seconds c 1.67 m/s
 5 a 800 g b 800 kg
 6 £2.65
 7 Recur. Denominator does not consist solely of powers of 2 and/or 5
 8 a $x^2 + 7x + 10$ b $y^2 + 2y - 99$ c $9 - 6p + p^2$
 9 a $15x^2 + x - 6$ b $a^2 - 6ab + 9b^2$
 10 a $x(x - 3)$ b $(x - 7)(x + 7)$ c $(x + 1)(x + 2)$ d $(x + 1)(x - 8)$
 11 a $(x - 7)(x - 3)$ b $3p^2(p - 2)(p + 2)$
 12 a $-4, -3$ b $-2, 3$ c $0, 3$ d $2, 10$
 13 a $a(a - b)$ b 987 654 321
 14 a i 38, 45 ii $7n - 4$ iii 381
 b i 14, 10 ii $34 - 4n$ iii -186
 15 3 years
 16 a $(x - 1)^2 + (4x)^2 = (4x + 1)^2$ b $x = 10$
 17 a $x(x + 5) = 36$ b $x = 4$, dimensions are 4 cm by 9 cm c 47.9°
 18 d Translation of $\begin{pmatrix} 10 \\ 10 \end{pmatrix}$ e $x + y = 14$ f 180° g $(11, 3)$ i $(15, 15), \frac{1}{3}$
 19 median = 23.5, $Q_1 = 17.5$, $Q_3 = 31$, range = 28, IQR = 13.5
 20 a 60 b

Weight (w g)	C.F.
$66 < w \leq 68$	5
$68 < w \leq 70$	18
$70 < w \leq 72$	36
$72 < w \leq 74$	46
$74 < w \leq 76$	54
$76 < w \leq 78$	60

- d $Q_1 = 69.6$, $Q_2 = 71.4$, $Q_3 = 73.7$
 e IQR = 4.1
 f 15%