Chapter 25

Exercise 25A

1 **a** $119.5\,cm^2$
b $51.7\,cm^2$
c $34.7\,cm^2$
d $92.7\,km^2$
e $45.3\,mm^2$
f $124.4\,cm^2$

2 Purple flag cheaper by 58p

3 2

4 $800\,cm^2$

5 $6.7\,km^2$

6 $11.1\,m^2$

7 The triangle on the right

8 $17.1\,cm^2$

9 **a** $15.6\,cm^2$
b $12.7\,cm^2$
c $10.6\,cm^2$

Exercise 25B

1 **a** 6 cm
b 7.5 m
c 11 mm
d 12.2 km
e 31.5 mm
f 14 cm

2 **a** 42°
b 110°
c 74.9°
d 80.1°
e 63.4°
f 43°

3 45°

4 3.8 m

5 10.77 cm

6 $18.69\ cm^2$

Activity p. 297

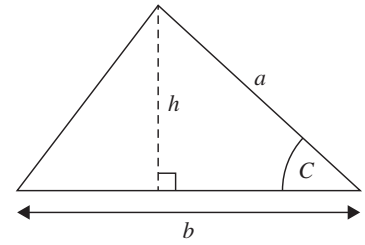
1 Pupil's own answers

2 $Area = \frac{1}{2}bh$

$\sin C = \frac{h}{a}$

$\Rightarrow h = a\sin C$

$\Rightarrow Area = \frac{1}{2}ba\sin C$



Chapter 26

Exercise 26A

1 **a** 15.2 cm
b 4.85 cm
c 19.2 cm
d 15.2 cm
e 16.7 cm
f 21.1 cm

2 **a** 81.9°
b 47.3°
c 50.8°
d 77.2°
e 102.6°
f 87.3°

3 **a** 110.7
b 122.4
c 110.4

4 3.57 km

5 20.5°

6 4 m

7 27.3 m

8 **a** 3.4 m
b 2.4 m

9 **a** 48.5°, 44.5°
b 3.2 m

10 588 m

Exercise 26B

1 **a** 7.99 cm
b 7.57 cm
c 22.67 cm
d 31.48 cm
e 10.24 cm
f 13.95 cm

2 4.1 cm

3 3 cm

4 £4106

5 **a** 15.2 cm
b 7.8 cm

Exercise 26C

1 **a** 111.8°
b 84.1°
c 56.6°
d 88.6°

2 71.3°

3 20.2°

4 29.8°

5 $\cos(A) = \frac{x^2 + x^2 - x^2}{2x^2} = \frac{1}{2}$

6 346.5 m

Exercise 26D

1 **a** 14.54 cm
b 13.72 cm
c 33.05°
d 63.03°
e 6.84 cm
f 26.59 cm
g 73.62°
h 113.33°
i 125.38°

2 **a** 3.62 cm
b 7.24 cm

3 8.72 cm

4 59.1°

5 23.9°, 11°

6 10.41 cm

Activity p. 306

1 Cosine rule becomes Pythagoras' Theorem

Chapter 27

Exercise 27A

1 **a** 102°
b 139°
c 50°
d 240°

2 **a** **r** 23°, **s** 84°, **t** 41°, **v** 287°
b **e** 50°, **f** 130°, **g** 230°

3 324°

Exercise 27B

1 8.84 km

2 23.99 km

3 10.79 km

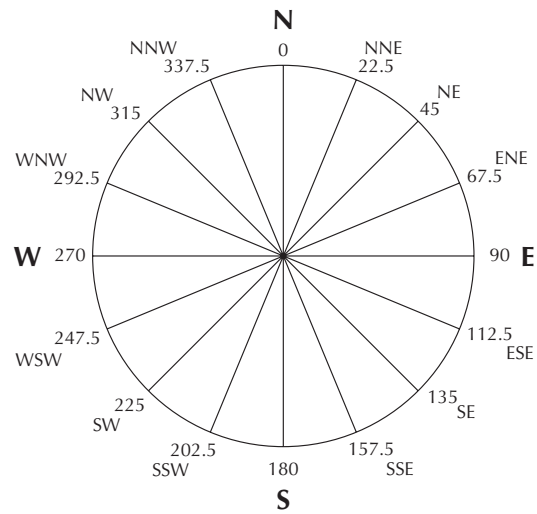
4 **a** 15.89 km
b 227°

5 170.53 miles

6 5.36 km, 5.71 km

Activity p. 310

1



2 Pupil's own answers

Chapter 28

Exercise 28A

1 **a** $\begin{pmatrix} 2 \\ 6 \end{pmatrix}$ AB

b $\begin{pmatrix} 1 \\ -6 \end{pmatrix}$ CD

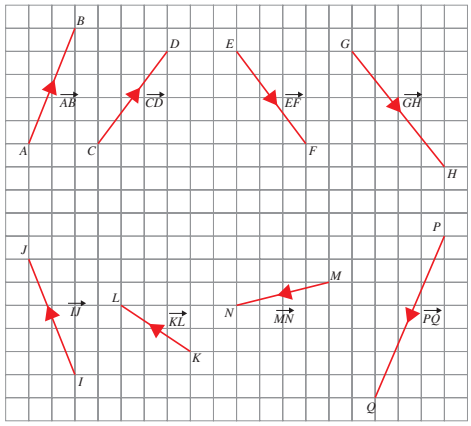
c $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$ EF

d $\begin{pmatrix} -4 \\ -2 \end{pmatrix}$ GH

e $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$ IJ

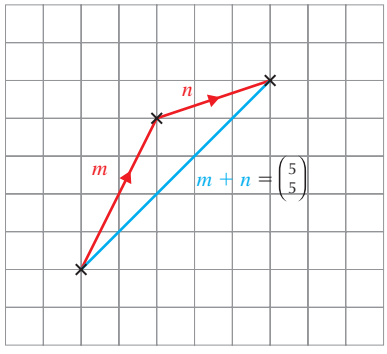
f $\begin{pmatrix} 0 \\ -4 \end{pmatrix}$ KL

2

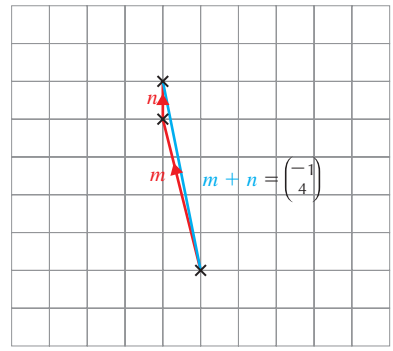


Exercise 28B

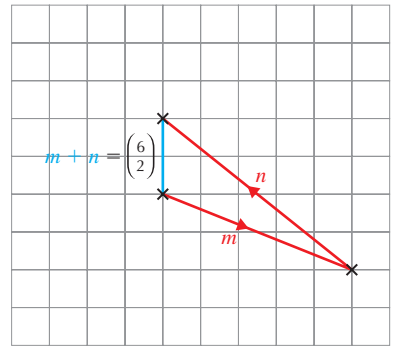
1 **a**



b



c

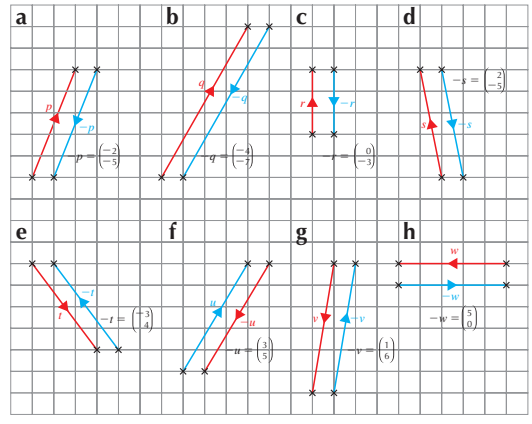


2 **a** $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$

b $\begin{pmatrix} 3 \\ 7 \end{pmatrix}$

c $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$

3



4 **a** $\begin{pmatrix} -2 \\ 7 \end{pmatrix}$

b $\begin{pmatrix} 6 \\ 2 \end{pmatrix}$

c $\begin{pmatrix} 4 \\ 11 \end{pmatrix}$

d $\begin{pmatrix} 11 \\ 6 \end{pmatrix}$

5 **a** $\begin{pmatrix} 6 \\ 15 \end{pmatrix}$

b $\begin{pmatrix} 2 \\ 5 \end{pmatrix}$

c $\begin{pmatrix} -12 \\ 16 \end{pmatrix}$

d $\begin{pmatrix} -8 \\ -10 \end{pmatrix}$

e $\begin{pmatrix} -12 \\ 20 \end{pmatrix}$

6 **a** $\begin{pmatrix} 3 \\ 8 \end{pmatrix}$

b $\begin{pmatrix} 12 \\ 20 \end{pmatrix}$

c $\begin{pmatrix} 5 \\ -9 \end{pmatrix}$

d $\begin{pmatrix} 19 \\ 10 \end{pmatrix}$

e $\begin{pmatrix} -1 \\ 19 \end{pmatrix}$

f $\begin{pmatrix} -12 \\ 8 \end{pmatrix}$

g $\begin{pmatrix} 1 \\ 8 \end{pmatrix}$

h $\begin{pmatrix} -2 \\ -11 \end{pmatrix}$

7 $\begin{pmatrix} 22 \\ 4 \end{pmatrix}$

8 **a** $\begin{pmatrix} 3 \\ 11 \end{pmatrix}$

b $\begin{pmatrix} 6 \\ 26 \end{pmatrix}$

9 **a** $\begin{pmatrix} -2 \\ -8 \end{pmatrix}$

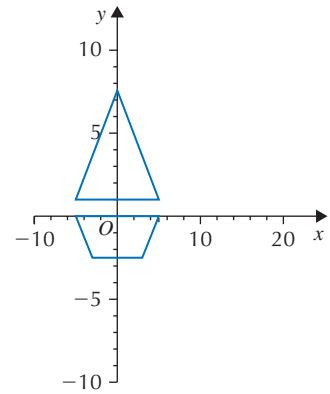
b $\begin{pmatrix} -7 \\ -8 \end{pmatrix}$

Activity p. 317

1 AB = (2, 3), BC = (1, 2), CD = (2, −3), AM = (4, 0), MD = (2, 1)

AD = AB + CD, AD = AB + BC + CD − MD

2



Chapter 29

Exercise 29A

1 **a** *A* (0, 0, 0)
B (6, 0, 0)
C (6, 3, 0)
D (0, 3, 0)
E (0, 0, 4)
F (6, 0, 4)
G (6, 3, 4)
H (0, 3, 4)

b *A* (0, 0, 0)
B (12, 0, 0)
C (12, 4, 0)

D (0, 4, 0)
E (0, 2, 4)
F (12, 2, 4)

c *A* (–2, 0, 0)
B (1, 0, 0)
C (1, 2, 0)
D (–2, 2, 0)
E (–2, 0, 3)
F (1, 0, 3)

d *A* (0, 0, 0)
B (6, 0, 0)
C (6, 6, 0)
D (0, 6, 0)

e *B* (5, –3, –1)
C (5, 0, –1)
D (0, 0, –1)
E (0, –3, 6)
F (5, –3, 6)
G (5, 0, 6)
H (0, 0, 6)

2 a (4, 0, 4)
b (8, 0, 2)
c (8, 1.5, 4)

3 a (0, 1, 2)
b (10, 1, 2)
c (5, 1, 2)

4 a 10
b 6
c 11.7
d 31°

5 a (0, 120, 0), (0, 180, 0), (30, 120, 0), (30, 180, 0), (0, 120, 120), (0, 180, 120), (30, 120, 120), (30, 180, 120)
b (75, 300, 80), (275, 300, 80), (75, 300, 180), (275, 300, 180)
c (175, 150, 200)
d $21\,m^3$

Activity p. 320

1 54.45°
2 Pupil's own answers

Chapter 30

Exercise 30A

1 a $\begin{pmatrix} 7 \\ 12 \end{pmatrix}$
b $\begin{pmatrix} 1 \\ 11 \end{pmatrix}$
c $\begin{pmatrix} 9 \\ 3 \\ 4 \end{pmatrix}$
d $\begin{pmatrix} 0 \\ 11 \\ 3 \end{pmatrix}$
e $\begin{pmatrix} -2 \\ 2.5 \\ -1 \end{pmatrix}$
f $\begin{pmatrix} 0 \\ -2 \\ 0 \end{pmatrix}$

2 a $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$
b $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$
c $\begin{pmatrix} -7 \\ -2 \end{pmatrix}$
d $\begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix}$
e $\begin{pmatrix} -7 \\ -1 \\ 2 \end{pmatrix}$
f $\begin{pmatrix} 7 \\ 3 \\ -1 \end{pmatrix}$

3 i $\begin{pmatrix} 2 \\ 6 \end{pmatrix}, \begin{pmatrix} 5 \\ -2 \end{pmatrix}; \begin{pmatrix} 7 \\ 4 \end{pmatrix}$
ii $\begin{pmatrix} 0 \\ 6 \end{pmatrix}, \begin{pmatrix} 5 \\ -3 \end{pmatrix}; \begin{pmatrix} 5 \\ 3 \end{pmatrix}$

iii $\begin{pmatrix}2\\-6\end{pmatrix}, \begin{pmatrix}5\\4\end{pmatrix}; \begin{pmatrix}7\\-2\end{pmatrix}$

iv $\begin{pmatrix}-6\\0\end{pmatrix}, \begin{pmatrix}8\\-4\end{pmatrix}; \begin{pmatrix}2\\-4\end{pmatrix}$

4 a **i** $\begin{pmatrix}24\\4\end{pmatrix}$; **ii** $\begin{pmatrix}-4\\22\end{pmatrix}$; **iii** $\begin{pmatrix}-17\\0\end{pmatrix}$; **iv** $\begin{pmatrix}-15\\40\end{pmatrix}$

b **i** $\begin{pmatrix}20\\4\end{pmatrix}$; **ii** $\begin{pmatrix}-10\\22\end{pmatrix}$; **iii** $\begin{pmatrix}-15\\0\end{pmatrix}$; **iv** $\begin{pmatrix}-25\\40\end{pmatrix}$

c **i** $\begin{pmatrix}24\\4\end{pmatrix}$; **ii** $\begin{pmatrix}-4\\26\end{pmatrix}$; **iii** $\begin{pmatrix}-17\\-6\end{pmatrix}$; **iv** $\begin{pmatrix}-15\\-50\end{pmatrix}$

d **i** $\begin{pmatrix}20\\-16\end{pmatrix}$; **ii** $\begin{pmatrix}-34\\8\end{pmatrix}$; **iii** $\begin{pmatrix}-18\\12\end{pmatrix}$; **iv** $\begin{pmatrix}-70\\20\end{pmatrix}$

5 a $a = 6$

b $x = 2,\ y = -6,\ z = 0$

c $a = 4,\ b = 2$

Exercise 30B

1 a 5

b $\sqrt{65}$

c 25

d $\sqrt{193}$

e $\sqrt{29}$

f $\sqrt{174}$

g $\sqrt{65}$

h $5\sqrt{2}$

2 a $\sqrt{193}$

b $\sqrt{122}$

c $\sqrt{2}$

d $\sqrt{85}$

e $\sqrt{106}$

f $\sqrt{130}$

g $\sqrt{11.25}$

h $\sqrt{10}$

i $\sqrt{2}$

j $\sqrt{5}$

k $\sqrt{53}$

l $\sqrt{6}$

m $3\sqrt{6}$

n $\sqrt{59}$

3 $2\sqrt{13}$

4 a $2\sqrt{6}$

b $\sqrt{35}$

c $\sqrt{59}$

d $4\sqrt{6}$

e $3\sqrt{35}$

f $\sqrt{411}$

g $2\sqrt{89}$

h $\sqrt{635}$

5 13 km

Activity p.326

1 Yes

2 No

3 $\mathbf{a} + \mathbf{a} = 2\mathbf{a}$

Chapter 31

Exercise 31A

1 114 000

2 288

3 510

4 13 200

Exercise 31B

1 19 500

2 13 500

3 31 500

4 2.5 mg

5 76.8 cm

6 £135 061

7 22 200

8 £5953

9 Unsuccesful: They are 6 tonnes short

10 9 years

11 a 3.57%

b £64 436

12 a £27 601

b £2452

13 20 years

Activity p. 332

a 1.53 million km^2

b Pupil's own answers

Exercise 31C

1 **a** £3377

b £377

2 £657

3 **a** Danny: £442. Michael: £263

b 5 years

4 **a** £733.76

b £955.37

5 **a** £30 125

b **i** £28753

ii £1372

Activity p. 334

There is an error in the printed question. The forth paragraph should end:

The **daily** interest rate for the loan advertised above is 0.8%. How much would be owed by the end of a year if the borrower was not in a position to pay anything back?

Answer: £9163.60; 1733%

Exercise 31D

1 £9239

2 40 889

3 750

4 115 000

5 £3000

6 26 000

7 450g

8 £8500

9 21 500

10 £618.67

11 £550

Exercise 31E

1 £200

2 £120

3 £90

4 £35

5 300

6 £360

7 £400

Activity p. 337

1 He made a loss

Chapter 32

Exercise 32A

1 **a** $\frac{5}{4}$

b $\frac{28}{15}$

c $\frac{3}{2}$

d $\frac{5}{6}$

e $\frac{5}{6}$

f $\frac{15}{16}$

g $\frac{5}{4}$

h $\frac{5}{9}$

i $\frac{9}{10}$

j $\frac{3}{4}$

k $\frac{1}{12}$

l $\frac{3}{8}$

2 **a** $\frac{45}{2}$

b $\frac{15}{2}$

c $\frac{56}{3}$

d $\frac{27}{2}$

e $\frac{128}{5}$

f 18

g 6

h $\frac{25}{2}$

3 20

4 14

Exercise 32B

1 **a** $5\frac{10}{21}$

b $9\frac{5}{12}$

c $9\frac{3}{10}$

d $6\frac{1}{6}$

e $9\frac{7}{30}$
f $8\frac{13}{14}$
g $9\frac{44}{45}$
h $6\frac{7}{12}$

2 **a** $4\frac{1}{2}$
b $5\frac{1}{4}$
c $3\frac{3}{10}$
d $3\frac{7}{12}$
e $1\frac{33}{35}$
f $5\frac{7}{8}$
g $2\frac{41}{45}$
h $2\frac{5}{8}$

3 $7\frac{5}{6}$

4 $2\frac{1}{6}$

5 $22\frac{5}{12}$

6 $5\frac{1}{24}$

Exercise 32C

1 **a** $2\frac{8}{9}$
b 9
c $10\frac{11}{16}$
d $3\frac{1}{2}$
e $7\frac{7}{15}$
f $22\frac{1}{24}$
g $5\frac{1}{16}$
h $12\frac{19}{27}$

2 **a** $1\frac{8}{21}$
b $1\frac{19}{44}$
c $2\frac{4}{15}$
d $2\frac{4}{57}$
e $\frac{110}{189}$
f $\frac{57}{80}$
g $2\frac{5}{8}$
h $1\frac{5}{9}$

3 **a** $8\frac{2}{3}$
b $16\frac{13}{20}$

4 $16\frac{5}{8}$km

5 $2\frac{51}{76}$

Activity p. 343

1 **a** circumference = 44 cm, area = 154 cm^2
b 77 cm^3

2 **a** 10.5
b 258.75
c 57

Exercise 32D

1 **a** $\frac{4}{15}$
b $\frac{17}{60}$
c $1\frac{47}{100}$
d $3\frac{13}{54}$
e $\frac{1}{6}$
f $\frac{13}{30}$
g 2

2 **a** $4\frac{3}{8}$
b $6\frac{7}{8}$
c $1\frac{1}{3}$
d $\frac{21}{40}$
e $3\frac{2}{15}$
f $3\frac{5}{6}$

Chapter 33

Exercise 33A

1 **a** mean = 7, sd = 2.45
b mean = 21, sd = 6.54

2 mean = 136, sd = 11.7

3 mean = 2, sd = 0.65

4 **a** mean = 528, sd = 160
b mean = 156, sd = 48.5
c Less rainfall and less variance in rainfal in New Delhi than Mumbai

5 **a** mean = 3258, sd = 855
b Women get paid less on average, but there is more variation.

6 **a** mean = 60, sd = $\sqrt{2}$
b Their claim is valid

7 **a** mean = 58, sd = 9.8
b Both samples have averages in the late fifties/early sixties

c The total population in the US is larger so we would need a larger sample size.

8 **a** mean = 10.6, sd = 1.7

b **i** mean = 16.2, sd = 14.9

ii mean increases, standard deviation greatly increases.

Activity p. 351

a Pupil's own answers

Exercise 33B

1 **a** Q1 = 3, Q2 = 6, Q3 = 7.75

b Q1 = 29, Q2 = 38.5, Q3 = 46.5

c Q1 = 3.075, Q2 = 5.3, Q3 = 7.5

2 **a** **i** 15

ii 14, 17

iii 3

b **i** 15

ii 12, 22

iii 10

c Rat length is more inconsistent, average length is the same

3 **a** **i** 140.3

ii 138.15, 144.5

iii 6.35

b Rural prices are less consitent

4 **a** Q1 = 22, Q2 = 29, Q3 = 40.5

b **i** Range = 56

ii IQR = 18.5

c **i** Range = 74 , IQR = 20

ii The range

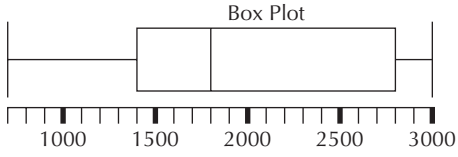
5 **a** **i** 1825

ii 1417, 2635.5

iii 1218.5

iv See **b iv**

b

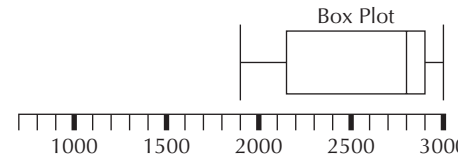


c **i** 2788.5

ii 2170, 2920

iii 750

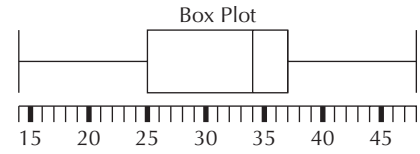
d



e Comedy is more popular. Less variation, higher average

6 **a** 14, 25, 34, 37, 48

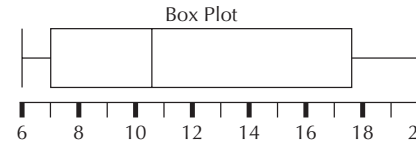
b



7 **a** **i** 6, 7, 10.5, 17.5, 21

ii 10.5

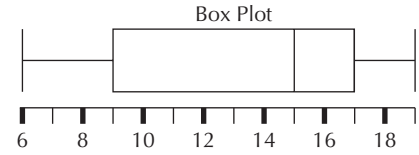
iii



b **i** 6, 9, 15, 17, 19

ii 8

iii



c The range of maximum temperatures in 1911 was greater than in 2011.

The average maximum temperatures in 2011 were greater than in 1911.

8 Girls had less variability, boys did worse than girls on average

9 **a** 51, 61, 77, 92, 118

b 31

10 **a** **i** 27, 36, 46, 51, 62

ii 21, 29, 43, 60, 78

b IQR (Park) 15

IQR (Fixit) 31

c Fixit has wider variability

Activity p. 359

a Pupil's own answers

Activity p. 360

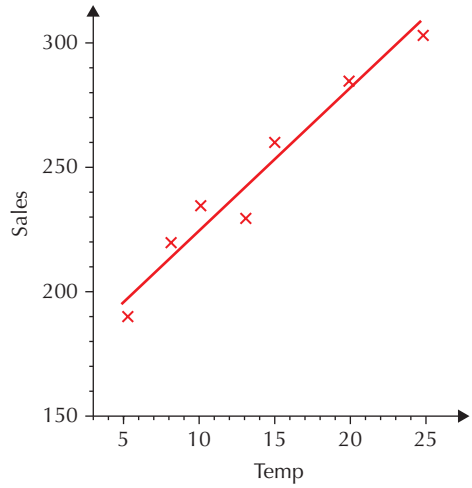
1 **a** average = 7, sd = 2.4

b Pupil's own answers

Chapter 34

Exercise 34A

1 a



b Positive

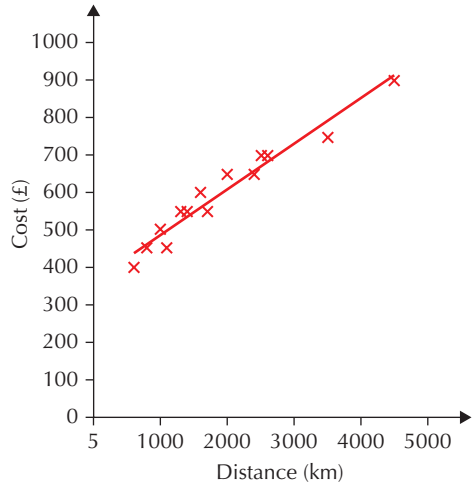
c See **a**

d $\frac{19}{3}$

e $\frac{475}{3}$

f $y = \frac{19}{3}x + \frac{475}{3}$

2 a



b Positive

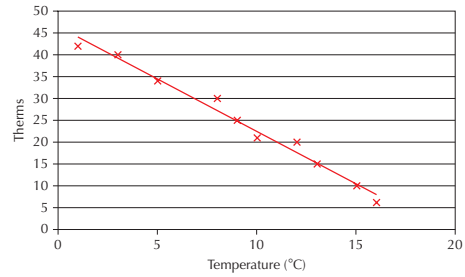
c See **a**

d $\frac{25}{2}$

e $\frac{725}{2}$

f $y = 0.121x + 366.2$

3 a

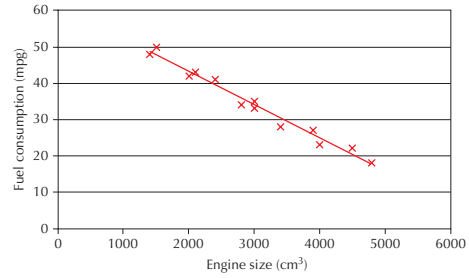


b negative

c See **a**

d $y = -2.4x + \frac{780}{17}$

4 a

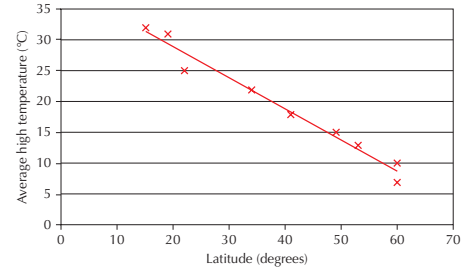


b negative

c See **a**

d $y = \frac{-13}{17}x + \frac{855}{17}$

5 a



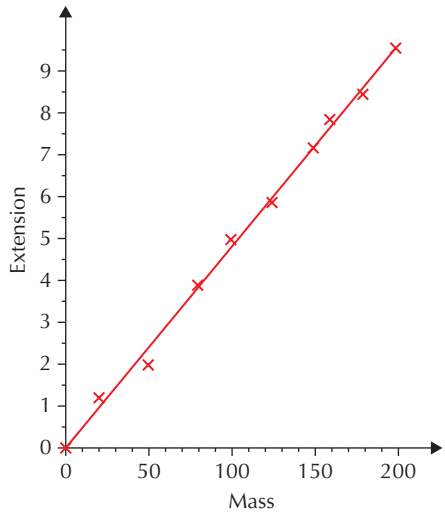
b negative

c See **a**

d $y = \frac{-1}{2}x + \frac{79}{2}$

Exercise 34B

1 a



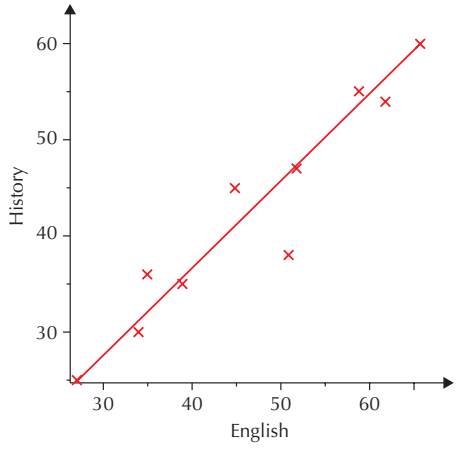
b See **a**

c $y = 0.048x$

d 12 cm

e 342 g

2 a



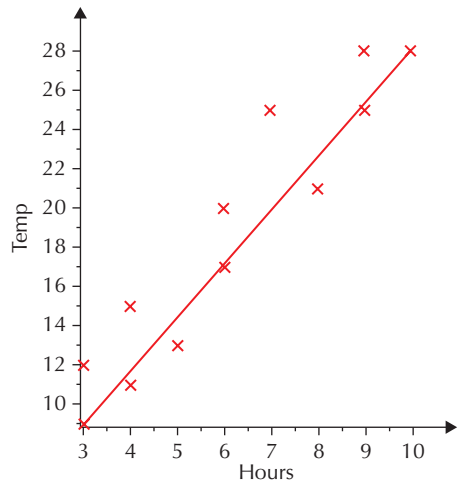
b See **a**

c $y = \frac{35}{39}x + \frac{10}{13}$

d 74.4

(Answers to **c** and **d** may very slightly.

3 a

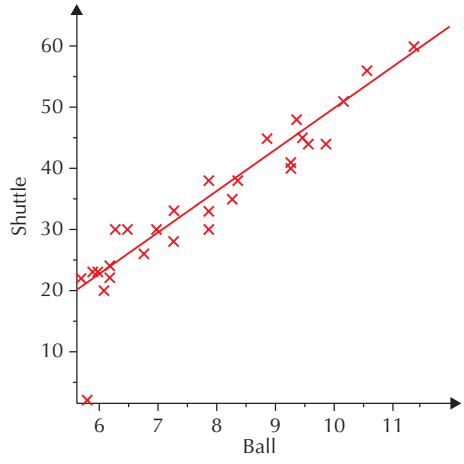


b See **a**

c $y = \frac{19}{7}x + \frac{6}{7}$

d 11.1 hours

4 a

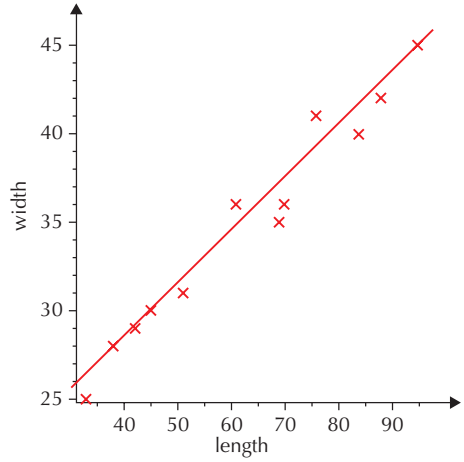


b See **a**

c $y = 7x - 21$

d 64

5 a



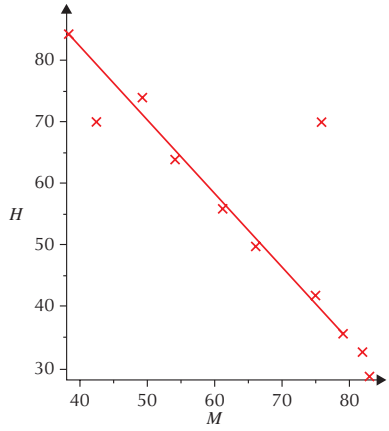
b See **a**

c $y = \frac{7}{25}x + \frac{434}{25}$

d 46.48

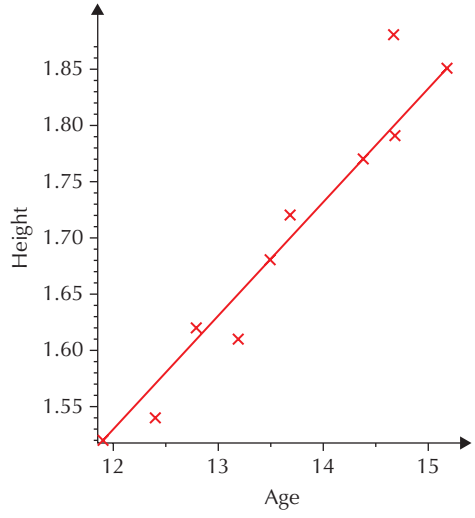
Exercise 34C

1 **a** $y = 0.98x + 118$



b 95.7

2 **a**



b see **a**

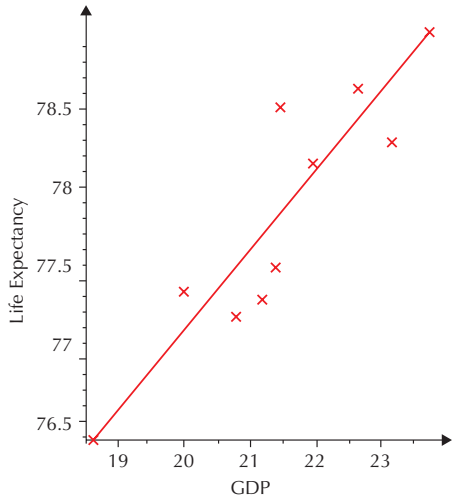
c $y = \frac{1}{10}x + \frac{33}{100}$

d 1.94

e 18.7, height does not increase linearly with age.

f see **e**

3 **a**



b see **a**

c $y = \frac{1}{2}x + 67.09$

d 75.84

Activity

1 Pupil's own answers