Revision exercise A1

1 Work out these.

a) $1\frac{2}{5} + 3\frac{1}{4}$

b) $2\frac{5}{6} + 1\frac{7}{8}$

c) $4\frac{7}{10} - 1\frac{2}{5}$

d) $3\frac{1}{4} - 2\frac{2}{3}$

e) $\frac{2}{3} + 4\frac{1}{2} - 2\frac{5}{6}$

f) $2\frac{4}{7} \times 1\frac{5}{6}$

g) $2\frac{1}{2} \times 3\frac{1}{5}$

h) $6 \div 2\frac{2}{3}$

2 To make a frame, John uses four pieces of wood: two are $4\frac{1}{4}$ inches long and two are $6\frac{2}{3}$ inches long.
He cut them all off a piece of wood 24 inches long.
How much wood was left?

3 a) Draw the graph of $y = x^3 - 7x$ for values of x from $^-3$ to 3.

b) Use your graph to solve the equation $x^3 - 7x = 0$.

4 Sketch the graphs of these curves.

a) $y = x^3$

b) $y = \dfrac{12}{x}$

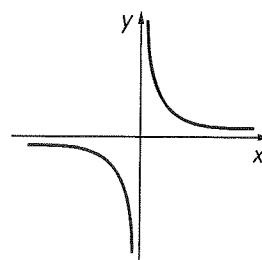5 Here are four equations.

a) $y = 2x^2$　　　　　　b) $y = 2x + 1$

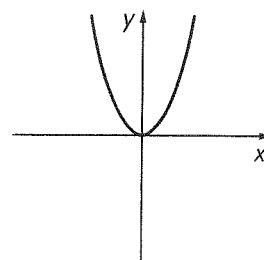c) $y = {}^-2x^3$　　　　　d) $y = \dfrac{2}{x}$

The graphs of these equations are sketched here. They are not in the correct order. Match each graph with the correct equation.
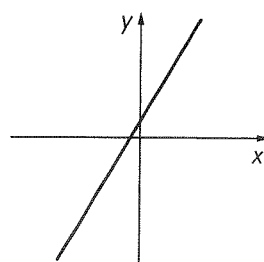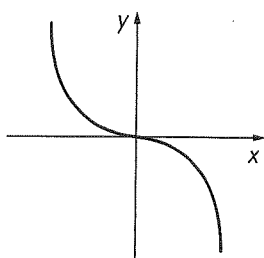
(i)

(ii)

(iii)

(iv)

6 Each of the letters of the word STATISTICS is written on a card.
The cards are shuffled and a card is drawn at random.
The card is then replaced, the cards reshuffled and another card is drawn at random.
Calculate the probability that the letter on both cards is
a) A.
b) I.
c) S.

7 The probability that the school bus is late on a Monday is 0·3.
The probability that it is late on a Tuesday is 0·2.
Assuming these probabilities are independent, find the probability that the bus is late on
a) both days.
b) neither day.

8 Mr and Mrs Brown intend to have three children.
Draw a tree diagram for the possible sexes of the three children.
Assuming that for each child they are equally likely to have a boy or a girl, find the probability that
a) all three children are girls.
b) Mr and Mrs Brown have two boys and a girl.

9 The whole of Year 9 takes tests in English, Maths and Science.
The probability that a randomly chosen student passes English is 0·8, Maths is 0·7 and Science is 0·9.
Copy and complete the tree diagram for the three subjects.

English   Maths   Science
0·8   Pass

Fail
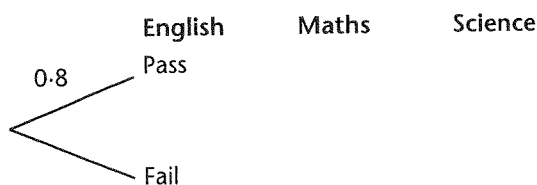
Calculate the probability that a randomly chosen Year 9 student
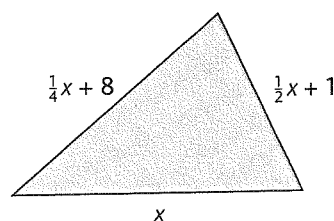a) passes all three subjects.
b) passes two out of the three subjects.

10 Solve these equations.
a) $\frac{x}{2} = 3x - 10$
b) $\frac{x}{3} = 3 - 2x$
c) $\frac{500}{x} = 20$
d) $\frac{300}{x} = 60$
e) $\frac{3x}{4} + \frac{x}{12} = 60$
f) $\frac{x-1}{7} = 3$
g) $\frac{1}{5}(4x - 9) = 7$
h) $\frac{4x}{3} + 2x = 20$
i) $4(x + 2) + 2(3x - 1) = 56$
j) $5(x - 2) - 3(x + 1) = 2$

11 Solve these inequalities.
a) $\frac{x}{3} \geqslant x - 12$
b) $\frac{x}{5} \geqslant 2x - 9$
c) $3(2x - 3) > 5(2x - 5)$
d) $\frac{2x}{3} > \frac{x}{6} + 5$
e) $\frac{2x-1}{4} \leqslant 7$
f) $\frac{1}{2}(3x - 14) \leqslant 5x$
g) $4(x - 1) > \frac{1}{3}(2x + 5)$

12 The lengths of the sides in this triangle are in centimetres.

$\frac{1}{4}x + 8$ $\frac{1}{2}x + 1$

x

The perimeter of this triangle is 30 cm.
a) Write down an equation in x.
b) Solve the equation to find the lengths of the sides in this triangle.

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13 Abigail has £100. She spends £x on a pair of jeans and then two-thirds of what she has left on a pair of trainers.

a) Write down, in terms of x, expressions for each of these.

    (i) How much she had left after she bought the jeans

    (ii) How much she spent on the trainers

    (iii) How much she spent in total on the jeans and trainers

b) Abigail sees a top for £20. Write down an inequality that states that she has enough money left to buy the top.

c) Solve the inequality to find the most Abigail could have paid for the jeans if she is able to buy the top.

Revision exercise B1

1 Danielle receives an increase in salary of 4%.
Her old salary was £17 000.
What will her new salary be?

2 In a sale, all prices are reduced by 15%.
Find the new price of a pair of trainers that originally cost £65.

3 A headline in a newspaper says 'Petrol prices up 20% in a year'.
If the price is 95p per litre now, what was the price one year ago?
Give your answer to the nearest penny.

4 Damien sold his bicycle for £286 at a loss of 45% on what he paid for it.
How much did he pay?

5 Write down the inequality satisfied by the shaded region in each of these diagrams.

a)

b)

$3x + 4y = 12$
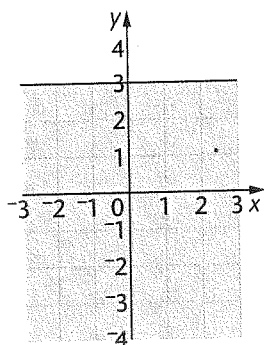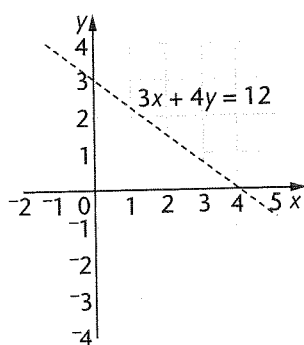
6 Draw sets of axes and label them from $^-4$ to 4 for x and y.
Shade these regions.
a) $x \leqslant 1$
b) $2y < 3x + 2$

7 Draw a set of axes and label them from $^-1$ to 8 for x and y.
Show, by shading, the region where $x > 0$, $y > 0$, $x < 7$ and $y < x - 1$.

8 Draw a set of axes and label x from $^-1$ to 8 and y from $^-1$ to 5.
Show, by shading, the region where $x \geqslant 0$, $y \geqslant 0$, $y \leqslant x + 2$ and $3x + 7y \leqslant 21$.

9 In 2005, a small factory employed 200 people.
The frequency table shows their weekly earnings.

Earnings (£E)	Frequency
$400 < E \leqslant 600$	50
$600 < E \leqslant 800$	55
$800 < E \leqslant 1000$	63
$1000 < E \leqslant 1200$	27
$1200 < E \leqslant 1400$	5

a) Draw a cumulative frequency diagram of the data.
b) Use your diagram to find
(i) the median earnings.
(ii) the interquartile range.
(iii) the number of employees who earned more then £900 a week.

10   This table shows the numbers of marks obtained by candidates in an examination.

Mark	Number of candidates obtaining less than this mark
10	7
20	16
30	36
40	64
50	102
60	130
70	151
80	162
90	168
100	170

a) Draw a cumulative frequency diagram of the data.

b) Use your diagram to find
  (i) the median mark.
  (ii) the interquartile range.
  (iii) the number of candidates who obtained at least 55 marks.
  (iv) the mark achieved by at least 60% of the candidates.

11   The table shows the age distribution for males (in millions) in England and Wales for two years.

Age	1881	1966
Under 15	4·7	5·6
15 and under 30	3·4	4·9
30 and under 45	2·3	4·4
45 and under 60	1·4	4·4
60 and under 75	0·7	1·7
75 and under 90	0·1	1·7

a) Draw cumulative frequency diagrams for the two years.
b) Use your diagrams to find the medians and quartiles for the two years.
c) Draw box plots for each of the two years using the same axis.
   Assume a minimum age of 0 and a maximum age of 90 for each year.
d) Use your box plots to compare the distributions.

12   Each year the value of an antique increases by 20% of its value at the beginning of the year.
It was worth £450 on 1st January 2003.
a) What was it worth on 1st January 2004?
b) What was it worth on 1st January 2006?

13   A bacterial culture is growing at 5% a day. There are 1450 bacteria on Tuesday. How many are there three days later?

14   David invests £5000 in a bank at 4% compound interest.
a) How much will the investment be worth after 5 years?
b) How many years will it take for the investment to be worth £7000?

15   A paper reported that the number of people taking their main holiday in Britain has reduced by 10% every year for the last five years.
There were 560 people from a small town who took their main holiday in Britain five years ago.
If the report is true, how many of them do so now?
Give your answer to the nearest person.

16   A town's road safety campaign aims to reduce accidents by $\frac{1}{8}$ every year for the next three years.
There were 860 accidents last year.
If the campaign is successful, what should the number be reduced to after the three years?

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Revision exercise C1

1 Draw a grid with the x-axis from 0 to 10 and the y-axis from 0 to 7.
   a) Plot the points (1, 4), (1, 6) and (2, 6) and join them to form a triangle. Label it A.
   Reflect triangle A in the line $y = x$. Label the image B.
   b) Rotate triangle B through 90° anticlockwise about the point (5, 5). Label the image C.
   c) Describe fully the single transformation that maps triangle A on to triangle C.

2 **a)** Draw a grid with the x-axis from 0 to 12 and the y-axis from 0 to 6.
   Plot the points (4, 1), (6, 1) and (4, 2) and join them to form a triangle. Label it D.
   Translate triangle D by $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$.
   Label the image E.
   b) Enlarge triangle E with scale factor 2 and centre of enlargement (5, 7). Label the image F.
   c) Describe fully the single transformation that maps triangle D on to triangle F.

3 Draw a grid with the x-axis from 0 to 11 and the y-axis from 0 to 8.
   Plot the plots A(1, 1), B(3, 1) and C(3, 2) and join them to form a triangle.
   Enlarge triangle ABC by a scale factor of ⁻2 with the point (4, 3) as the centre of enlargement.

4 Look at this diagram.
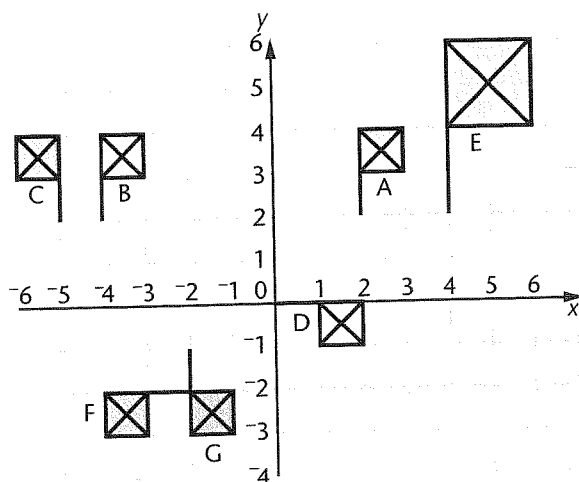
Describe fully these single transformations.
   a) Flag A on to flag B
   b) Flag B on to flag C
   c) Flag A on to flag D
   d) Flag D on to flag B
   e) Flag E on to flag A
   f) Flag A on to flag F
   g) Flag G on to flag E

5 Solve these simultaneous equations graphically.
   a) $y = x + 3$ and $y = 6 - 2x$.
      Use values of x from ⁻1 to 3.
   b) $y = 2x - 1$ and $3x + 2y = 12$.
      Use values of x from 0 to 4.

6 Solve these simultaneous equations.
   a) $x + y = 15$ $2x + y = 22$
   b) $2x + 3y = 13$ $3x - y = 3$
   c) $2x - 3y = 3$ $4x + 5y = 17$
   d) $3x - 6y = 3$ $2x + 3y = 16$
   e) $x + 2y = 3$ $3x + 3y = 3$
   f) $y = x + 5$ $2x + 3y = 5$
   g) $2x + 3y = 8$ $5x - 2y = 1$
   h) $x + y = 3$ $5x + 3y = 10$
   i) $6x + 5y = -2$ $4x - 3y = 5$

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7 Round each of these numbers to the number of significant figures given in brackets
   a) 78 900 (2)
   b) 0·000 538 2 (3)
   c) 635 084 (4)
   d) 0·070 385 (3)
   e) 8 496 000 (3)
   f) 0·005 03 (2)
   g) 86 749 000 (3)
   h) 0·000 997 3 (2)

8 Write these numbers in standard form.
   a) 7600
   b) 89·9
   c) 60 000
   d) 466
   e) 0·056
   f) 564 600
   g) 0·0055
   h) 67 400
   i) 0·000 042
   j) 24 million

9 These numbers are in standard form. Write them out in full.
   a) 6×10^3
   b) 5×10^2
   c) 7×10^{-3}
   d) $4 \cdot 5 \times 10^2$
   e) $8 \cdot 4 \times 10^{-3}$
   f) $2 \cdot 87 \times 10^{-3}$
   g) $4 \cdot 7 \times 10^3$
   h) $5 \cdot 5 \times 10^{-2}$
   i) $7 \cdot 23 \times 10^6$
   j) $5 \cdot 48 \times 10^{-5}$

10 Without using your calculator, work out these.
   Give your answers in standard form.
   a) $(3 \times 10^5) \times (2 \times 10^3)$
   b) $(4 \times 10^8) \times (1 \cdot 5 \times 10^{-3})$
   c) $(8 \times 10^8) \div (2 \times 10^5)$
   d) $(6 \times 10^3) \div (2 \times 10^{-4})$
   e) $(4 \times 10^3) \times (3 \times 10^6)$
   f) $(4 \times 10^7) \div (8 \times 10^3)$
   g) $(6 \times 10^4) + (3 \times 10^3)$
   h) $(8 \times 10^5) - (3 \times 10^4)$
   i) $(6 \times 10^{-4}) + (3 \times 10^{-3})$

11 Use your calculator to work out these. Give your answers, in standard form, correct to 3 significant figures.
   a) $(3 \cdot 2 \times 10^5) \times (2 \cdot 8 \times 10^2)$
   b) $(4 \cdot 6 \times 10^8) \times (1 \cdot 7 \times 10^{-4})$
   c) $(8 \cdot 23 \times 10^8) \div (2 \cdot 6 \times 10^5)$
   d) $(6 \cdot 3 \times 10^3) \div (7 \cdot 9 \times 10^{-4})$
   e) $(8 \cdot 9 \times 10^3) \times (6 \cdot 7 \times 10^6)$
   f) $(4 \cdot 53 \times 10^8) \div (8 \cdot 69 \times 10^4)$
   g) $(6 \cdot 3 \times 10^4) + (3 \cdot 5 \times 10^3)$
   h) $(8 \cdot 23 \times 10^5) - (3 \cdot 78 \times 10^4)$
   i) $(6 \cdot 98 \times 10^{-5}) + (3 \cdot 2 \times 10^{-4})$

12 Find the gradient of the lines joining these pairs of points.
   a) $(2, 4)$ and $(4, 9)$
   b) $(2, 4)$ and $(6, 0)$
   c) $(^-1, 2)$ and $(5, 2)$

13 Draw a grid with the x-axis from $^-4$ to 6 and the y-axis from 0 to 7.
   Plot the points A(3, 1), B($^-3$, 4) and C(5, 6) and join them to form a triangle.
   Calculate the gradient of each of the sides of triangle ABC.

14 The data in the table show the distance (d km) of a car from a motorway junction at time t minutes.

t	2	4	8	15
d	5·0	7·4	12·2	20·6

   a) Draw a grid with the horizontal axis from $t = 0$ to 16 and the vertical axis from $d = 0$ to 22.
      Plot a graph to show the data in the table.
   b) What was the speed of the car, in kilometres per minute?
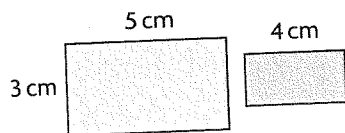   c) How far was the car from the junction when t was zero?

15 Sketch the graph of each of these straight lines on a separate diagram.
   a) $y = 3x - 2$
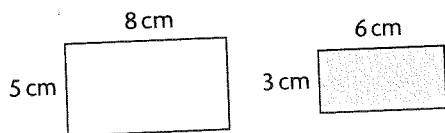   b) $y = {}^-3x + 1$
   c) $x = 2y$
   d) $x = 2$

16 For each of the lines in question **15**, write down the equation of a second line, parallel to the first.
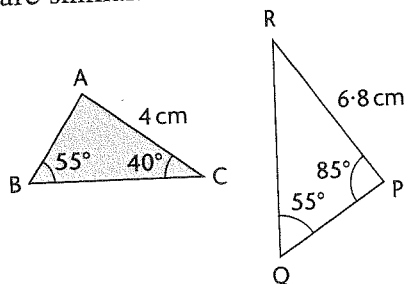
Revision exercise D1

1 The two rectangles are similar. Calculate the height of the smaller rectangle.

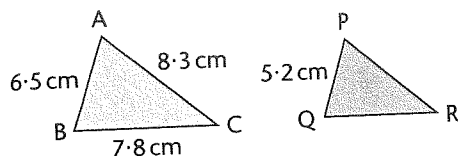**2** Are these rectangles similar? Show a calculation to explain your answer.

3 **a)** Explain why triangles ABC and PQR are similar.

  b) What is the scale factor?

4 Triangle PQR is similar to triangle ABC. Calculate the lengths PR and QR.

5 Over the last month, David's mean journey time to work was 43 minutes, with an interquartile range of 7 minutes.
Angie's mean time was 32 minutes, with an interquartile range of 12 minutes.
Make two comparisons of David's and Angie's journey times.

6 Eleven members of Class 10G and eleven members of Class 10F were given a Maths problem to solve.
The times, in seconds, they took to solve the problem are shown in the table.

Class 10F	Class 10G
17	4
15	13
11	15
9	11
6	32
27	7
18	9
21	12
6	6
19	10
8	14

Find the median and range for each class and comment on the results.
Why might the interquartile range be a better measurement to use?

7 A survey was carried out on 50 adults in each of England and France to study the amount of wine consumed in a year.
The table shows the mean and interquartile range of the number of bottles consumed in each of the countries.

|	Mean	Interquartile range
England	21	9
France	46	8

Compare the two countries.

8 The table shows the prices of a sample of 100 houses in the Northwest of England.

| Price (£000)	Number of houses
$80 < x \leqslant 100$	2
$100 < x \leqslant 120$	4
$120 < x \leqslant 140$	13
$140 < x \leqslant 160$	26
$160 < x \leqslant 180$	37
$180 < x \leqslant 200$	10
$200 < x \leqslant 220$	5
$220 < x \leqslant 240$	3

a) Use mid-interval values of £90 000, £110 000, £130 000, £150 000, £170 000, £190 000, £210 000 and £230 000 to estimate the mean house price in the sample.

b) A similar sample in the Southeast gave a mean of £207 000 and a range of £210 000. Compare the two areas.

9 Calculate the lengths and angles marked with letters. (All lengths are in centimetres.)

a)

23, a, 40

b)

8, 7, a

c)

7, a, 12

d)

x, 14, 37°

e)

9, 50°, x

f)

x, 48°, 13
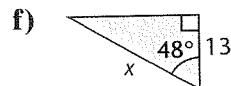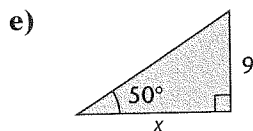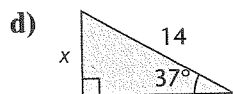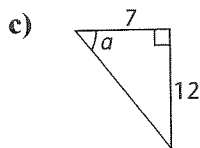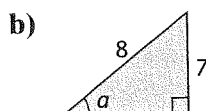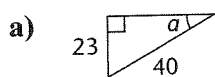
10 A boy is flying a kite with a string of length 45 m.
The string is straight and it makes an angle of 75° with the ground.
How high is the kite? (Ignore the height of the boy.)

11 The sides of a triangle are 5 cm, 5 cm and 7 cm.
Calculate the angles of the triangle.

12 A ramp for disabled people must slope at not more than 10° to the horizontal.
The height of the ramp is 0·8 m.
How long is the ramp?

10°, 0·8 m
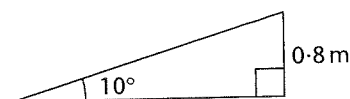
13 A man sails for 5 km on a bearing of 285° from a harbour.
a) How far north and west of the harbour is he?
He then sails 3 km due north.
b) Find the bearing on which he needs to sail to return to the harbour, and how far he needs to sail.

14 In these expressions, r and h are lengths. State which of length, area and volume is represented by each of these expressions.
a) $\pi rh + \pi r^2$
b) $\frac{1}{2}(r + h)$
c) $3r^2h$

15 Find the missing powers in these formulae.
a) volume $= \frac{1}{3}\pi r^? h$
b) area $= 6r^?$
c) length $= \dfrac{r^?}{h^2}$

1 Multiply out these brackets and simplify your answers.
   a) $(x + 3)(x + 9)$
   b) $(y - 6)(y + 7)$
   c) $(a - 8)^2$
   d) $(b - 2)(b - 10)$
   e) $(p + 10)(p - 3)$
   f) $(a + 9)(a - 9)$
   g) $(a + 9)^2$
   h) $(x - 20)(x - 1)$

2 Factorise these.
   a) $x^2 + 5x + 4$
   b) $x^2 - 6x + 8$
   c) $x^2 - 10x + 16$
   d) $x^2 + 8x + 15$
   e) $x^2 - 6x - 7$
   f) $x^2 - 3x - 10$
   g) $x^2 - 8x + 12$
   h) $x^2 - 2x - 15$
   i) $x^2 - 3x - 70$
   j) $x^2 + 16x + 48$
   k) $x^2 - 7x - 18$
   l) $x^2 + 8x - 20$

3 Factorise these.
   a) $a^2 - 64$
   b) $x^2 - 9$
   c) $p^2 - 100$
   d) $x^2 - 196$

4 The table shows the number of people unemployed at the end of each quarter in a county to the nearest 100.
The months indicate the end of the quarter for which the figures are given.

	January	April	July	October
2002	41 700	38 300	35 600	33 100
2003	33 800	28 500	24 600	23 500
2004	26 600	24 000	22 200	21 100
2005	23 800	20 900	18 900	17 700

   a) Plot these figures in a graph.
      Use a scale of 1 cm to each quarter on the horizontal axis and 2 cm to 10 000 people on the vertical axis.
   b) Calculate the four-quarter moving averages.
   c) Plot the moving averages on your graph.
   d) Comment on the general trend and the quarterly variation.

5 The table shows the daily absences from a school over a four-week period.

	M	Tu	W	Th	F
Week 1	52	38	33	37	46
Week 2	48	33	29	28	41
Week 3	46	28	30	25	35
Week 4	39	25	23	21	29

   a) Plot a time-series graph of these figures.
      Use a scale of 1 cm to each day on the horizontal axis and 2 cm to 10 people on the vertical axis.
   b) Calculate the five-day moving averages.
   c) Plot the moving averages on your graph.
   d) Comment on the general trend and the daily variation.

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6   The table shows the number of people visiting a leisure centre each day for a four-week period.

	Su	M	Tu	W	Th	F	Sa
Week 1	1037	542	731	1084	832	905	1617
Week 2	1405	741	750	905	794	927	1392
Week 3	1605	763	801	928	937	1017	1854
Week 4	2047	694	728	861	904	935	1532

a) Plot a time-series graph of these figures. Use a scale of 1 cm to 2 days on the horizontal axis and 1 cm to 100 people on the vertical axis. (You can start the y-axis at 500.)

b) Calculate the seven-day moving averages.

c) Plot the moving averages on your graph.

d) Comment on the general trend and the daily variation.

7   Solve these quadratic equations.
a) $x^2 - 6x + 8 = 0$
b) $x^2 + 5x + 6 = 0$
c) $x^2 - 2x - 3 = 0$
d) $x^2 - 3x - 10 = 0$
e) $x^2 - 5x + 4 = 0$
f) $x^2 + 7x + 10 = 0$
g) $x^2 - 5x - 14 = 0$
h) $x^2 + 17x + 30 = 0$
i) $x^2 - 9x + 20 = 0$
j) $x^2 + 4x + 3 = 0$
k) $x^2 - 9x - 36 = 0$
l) $x^2 + 7x - 18 = 0$

8   Solve these quadratic equations.
a) $x^2 + 8x = 0$
b) $x^2 - 5x = 0$
c) $x^2 = 64$
d) $x^2 - 100 = 0$
e) $x^2 = 10x$
f) $x^2 - 4x = 5$
g) $x^2 + 2x = 8$
h) $x^2 = 8x + 9$

9   Make the letter shown in brackets the subject of these formulae.
a) $x = by + a^2$ $\quad\quad\quad\quad$ (a)
b) $y = x + ay$ $\quad\quad\quad\quad$ (y)
c) $ab - cd = bx$ $\quad\quad\quad$ (b)
d) $ab + cd = ac - bd$ $\quad$ (b)
e) $A = b^3 + 3c^2d$ $\quad\quad$ (b)
f) $A = ab + \dfrac{\pi a}{2}$ $\quad\quad$ (a)
g) $3(x - 5) = y(4 - 3x)$ $\quad$ (x)
h) $V = \pi r^2 h$ $\quad\quad\quad\quad$ (r)
i) $3(x - y) = 4(x + 2ay)$ $\quad$ (y)
j) $P = 3t - 5s^2$ $\quad\quad\quad$ (s)
k) $\dfrac{1}{u} + \dfrac{1}{v} = \dfrac{1}{f}$ $\quad\quad\quad$ (u)

10 The formula $V = \frac{2}{3}\pi r^3$ gives the volume of a hemisphere. Where necessary, give your answers to 3 significant figures.
a) Find the volume of a hemisphere with a radius of 8 cm.
b) Make r the subject of the formula $V = \frac{2}{3}\pi r^3$.
c) Find the radius of a hemisphere with a volume of 5000 cm^3.