Predicted paper 3

Higher
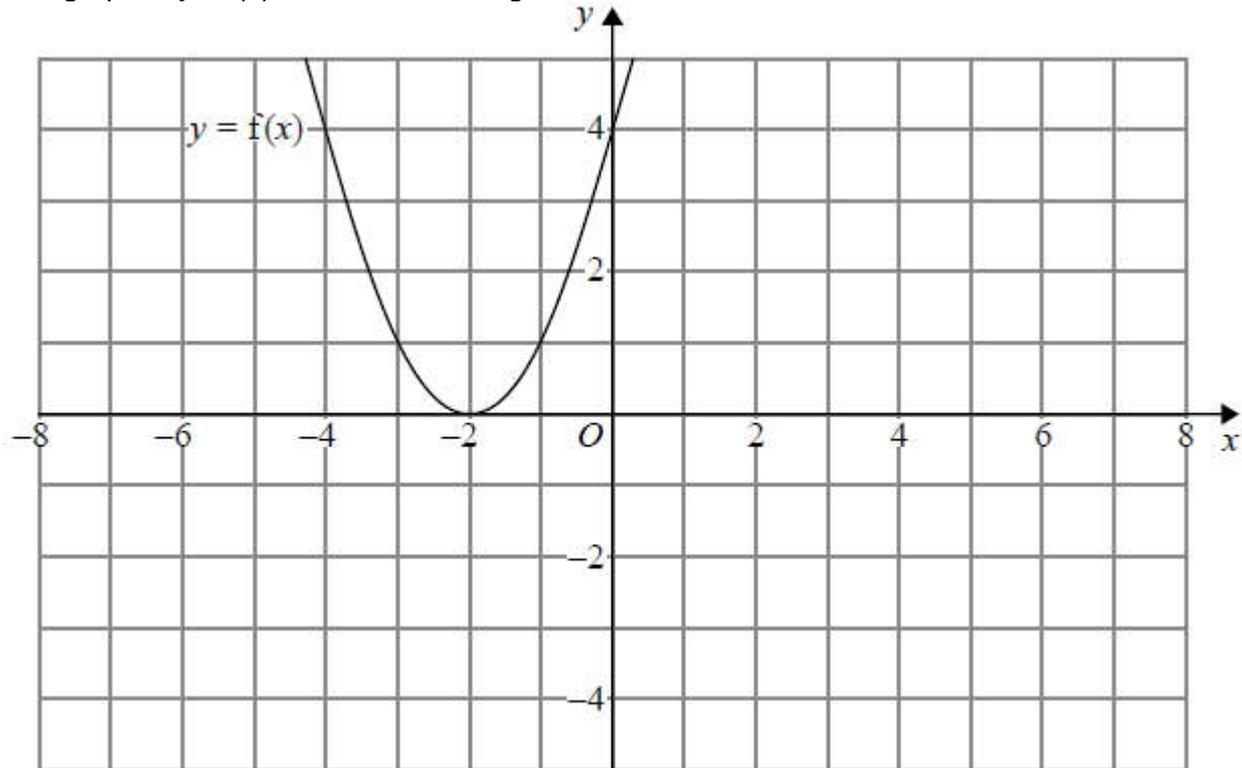
Questions

Q1.

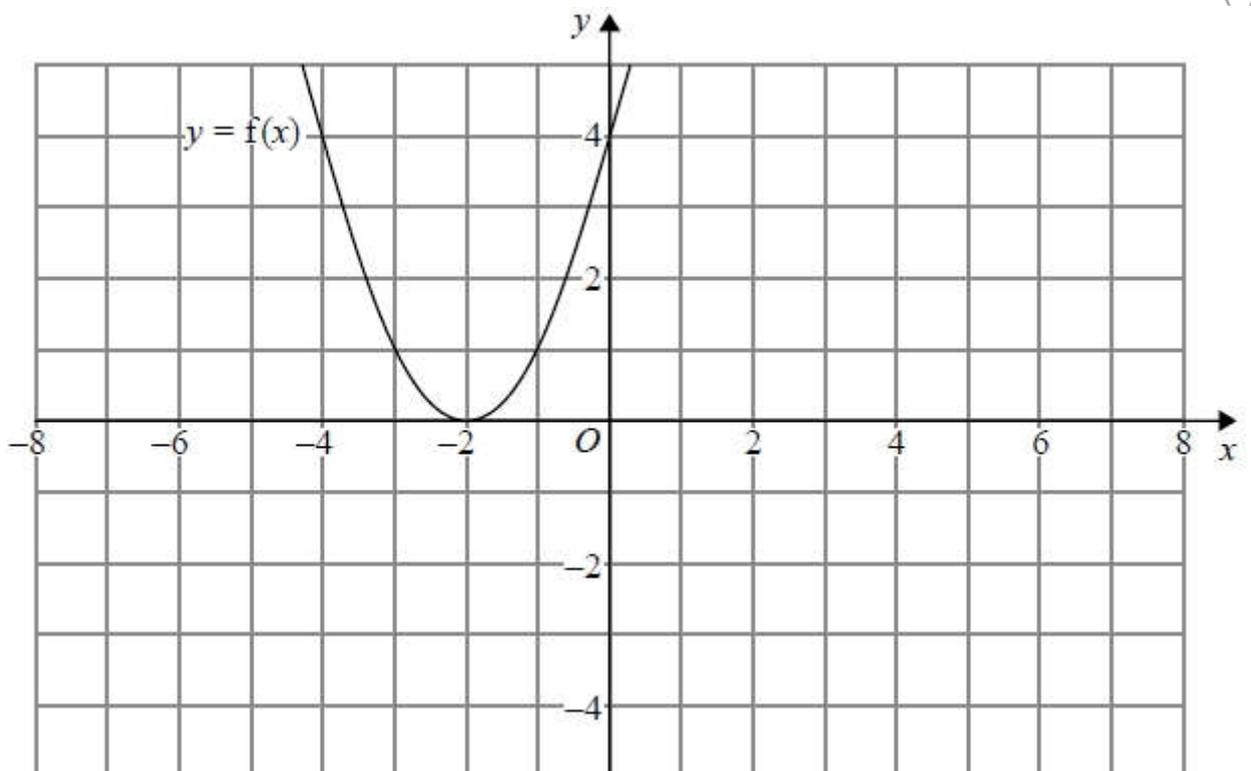(a) Sketch the graph of $y = \cos x°$ for $0 \leqslant x \leqslant 360$
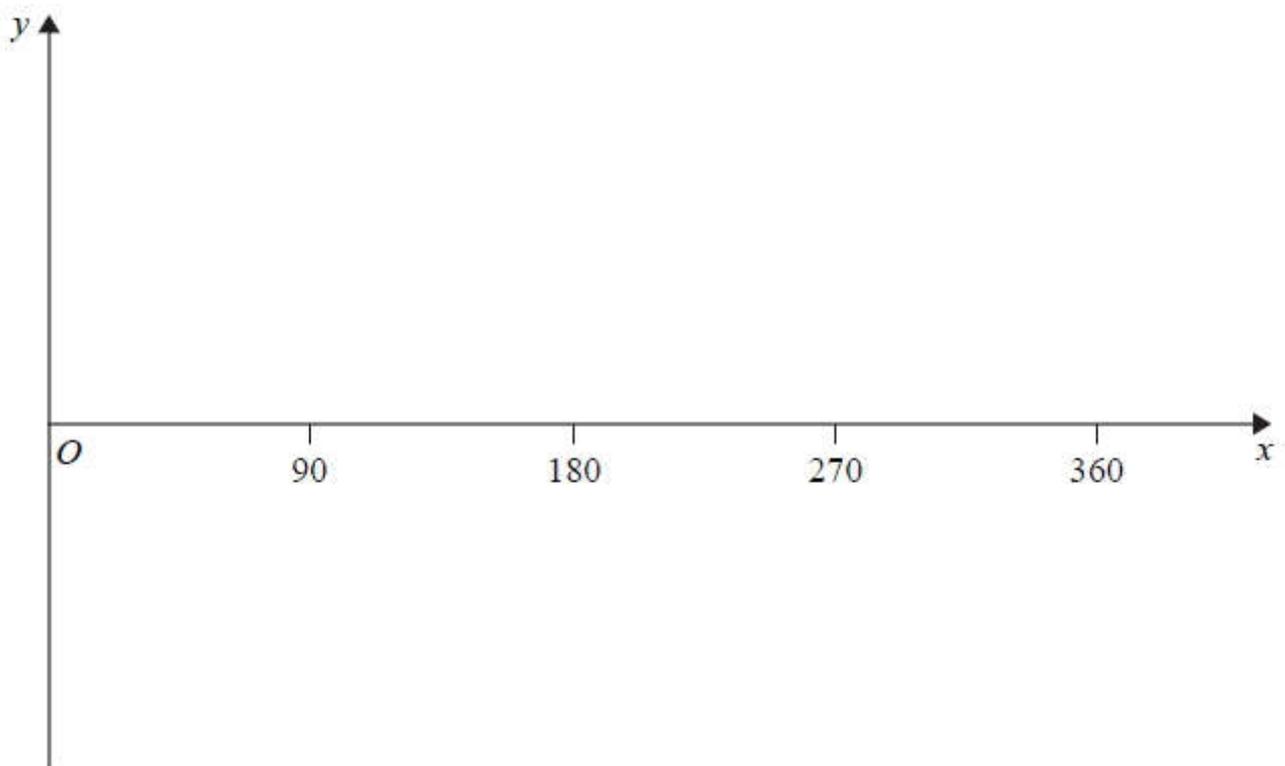
(2)

Q2.

The graph of $y = f(x)$ is shown on both grids below.

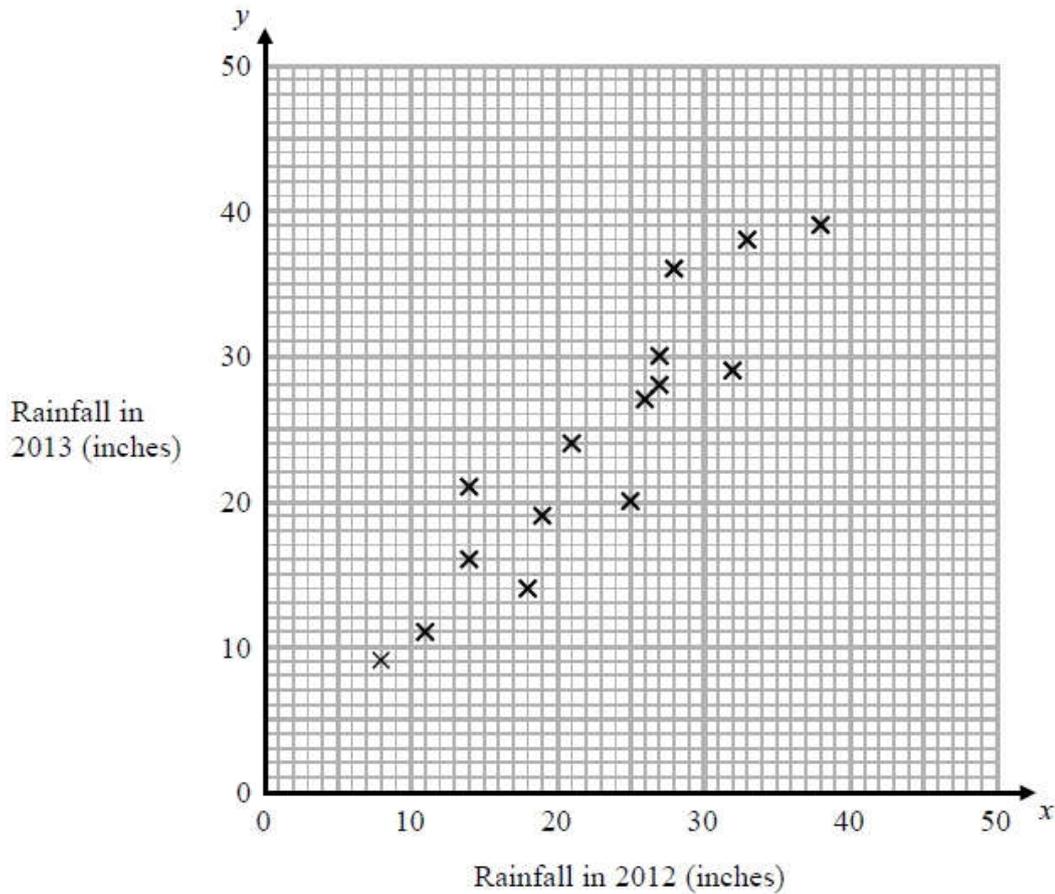(a) On the grid above, sketch the graph of $y = f(-x)$

(1)

(b) On this grid, sketch the graph of $y = -f(x) + 3$

(Total for question = 2 marks)

Q3.

The scatter graph gives information about the rainfall, in inches, in 2012 and the rainfall, in inches, in 2013 for each of 15 countries.

Rainfall in 2012 (inches)

The box plot for the rainfall in 2012 for the 15 countries is drawn on the grid below.

(a) On the same grid, draw the box plot for the rainfall in 2013 for the 15 countries.

Rainfall 2012

Rainfall 2013
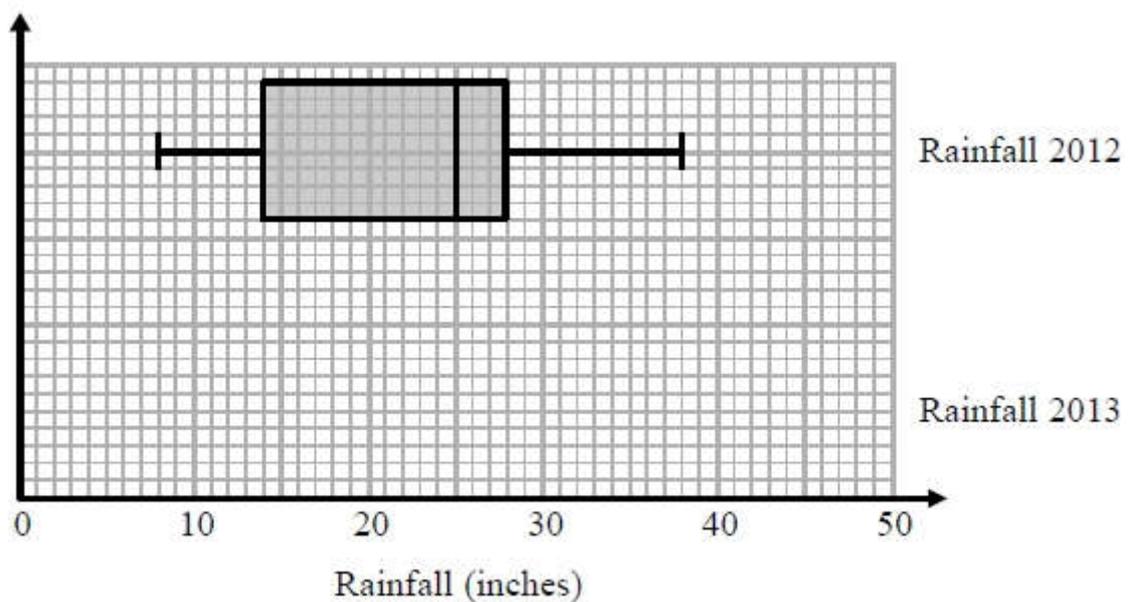
Rainfall (inches)

(b) Compare the distributions of the rainfall in the 2 years.   (4 marks)

Q4.

Solve the simultaneous equations

$$2x - 4y = 19$$
$$3x + 5y = 1$$

x = ...

y =...

(Total for question = 4 marks)

Q5.
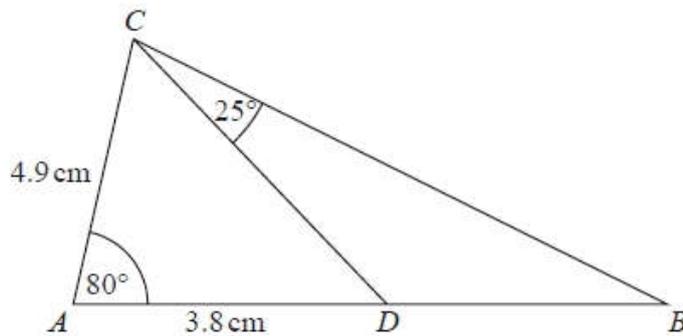
ABC is a triangle.
D is a point on *AB*.

Work out the area of triangle *BCD*.
Give your answer correct to 3 significant figures.

.... cm^2

(Total for question = 5 marks)

Q6.

Here is part of a map showing the position of a port **A**.

B is a lighthouse 36 km from **A** on a bearing of 050°

(a) (i) Construct a diagram to show the position of **B**.
Use a scale of 1cm represents 4 km.

(ii) Write down the bearing of **A** from **B**.

(3)

From the lighthouse at **B**, ships can be seen when they are within a range of 23 km of **B**.
A ship sails due East from **A**.

(b) Show, **by calculation**, that on this course this ship will not be seen from the lighthouse at **B**.

You must not use a scale drawing.

(4)

(Total for question = 7 marks)

Q7.

The diagram shows a cuboid *ABCDEFGH*.
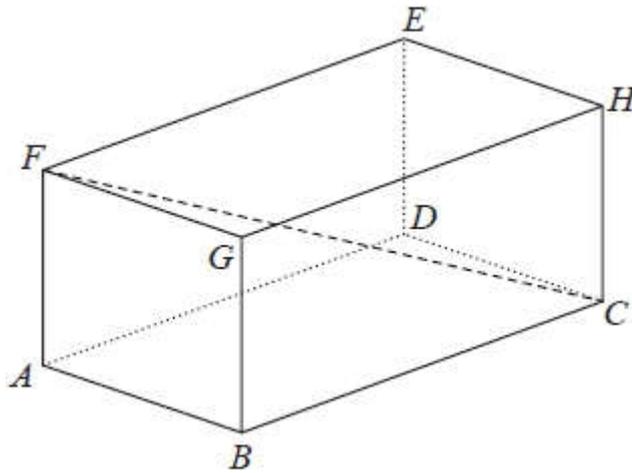
AB = 7 cm, *AF* = 5 cm and *FC* = 15 cm.

Calculate the volume of the cuboid.
Give your answer correct to 3 significant figures.

.... cm³

(Total for question is 4 marks)

Q8.

There are 80 students at a language school.

All 80 students speak at least one language from French, German and Spanish.

9 of the students speak French, German and Spanish.
19 of the students speak French and German.
28 of the students speak French and Spanish.
17 of the students speak Spanish and German.
45 students speak French.
50 students speak Spanish.

(a) Draw a Venn diagram to show this information.

(3)

One of the 80 students is selected at random.

(b) Find the probability that this student speaks German but not Spanish.
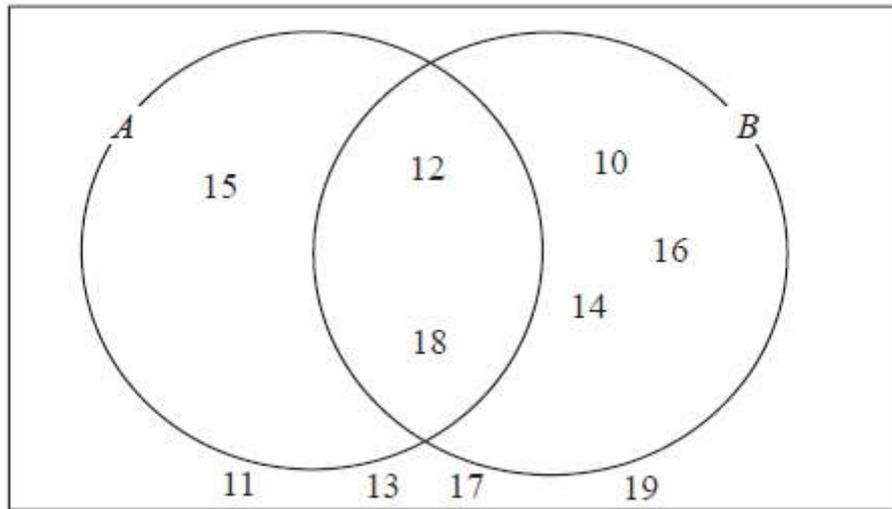
(1)

Given that the student speaks German,

(c) find the probability that this student also speaks French.

(2)

(Total for question = 6 marks)

Q9.

Here is a Venn diagram.

(a) Write down the numbers that are in set

   (i) $A \cup B$

....

   (ii) $A \cap B$

....

(2)

One of the numbers in the diagram is chosen at random.

(b) Find the probability that the number is in set A'

....
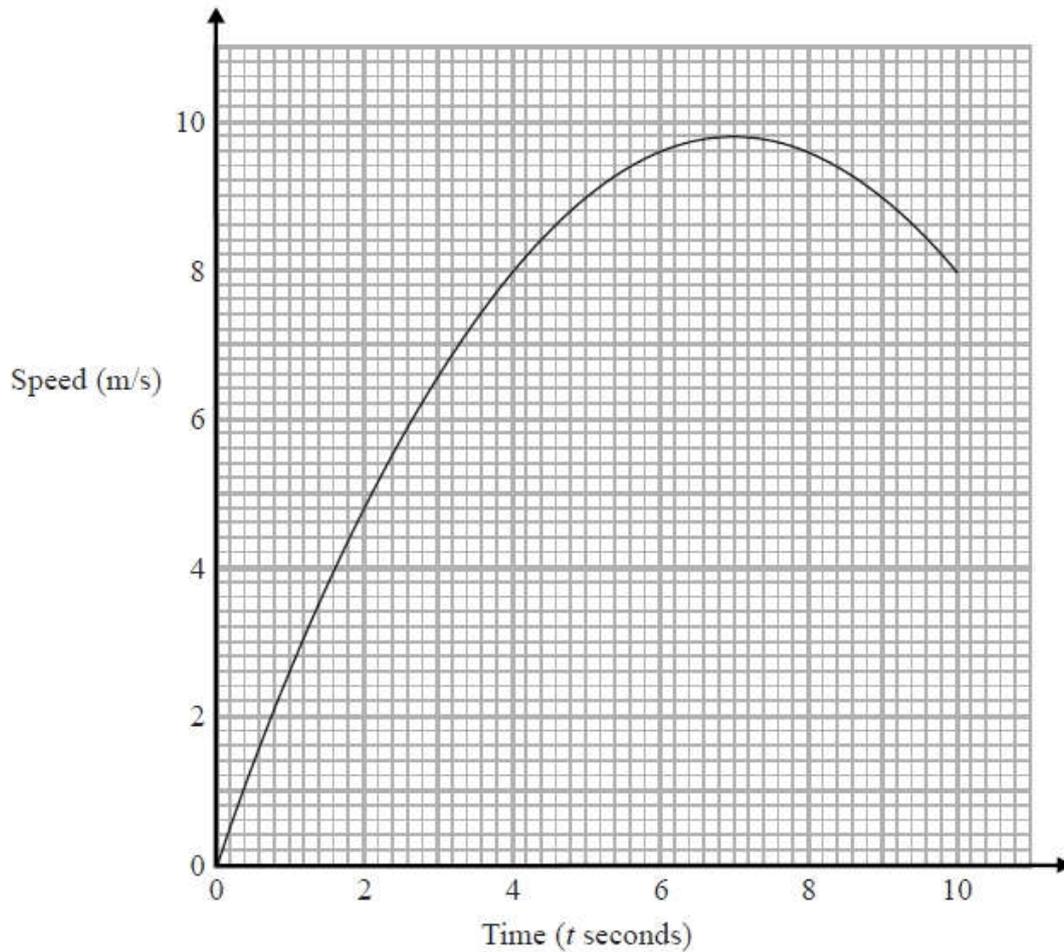
(2)

(Total for question = 4 marks)

Q10.

Karol runs in a race.

The graph shows her speed, in metres per second, t seconds after the start of the race.

(a) Calculate an estimate for the gradient of the graph when $t = 4$
    You must show how you get your answer.

....

(3)

(b) Describe fully what your answer to part (a) represents.

....

....

(2)

(c) Explain why your answer to part (a) is only an estimate.

....

....
(1)

(Total for question = 6 marks)

Q11.

(a) Show that the equation $x^3 + 4x = 1$ has a solution between $x = 0$ and $x = 1$

(2)

(b) Show that the equation $x^3 + 4x = 1$ can be arranged to give $x = \dfrac{1}{4} - \dfrac{x^3}{4}$

(1)

(c) Starting with $x_0 = 0$, use the iteration formula $x_{n+1} = \dfrac{1}{4} - \dfrac{x_n^{\,3}}{4}$ twice, to find an estimate for the solution of $x^3 + 4x = 1$

....

(3)

(Total for question = 6 marks)

Q12.

The number of bees in a beehive at the start of year n is P_n.
The number of bees in the beehive at the start of the following year is given by

$$P_{n+1} = 1.05(P_n - 250)$$

At the start of 2015 there were 9500 bees in the beehive.

How many bees will there be in the beehive at the start of 2018?

....

(Total for question is 3 marks)

Q13.

The functions f and g are such that

$$f(x) = 3(x - 4) \quad \text{and} \quad g(x) = \frac{x}{5} + 1$$

(a) Find the value of f(10)

....

(1)

(b) Find $g^{-1}(x)$

$g^{-1}(x) =$ ....

(2)

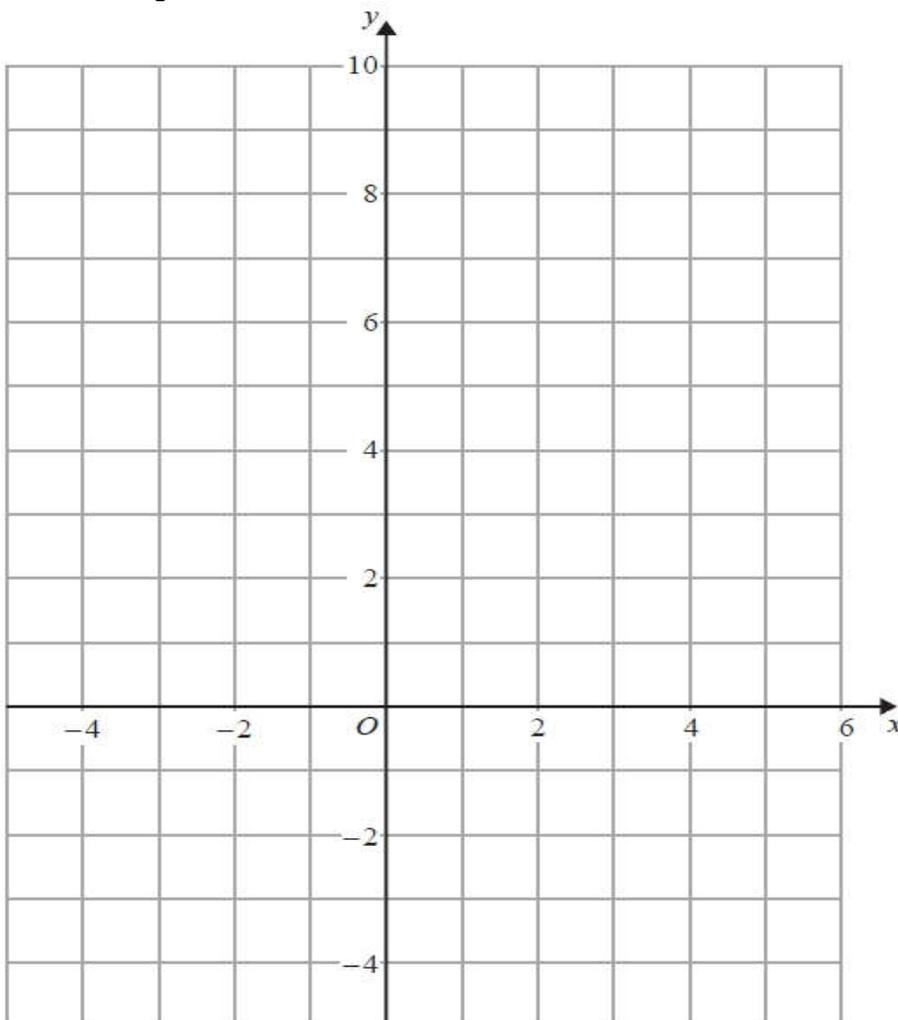(c) Show that ff(x) = 9x – 48

(2)

(Total for question = 5 marks)

Q14.

On the grid, shade the region that satisfies all these inequalities.

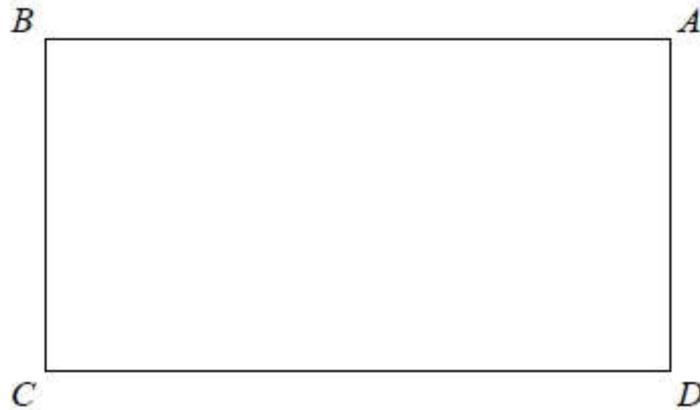$$x + y < 4 \qquad y > x - 1 \qquad y < 3x$$

Label the region **R**.

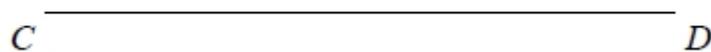**(Total for question is 4 marks)**

Q15.

The diagram shows a rectangle *ABCD*.

In the space below, use a ruler and a pair of compasses to construct a right-angled triangle equal in area to the area of the rectangle *ABCD*.

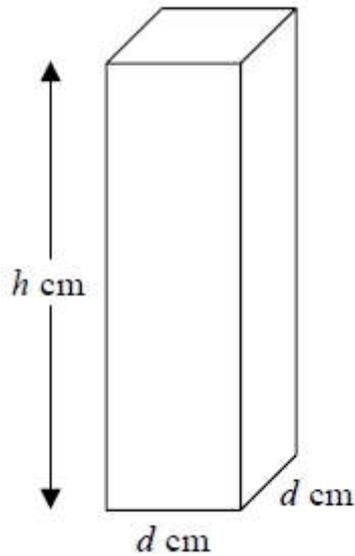You must show all your construction lines.

The base of the triangle, which is equal in length to the side *CD*, has been drawn for you.

(Total for question = 3 marks)

Q16.

Here is a solid bar made of metal.

The bar is in the shape of a cuboid.
The height of the bar is h cm.
The base of the bar is a square of side d cm.

The mass of the bar is M kg.

$d = 8.3$ correct to 1 decimal place.
$M = 13.91$ correct to 2 decimal places.
$h = 84$ correct to the nearest whole number.

Find the value of the density of the metal to an appropriate degree of accuracy.
Give your answer in g/cm^3.

You must explain why your answer is to an appropriate degree of accuracy.

(Total for question = 5 marks)

Q17.
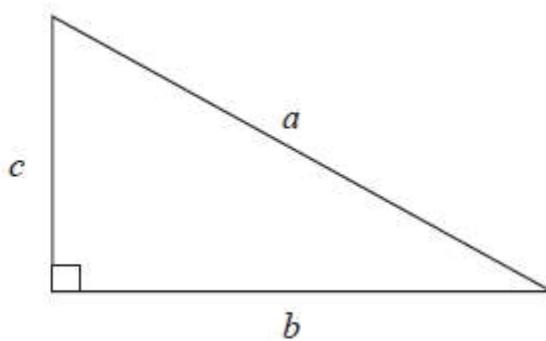
a is 8.3 cm correct to the nearest mm
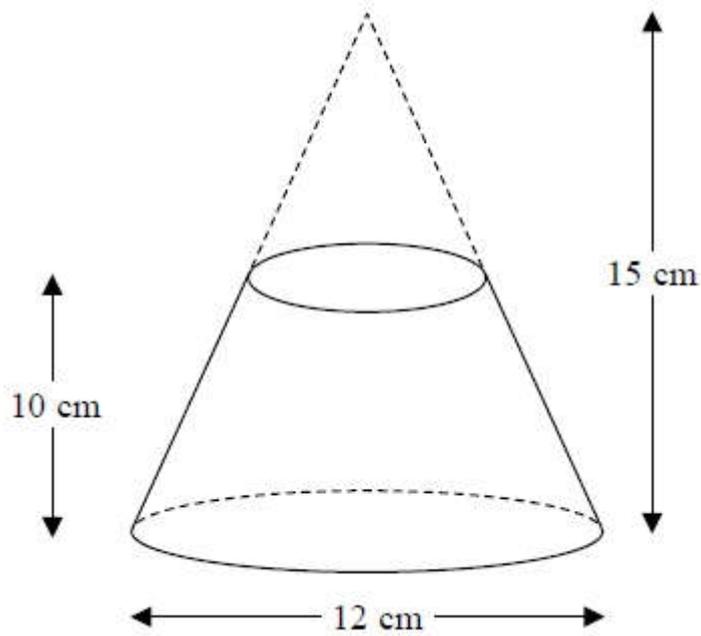*b* is 6.1 cm correct to the nearest mm

Calculate the upper bound for *c*.
You must show your working.

.... cm

(Total for question = 4 marks)

Q18.

A frustum is made by removing a small cone from a large cone as shown in the diagram.

15 cm

$$\text{Volume of cone} = \frac{1}{3}\pi r^2 h$$

10 cm

12 cm

The frustum is made from glass.
The glass has a density of 2.5 g / cm^3

Work out the mass of the frustum.
Give your answer to an appropriate degree of accuracy.

.... g
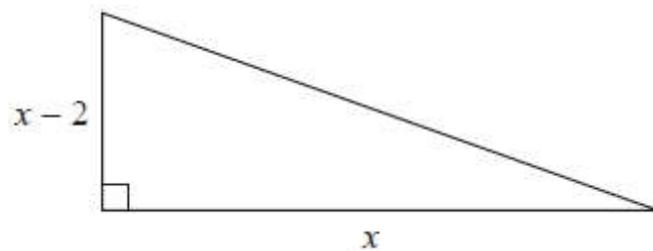
(Total for question = 5 marks)

Q19.

Solve $x^2 - 5x + 3 = 0$

Give your solutions correct to 3 significant figures.

....

(Total for question = 3 marks)

Q20.

Here is a right-angled triangle.

All measurements are in centimetres.
The area of the triangle is 2.5 cm^2.
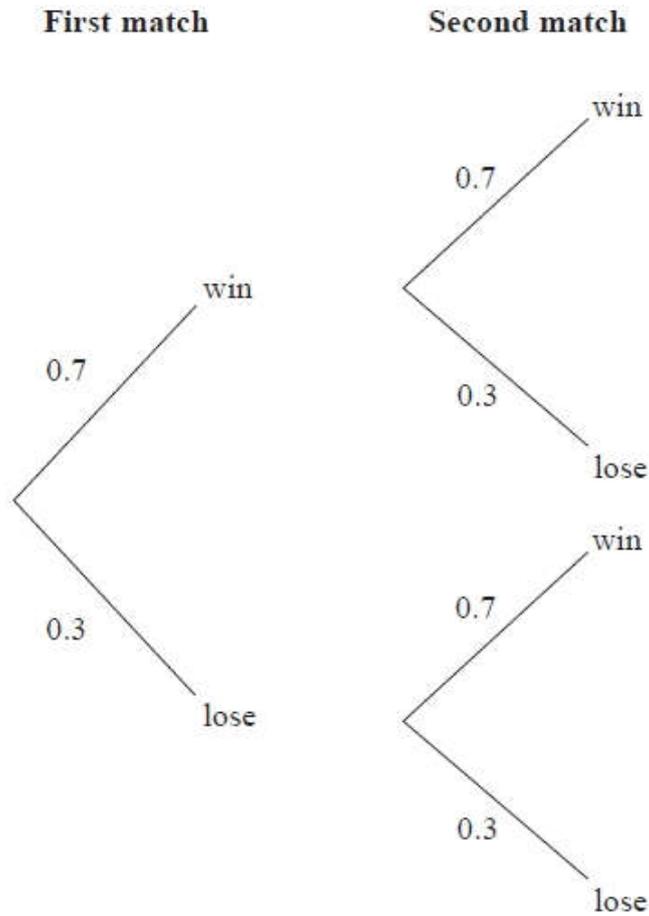
Find the perimeter of the triangle.
Give your answer correct to 3 significant figures.
You must show all of your working.

.... cm

(Total for question is 6 marks)

Q21.

Finlay plays two tennis matches.

The probability that he will win a match and the probability that he will lose a match are shown in the probability tree diagram.

(a) Work out the probability that Finlay wins both matches.

....

(2)

(b) Work out the probability that Finlay loses at least one match.

....

(2)

(Total for question is 4 marks)

Q22.

(a) Write $2x^2 + 16x + 35$ in the form $a(x + b)^2 + c$ where a, b, and c are integers.

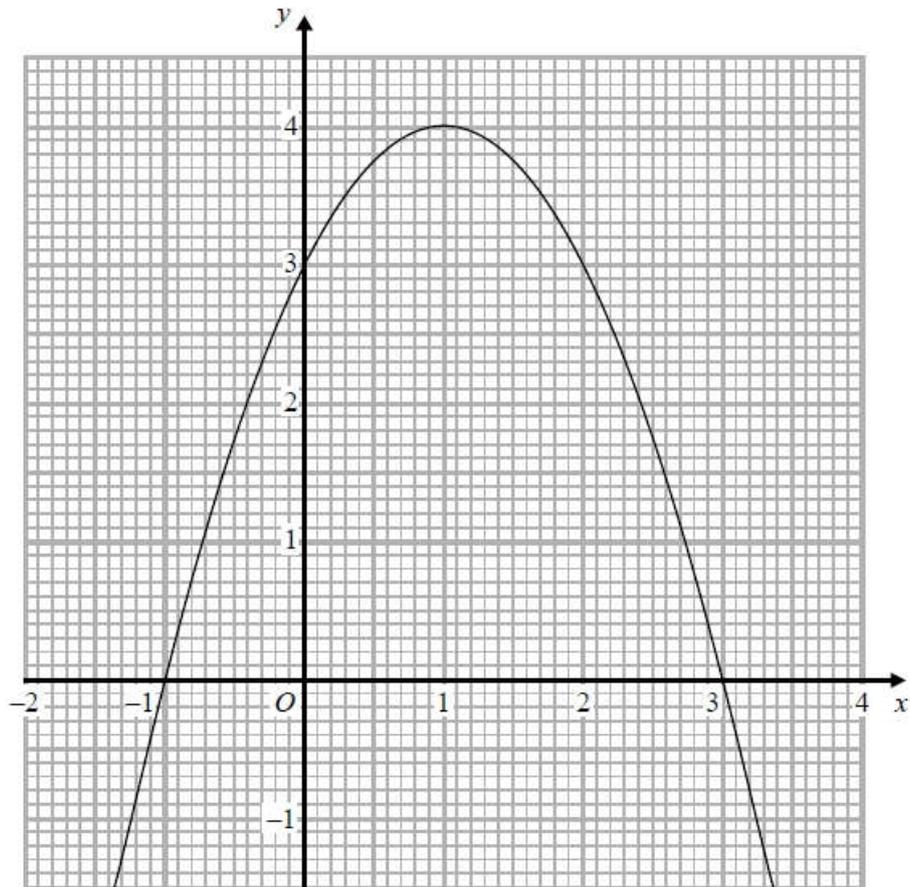...

(3)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = 2x^2 + 16x + 35$

....

(1)

(Total for question = 4 marks)

Q23.

The graph of $y = f(x)$ is drawn on the grid.

(a) Write down the coordinates of the turning point of the graph.

(.........................., ...)

(1)

(b) Write down the roots of f(x) = 2

....

(1)

(c) Write down the value of f(0.5)

....

(1)

(Total for question = 3 marks)

Q24.

Mark has made a clay model.
He will now make a clay statue that is mathematically similar to the clay model.

The model has a base area of 6cm^2
The statue will have a base area of 253.5cm^2

Mark used 2kg of clay to make the model.

Clay is sold in 10kg bags.
Mark has to buy all the clay he needs to make the statue.

How many bags of clay will Mark need to buy?

....

(Total for question is 3 marks)

Q25.

Find the values which satisfy the inequality:

$y^2 - 2y - 35 < 0$

....

(Total for Question is 4 marks)