Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number

Candidate Number

Mathematics B

Paper 2

Monday 16 January 2012 – Morning
Time: 2 hours 30 minutes

Paper Reference
4MB0/02

You must have: Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may be used.**

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.
- Without sufficient working, correct answers may be awarded no marks.

Turn over ▶

P40615A

6/6/6/6/4

P 4 0 6 1 5 A 0 1 3 6

PEARSON

Answer ALL ELEVEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1 Solve the inequalities

$$5 \leqslant 3x - 1 \leqslant 2x + 5$$

(Total for Question 1 is 4 marks)

2 Ahmed bought a car on 1st January 2010 for £15 000

During 2010, the value of the car decreased by 25% of its value on 1st January 2010

During 2011, the value of the car decreased by 20% of its value on 1st January 2011

(a) Calculate the value of the car on 1st January 2012

(3)

(b) Calculate the total percentage decrease in the value of the car on 1st January 2012 from its value on 1st January 2010

(2)

(Total for Question 2 is 5 marks)

3

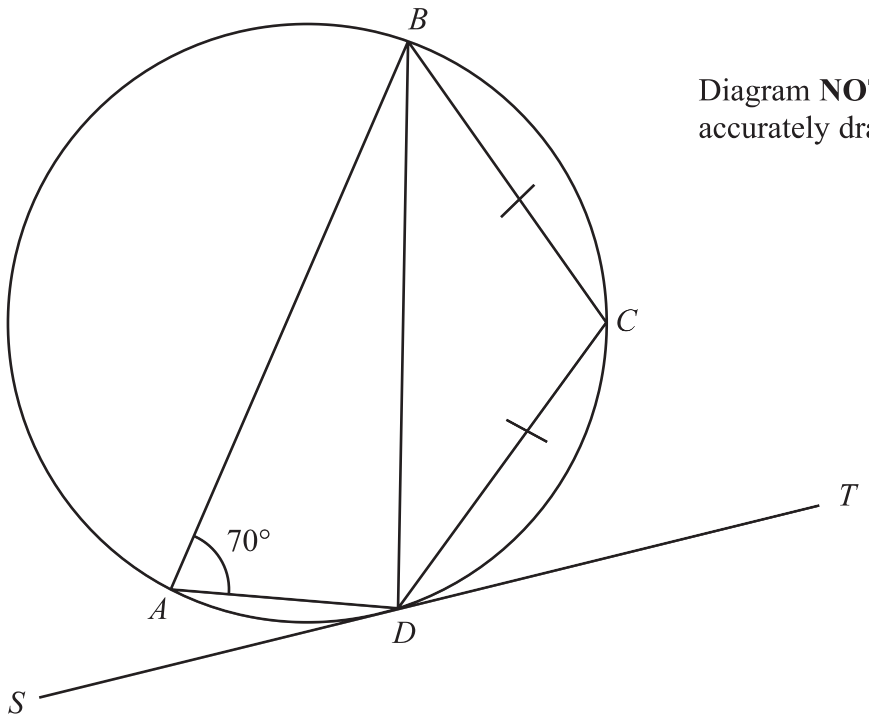


Diagram **NOT** accurately drawn

Figure 1

In Figure 1, *ABCD* is a circle. *AB* is a diameter with *BC* = *CD*. The straight line *SDT* is a tangent to the circle *ABCD* at the point *D* and ∠*BAD* = 70°.

(a) Find, giving reasons, the size, in degrees, of ∠*CDT*.

(3)

(b) Find the size, in degrees, of ∠*ADS*.

(1)

Question 3 continued

(Total for Question 3 is 4 marks)

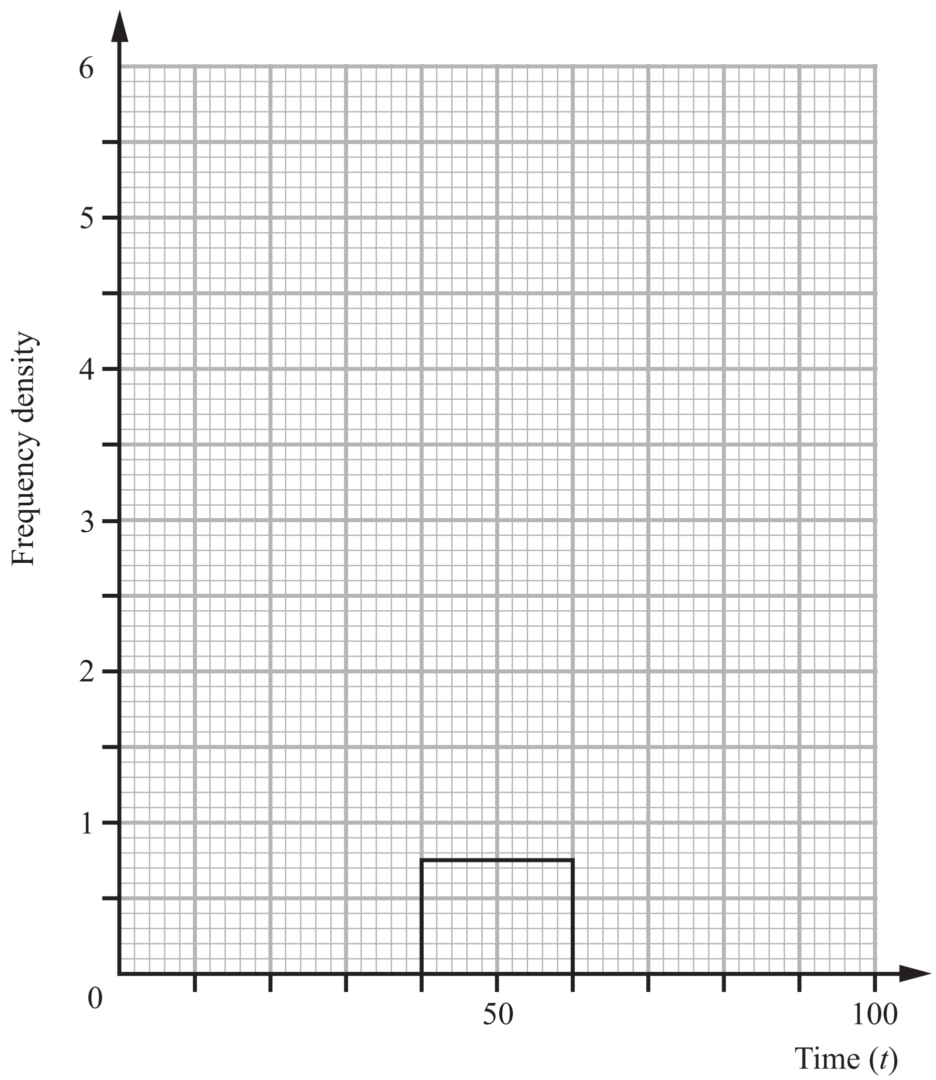
4 One hundred students sat a test. The times taken by the students to complete the test are summarized in the table.

Time (t)	**Number of students**
$0 \leqslant t < 25$	20
$25 \leqslant t < 35$	11
$35 \leqslant t < 40$	27
$40 \leqslant t < 60$	15
$60 \leqslant t < 90$	15
$90 \leqslant t < 100$	12

(a) Use the information given in the table to calculate an estimate for the mean time taken, to one decimal place.

(3)

(b) Given that the frequency density for the $40 \leqslant t < 60$ time interval is 0.75, complete the histogram to represent this information on the graph paper.



(4)

P 4 0 6 1 5 A 0 6 3 6

Question 4 continued

(Total for Question 4 is 7 marks)

5

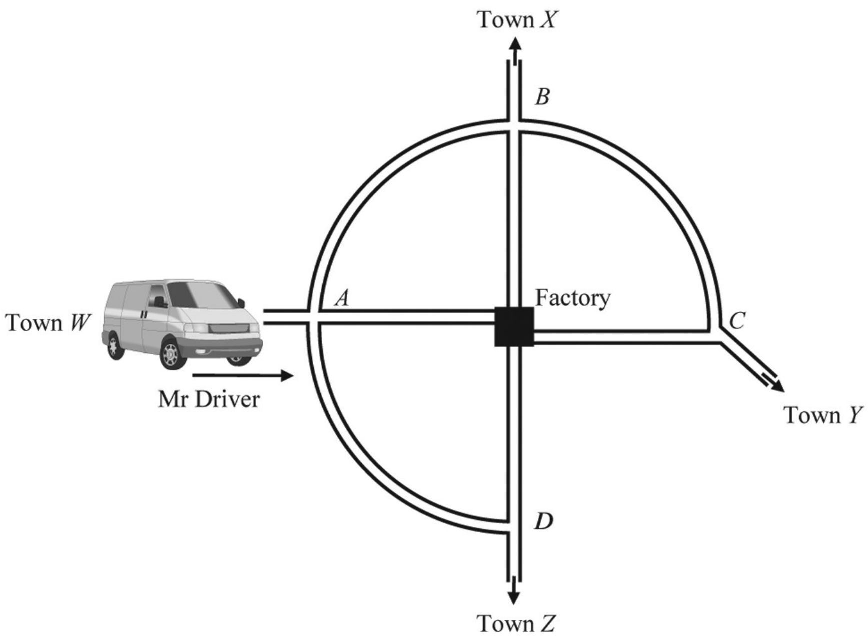


Figure 2

Figure 2 shows a diagram of routes to a factory. There are four road junctions labelled A, B, C and D and four towns labelled W, X, Y and Z. Mr Driver is approaching junction A from Town W, as shown, when he realises that he does not know how to get to the factory. He decides that at each road junction he will choose a road to take at random, but he will **not** turn around and go back along the road he has just travelled.

(a) Write down the probability that Mr Driver will choose the direct road to the factory at road junction A.

(1)

(b) Show that the probability that Mr Driver will pass through exactly two road junctions and reach the factory is $\frac{5}{18}$.

(3)

During the journey, if Mr Driver takes the road towards Town X, the road towards Town Y or the road towards Town Z he will not arrive at the factory.

(c) Find the probability that Mr Driver will not arrive.

(3)

Question 5 continued

Question 5 continued

Question 5 continued

(Total for Question 5 is 7 marks)

6 The points $A(1, 3)$, $B(4, 4)$ and $C(6, 2)$ are the vertices of ΔABC.

(a) On the graph paper, draw and label ΔABC.

(1)

The matrix $\mathbf{S} = \begin{pmatrix} -\frac{3}{2} & 0 \\ 0 & \frac{3}{2} \end{pmatrix}$

ΔABC is transformed to $\Delta A_1B_1C_1$, where A_1, B_1 and C_1 are respectively the images of A, B and C, under the transformation with matrix **S**.

(b) (i) Find the coordinates of A_1, B_1 and C_1

(ii) Draw and label $\Delta A_1B_1C_1$

(3)

The matrix $\mathbf{T} = \begin{pmatrix} -\frac{1}{2} & 0 \\ 0 & -\frac{1}{2} \end{pmatrix}$

$\Delta A_1B_1C_1$ is transformed into $\Delta A_2B_2C_2$, where A_2, B_2 and C_2 are respectively the images of A_1, B_1 and C_1, under the transformation with matrix **T**.

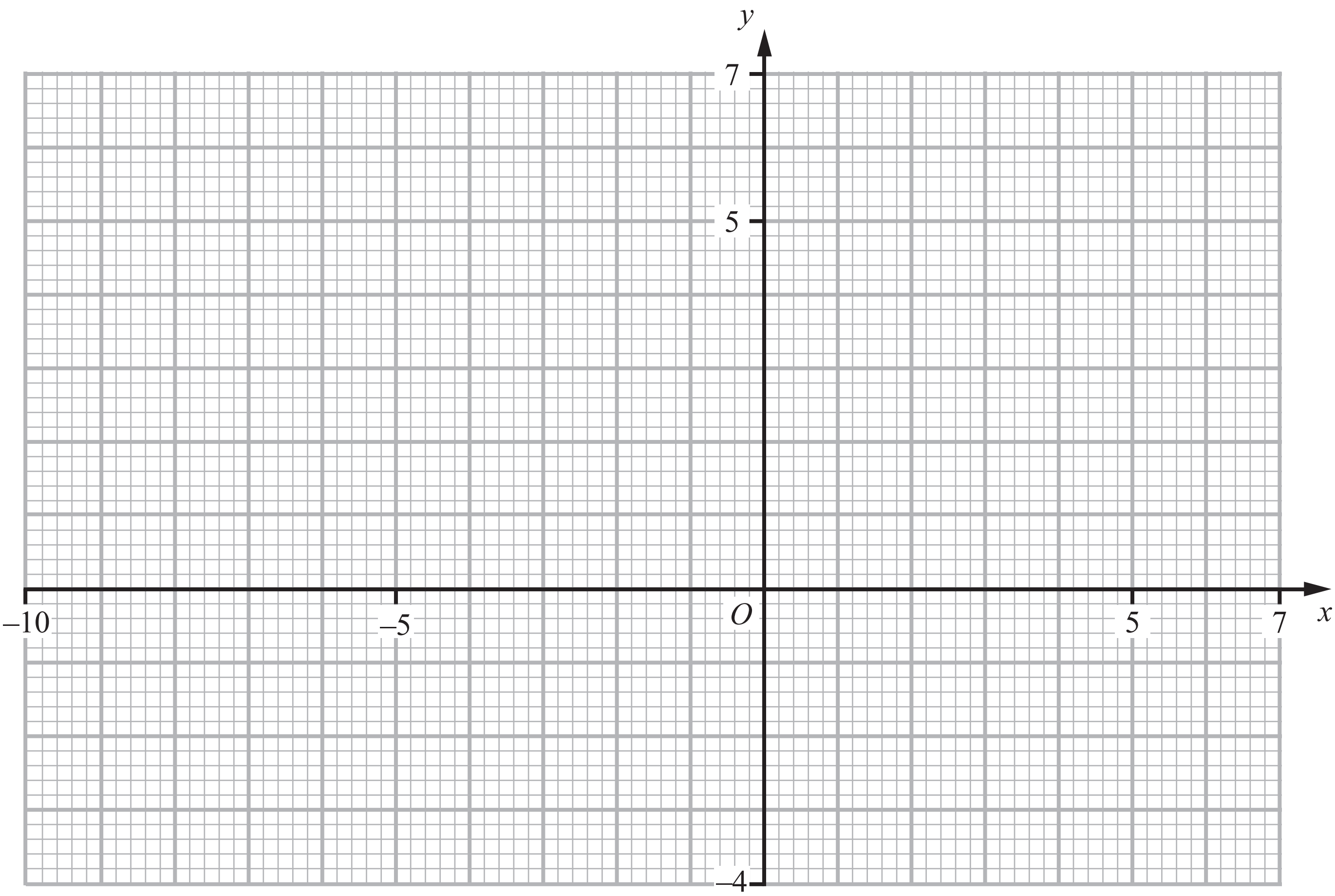
(c) (i) Find the coordinates of A_2, B_2 and C_2

(ii) Draw and label $\Delta A_2B_2C_2$

(3)

(d) Describe fully the transformation of ΔABC to $\Delta A_2B_2C_2$

(3)



Question 6 continued

Question 6 continued

Question 6 continued

(Total for Question 6 is 10 marks)

7 There are 25 boys in a class in a school.

All of the boys in the class play at least one of the sports football (F), cricket (C) and tennis (T). Some details about the number of boys who play these three sports are given in the Venn diagram Figure 3.

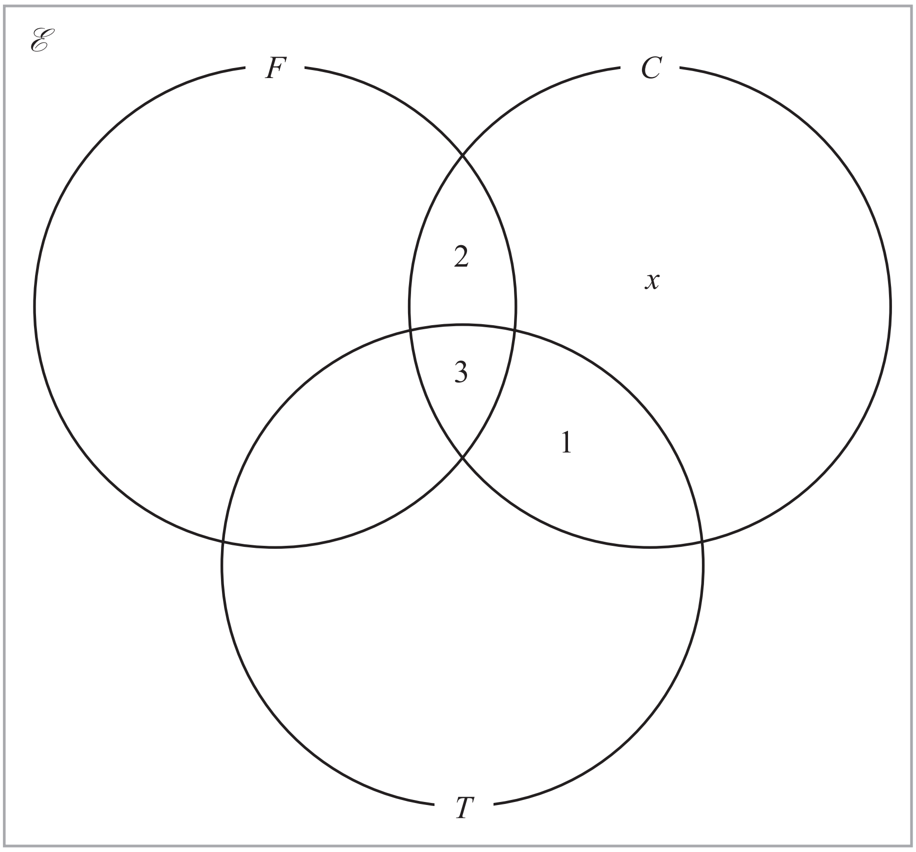


Figure 3

9 boys play cricket.

(a) Find the value of x.

(2)

8 boys do not play football or cricket.

(b) Calculate how many boys play football.

(2)

Only 3 boys play both football and tennis but not cricket.

(c) Calculate how many boys play football only.

(2)

(d) (i) Shade the region $F' \cap (T \cup C)$ in the Venn diagram.

(ii) What sports are played by the boys in this set?

(iii) What sport is played by all the boys not in this set?

(4)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 10 marks)

8

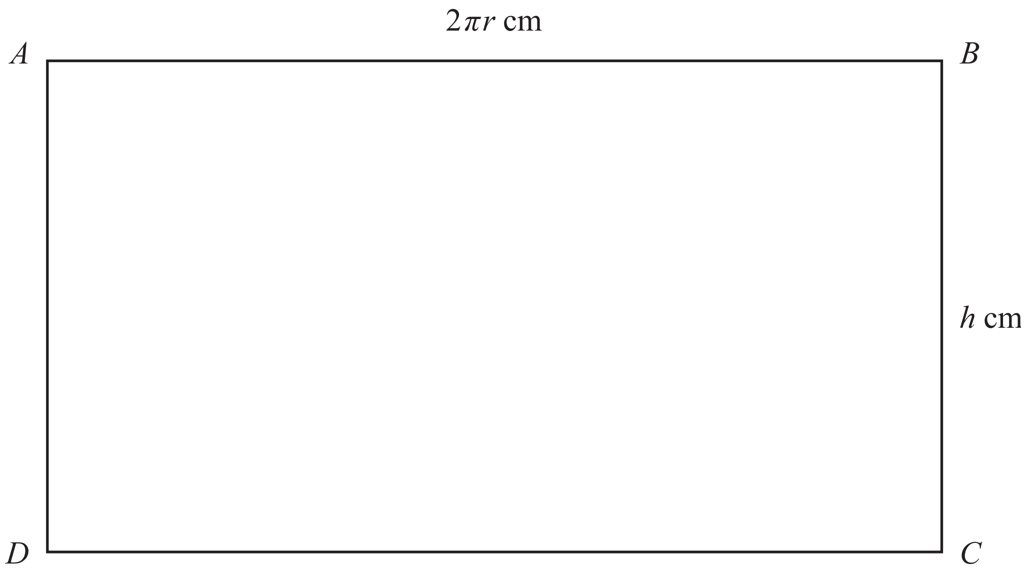


Figure 4

ABCD is a rectangular piece of paper where $AB = 2\pi r$ cm and $BC = h$ cm.

A right circular hollow cylinder, of radius r cm and height h cm, is made by joining side *AD* to side *BC* so that the circumference of the cylinder is $2\pi r$ cm and its height h cm.

Given that the perimeter of *ABCD* is 60 cm,

(a) show that

$$h = 30 - 2\pi r$$

(2)

(b) show that the volume, V cm^3, of the hollow cylinder is given by

$$V = 2\pi r^2 (15 - \pi r)$$

(2)

(c) show that for the volume of the cylinder to be a maximum

$$r = \frac{10}{\pi}$$

(5)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 9 marks)

9

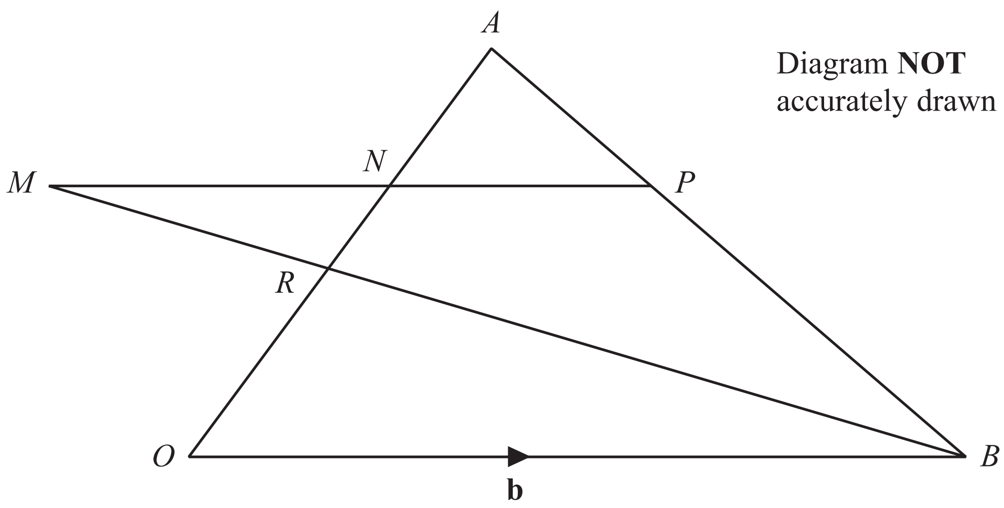


Figure 5

In Figure 5, OAB is a triangle with $\overrightarrow{OB} = \mathbf{b}$.

The point R lies on OA such that $OR : RA = 1 : 3$ and $\overrightarrow{OA} = 4\mathbf{a}$.

Express in terms of **a** and **b** or **a** or **b**,

(a) (i) $\overrightarrow{OR}$, (ii) $\overrightarrow{RB}$, (iii) $\overrightarrow{AB}$.

(3)

The point P lies on AB such that $AP : PB = 1 : 2$

Express in terms of **a** and **b**, simplifying your answers where possible,

(b) (i) $\overrightarrow{PB}$, (ii) $\overrightarrow{OP}$.

(3)

BRM is a straight line such that $\overrightarrow{MB} = k\overrightarrow{RB}$, where k is a constant.

Given that the line MP is parallel to OB,

(c) (i) show that $k = \dfrac{8}{3}$,

(ii) find an expression for $\overrightarrow{MP}$ in terms of **b**

(4)

The point of intersection of MP and OA is N such that

$\overrightarrow{NP} = l\mathbf{b}$ and $\overrightarrow{RN} = m\mathbf{a}$

(d) Find an expression for $\overrightarrow{OP}$ in terms of **a**, **b**, l and m

(1)

(e) Hence find the value of m

(3)

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 14 marks)

10

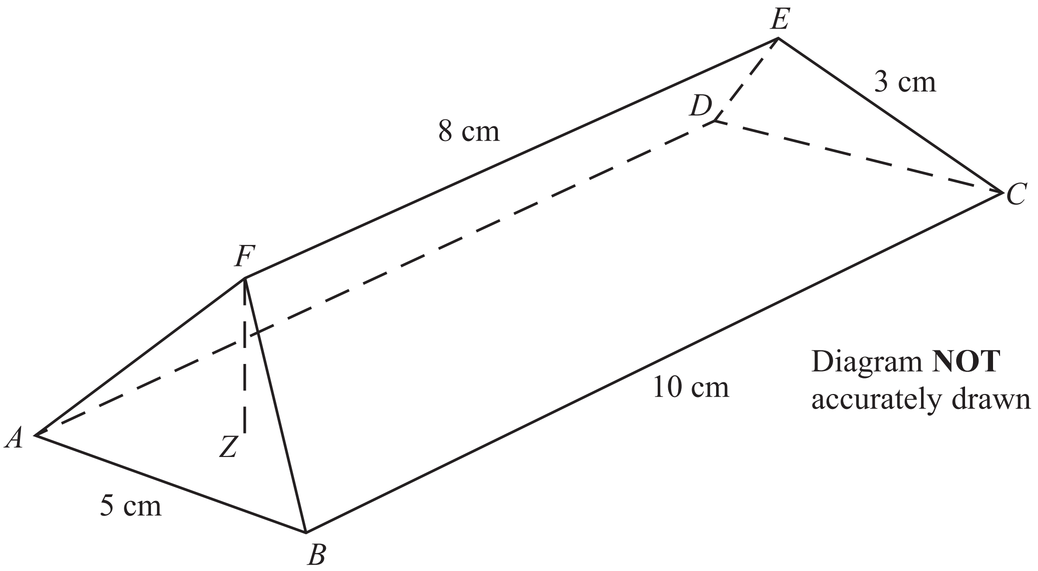


Figure 6

Figure 6 shows a solid *ABCDEF* in which *ABCD* is a horizontal rectangle, *ADEF* and *BCEF* are trapezia, and *ABF* and *CDE* are non-vertical triangles.

In the horizontal rectangle *ABCD*, $AB = CD = 5$ cm and $BC = AD = 10$ cm.

In the trapezia *ADEF* and *BCEF*, $FE = 8$ cm, $AF = BF = CE = DE = 3$ cm.

Calculate the size, in degrees to 3 significant figures, of

(a) $\angle ABF$

(3)

(b) $\angle FBC$

(3)

Z is the point in the rectangle *ABCD* such that *FZ* is vertical.

(c) Calculate the length, in cm to 3 significant figures, of *FZ*.

(4)

(d) Calculate the total surface area, in cm^2 to 3 significant figures, of the solid *ABCDEF*.

(6)

[Area of triangle = $\frac{1}{2}bc\sin A$, Area of trapezium = $\frac{1}{2}(a+b)h$,

Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$]

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 16 marks)

Turn over

11

$$y = \frac{x^2}{5} + \frac{4}{x} - 1$$

(a) Complete the table of values for $y = \frac{x^2}{5} + \frac{4}{x} - 1$, giving your answers to 2 decimal places where necessary.

x	1	1.5	2	2.5	3	3.5	4
y	3.2		1.8		2.13		3.2

(3)

(b) On the grid, plot the points from your completed table and join them to form a smooth curve.

(3)

(c) On the grid, draw the straight line with equation $y = \frac{x}{5} + 2$

(1)

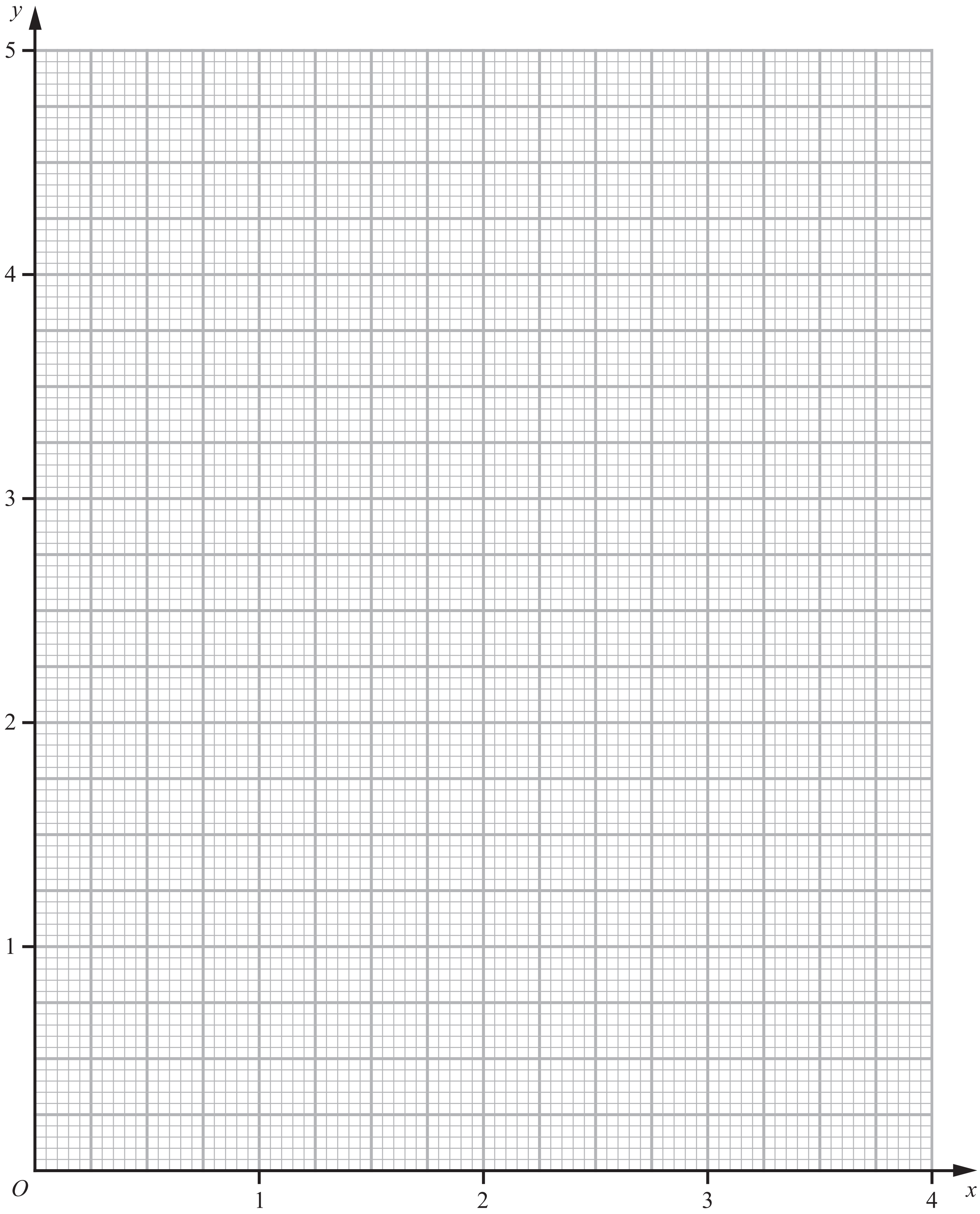
(d) For values of x in $1 \leqslant x \leqslant 4$, use your graphs to find the range of values of x for which $\frac{x}{5} + 2 \geqslant \frac{x^2}{5} + \frac{4}{x} - 1$

(2)

(e) By algebraically rearranging $x^3 - x^2 - 15x + 20 = 0$ and using your graphs, find the solutions of $x^3 - x^2 - 15x + 20 = 0$ in the range $1 \leqslant x \leqslant 4$

(5)

Question 11 continued



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Question 11 continued

Question 11 continued

Question 11 continued

(Total for Question 11 is 14 marks)

TOTAL FOR PAPER IS 100 MARKS