Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics B

Paper 2

Tuesday 19 January 2016 – 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 ▶

P46913A

1/1/

P 4 6 9 1 3 A 0 1 3 2

PEARSON

Answer ALL ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Make x the subject of the formula $y = \dfrac{(1-x)^2}{x} - x$

(Total for Question 1 is 4 marks)

2 (a) Find the inverse of the matrix $\begin{pmatrix} 3 & -2 \\ 5 & -1 \end{pmatrix}$

(2)

(b) Hence, or otherwise, find the value of x and the value of y that satisfy

$$\begin{pmatrix} 3 & -2 \\ 5 & -1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 \\ 9 \end{pmatrix}$$

(4)

$$\left[\text{Inverse of matrix } \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \frac{1}{ad - bc}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}\right]$$

(Total for Question 2 is 6 marks)

3 In 2014, the owner of a shop bought 40 000 articles at a cost of £0.56 each and sold all of the articles at £0.68 each.

(a) Calculate the total profit made, in £s, in selling all of the articles.

(2)

In 2015, the owner of the shop bought 25% more of these articles than she bought in 2014.

The owner paid 12½% more for each article in 2015 than she did in 2014.

The selling price of each article in 2015 was such that the total profit made in selling all of the articles in 2015 was £200 more than the total profit made in 2014.

(b) Calculate the selling price, in £s, of each article in 2015.

(4)

Question 3 continued

(Total for Question 3 is 6 marks)

4

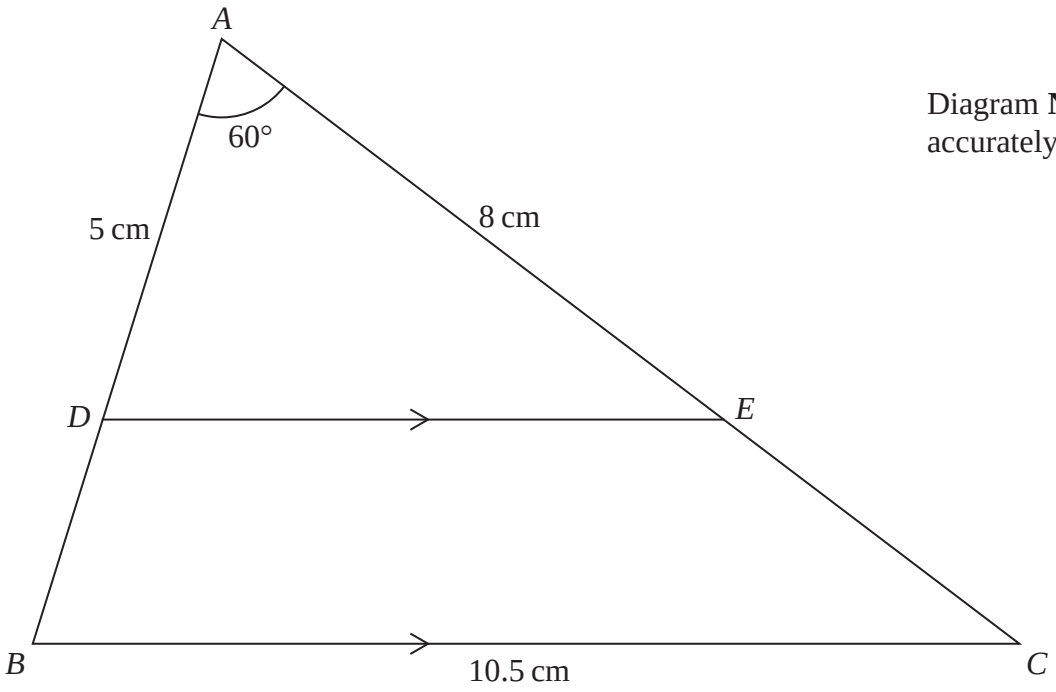


Diagram **NOT** accurately drawn

Figure 1

In ΔADE, $AD = 5$ cm, $AE = 8$ cm and $\angle DAE = 60°$ as shown in Figure 1.

(a) Calculate the length, in cm, of DE.

(3)

In Figure 1, D is a point on AB and E is a point on AC so that DE is parallel to BC.

$BC = 10.5$ cm.

(b) Calculate the length, in cm, of BD.

(2)

Given that the area of ΔADE is 17.3 cm^2 to 3 significant figures,

(c) calculate the area, in cm^2, of ΔABC.

(2)

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

Question 4 continued

(Total for Question 4 is 7 marks)

5 f and g are two functions such that

$$f : x \mapsto 2 - 4x \quad \text{where} \quad x < 1$$
$$g : x \mapsto 7 - x^2 \quad \text{where} \quad x \leqslant 0$$

(a) Write down the range of

(i) f

(ii) g

(2)

(b) Express the inverse function f^{-1} in the form $f^{-1} : x \mapsto ...$

(2)

(c) Find the value of x for which $3f(x) = 4g(x)$.
Give your answer to 3 significant figures.

(5)

$$\left[\text{Solutions of } ax^2 + bx + c = 0 \text{ are } x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}\right]$$

Question 5 continued

(Total for Question 5 is 9 marks)

6

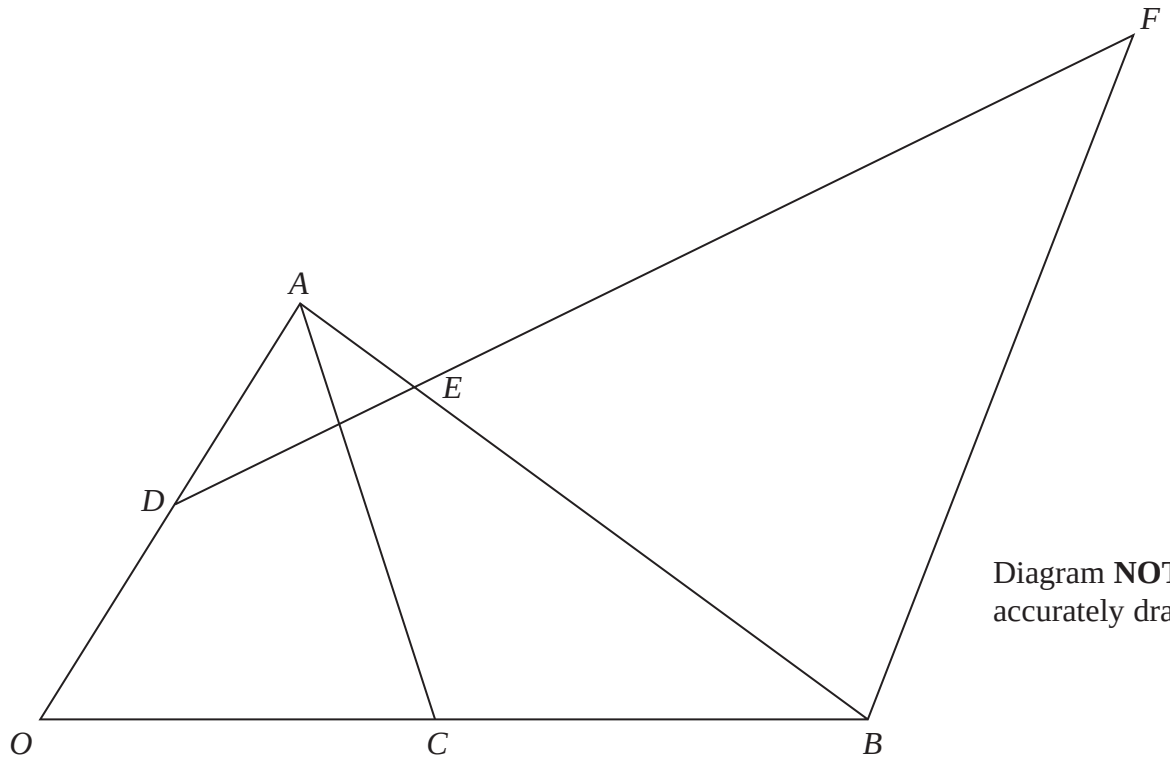


Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows ΔOAB in which $\overrightarrow{OA} = 2\mathbf{a}$ and $\overrightarrow{OB} = 12\mathbf{b}$

The point D is the midpoint of OA and the point C is the midpoint of OB.

The point E on AB is such that $AE : AB = 1 : 4$

(a) Find in terms of **a** and **b**, simplifying your answers where possible,

(i) $\overrightarrow{AB}$ (ii) $\overrightarrow{AE}$ (iii) $\overrightarrow{DE}$

(4)

The point F is such that DEF is a straight line and $\overrightarrow{BF} = m\mathbf{a}$, where m is a scalar.

(b) Write down $\overrightarrow{EF}$ in terms of **a**, **b** and m.

(1)

Given that $\overrightarrow{DE} = n\overrightarrow{EF}$, where n is a scalar,

(c) find the value of m and the value of n.

(5)

.....

.....

.....

.....

Question 6 continued

Question 6 continued

Question 6 continued

(Total for Question 6 is 10 marks)

7

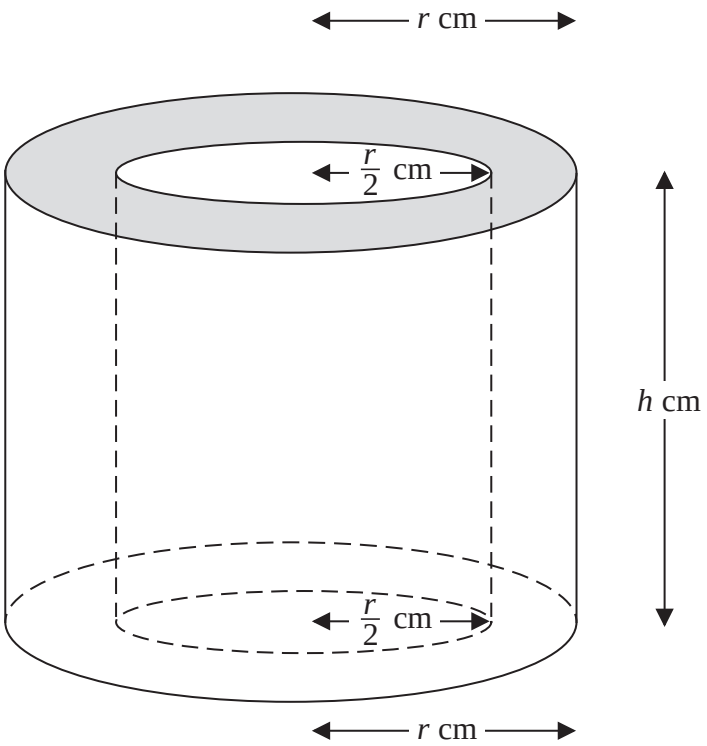


Figure 3

Figure 3 shows solid S formed by removing a right circular cylinder of radius $\frac{1}{2}r$ cm and height h cm from a right circular cylinder of radius r cm and height h cm.
Both cylinders have the same axis.

The total surface area of S is A cm^2

(a) Show that $A = \frac{3}{2}\pi r^2 + 3\pi rh$

(2)

The volume of S is 30 cm^3

(b) Find a formula for h in terms of π and r.

(2)

(c) Hence show that $A = \frac{3}{2}\pi r^2 + \frac{120}{r}$

(2)

(d) Find the value of r, to 3 significant figures, for which the value of A is a minimum.

(4)

.....

.....

[Area of circle = πr^2
Curved surface area of a right circular cylinder = $2\pi rh$]

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 10 marks)

8 Each morning, Tang takes at random one carton of juice from her fridge and drinks the juice with her breakfast. She does not return the carton to the fridge.

On Monday, there are 9 cartons of grapefruit juice (G) and 6 cartons of mixed fruit juice (M) in the fridge.

The incomplete probability tree diagram, on page 19, shows information about the juice Tang drank on Monday, Tuesday and Wednesday.

(a) Complete the probability tree diagram.

(4)

(b) Calculate the probability that Tang will have

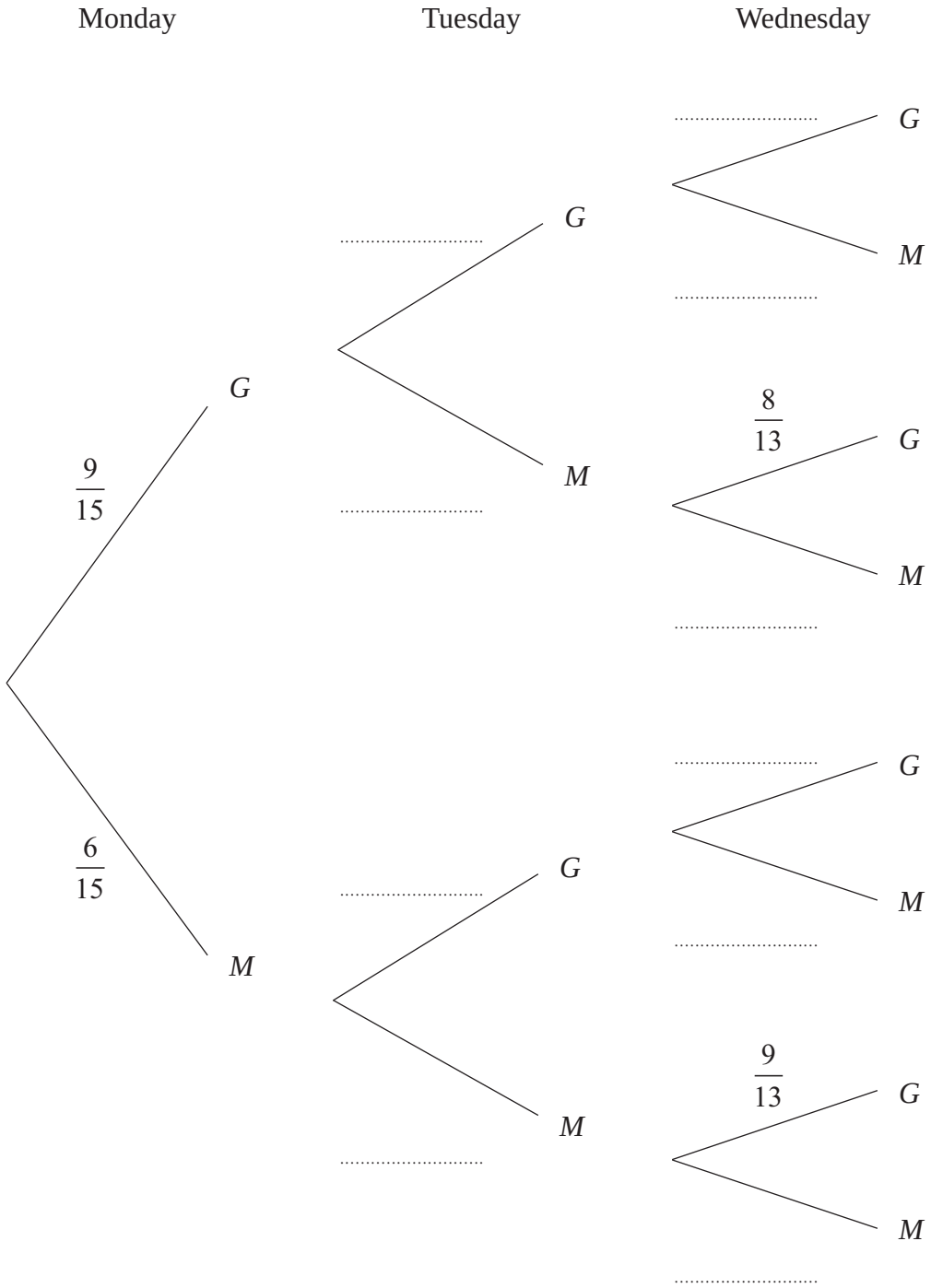
(i) grapefruit juice on all three mornings,

(ii) mixed fruit juice on at least one of the three mornings,

(iii) grapefruit juice on at least two of the three mornings.

(7)

Question 8 continued



Question 8 continued

Question 8 continued

(Total for Question 8 is 11 marks)

9 The points $A(2, 2)$, $B(3, 3)$ and $C(4, 1)$ are the vertices of a triangle.

(a) On the grid, draw and label triangle ABC

(1)

$$\mathbf{P} = \begin{pmatrix} 2 & 0 \\ 1 & -1 \end{pmatrix}$$

(b) Calculate the matrix product

$$\mathbf{P}\begin{pmatrix} 2 & 3 & 4 \\ 2 & 3 & 1 \end{pmatrix}$$

(2)

Triangle $A'B'C'$ is the image of triangle ABC where A', B' and C' are respectively the images of the points A, B and C under the transformation with matrix **P**.

(c) On the grid, draw and label triangle $A'B'C'$

(1)

$$\mathbf{Q} = \begin{pmatrix} -1 & 0 \\ -1 & 2 \end{pmatrix}$$

Triangle $A''B''C''$ is the image of triangle $A'B'C'$ where A'', B'' and C'' are respectively the images of the points A', B' and C' under the transformation with matrix **Q**.

(d) On the grid, draw and label triangle $A''B''C''$

(3)

(e) Describe fully the **single** transformation that maps triangle ABC onto triangle $A''B''C''$

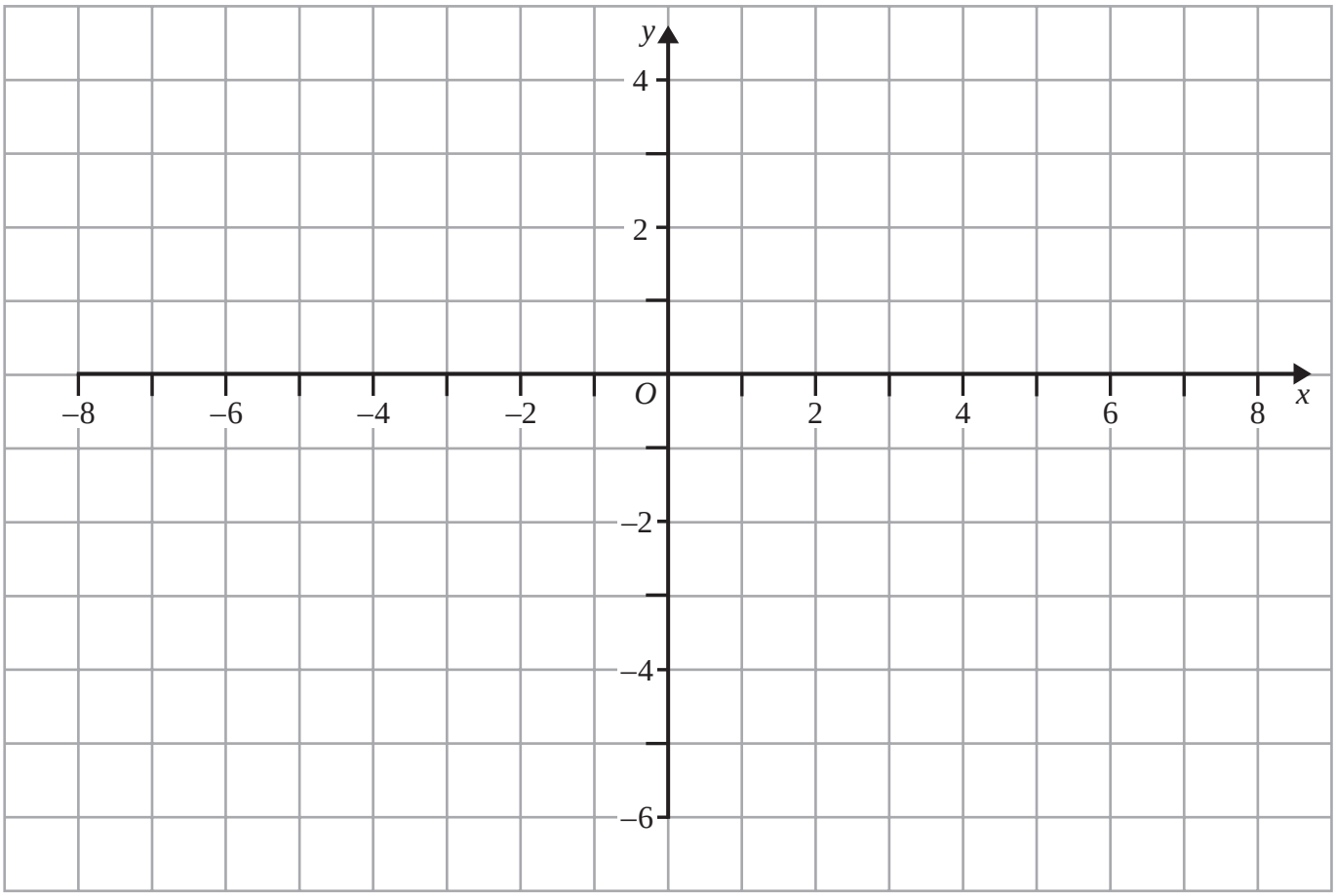
(3)

(f) Find the matrix that represents this transformation.

(1)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 9 continued



Question 9 continued

Question 9 continued

(Total for Question 9 is 11 marks)

10

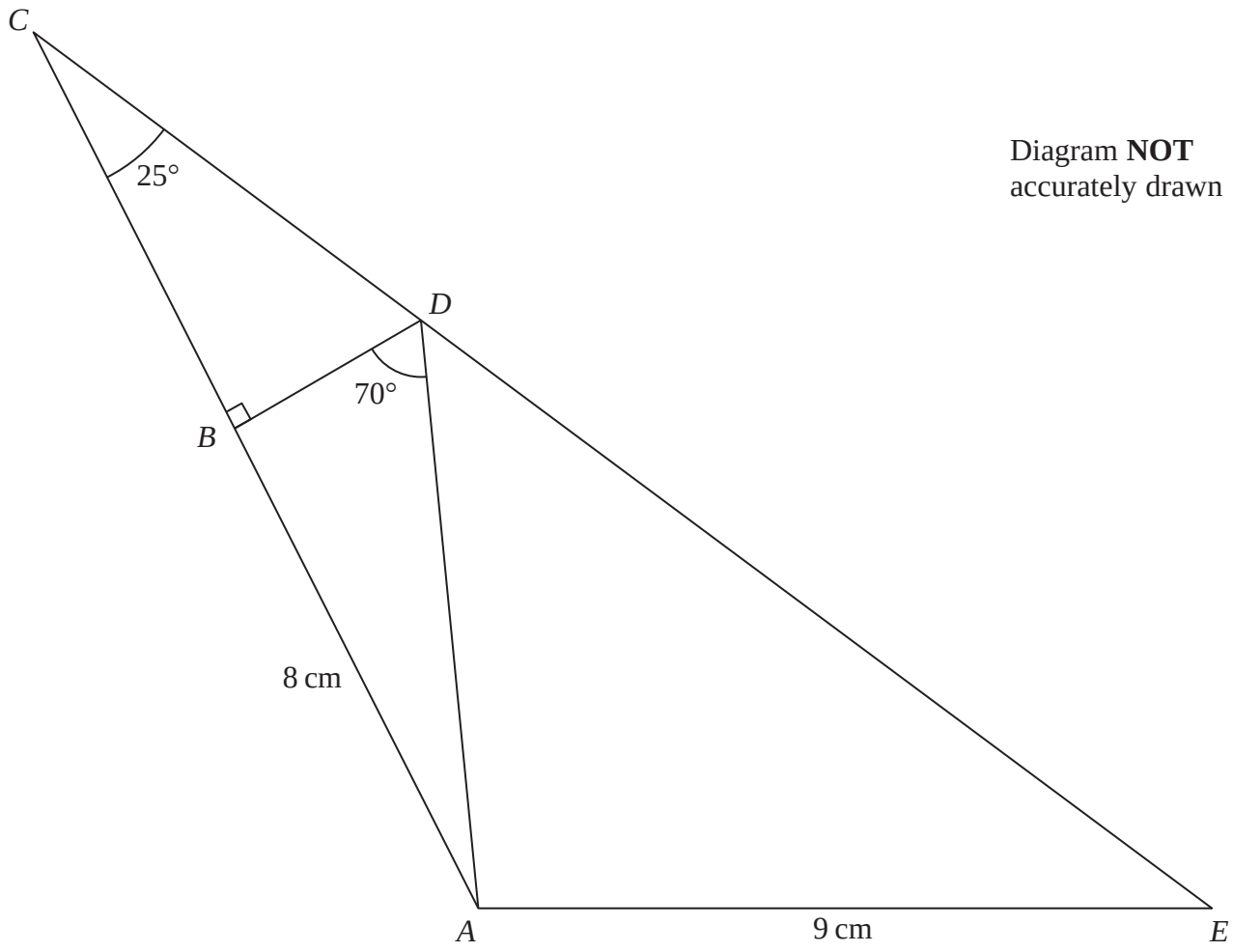


Diagram **NOT** accurately drawn

Figure 4

Figure 4 shows ΔACE in which $AE = 9$ cm.

The point B lies on AC and the point D lies on CE so that $\angle DBC = 90°$, $\angle BCD = 25°$, $\angle BDA = 70°$ and $AB = 8$ cm.

Calculate the length, in cm to 3 significant figures, of

(a) AD,

(2)

(b) BC.

(3)

(c) Calculate the size, to the nearest degree, of $\angle AEC$.

(3)

(d) Calculate the area, in cm^2 to 3 significant figures, of $ABDE$.

(5)

.....

.....

Question 10 continued

$$\left[\begin{array}{c}\text{Area of triangle} = \frac{1}{2}bc\sin A \\ \\ \text{Sine rule: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}\end{array}\right]$$

Question 10 continued

Question 10 continued

(Total for Question 10 is 13 marks)

11 (a) Complete the following table for $y = 3x^3 - x^2 - 20x$ giving the values of y to one decimal place.

x	0	0.5	1	1.5	2	2.5	3
y	0.0		–18.0		–20.0		12.0

(3)

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

(3)

(c) On your grid, draw the straight line with equation $y = 5x - 8$

(1)

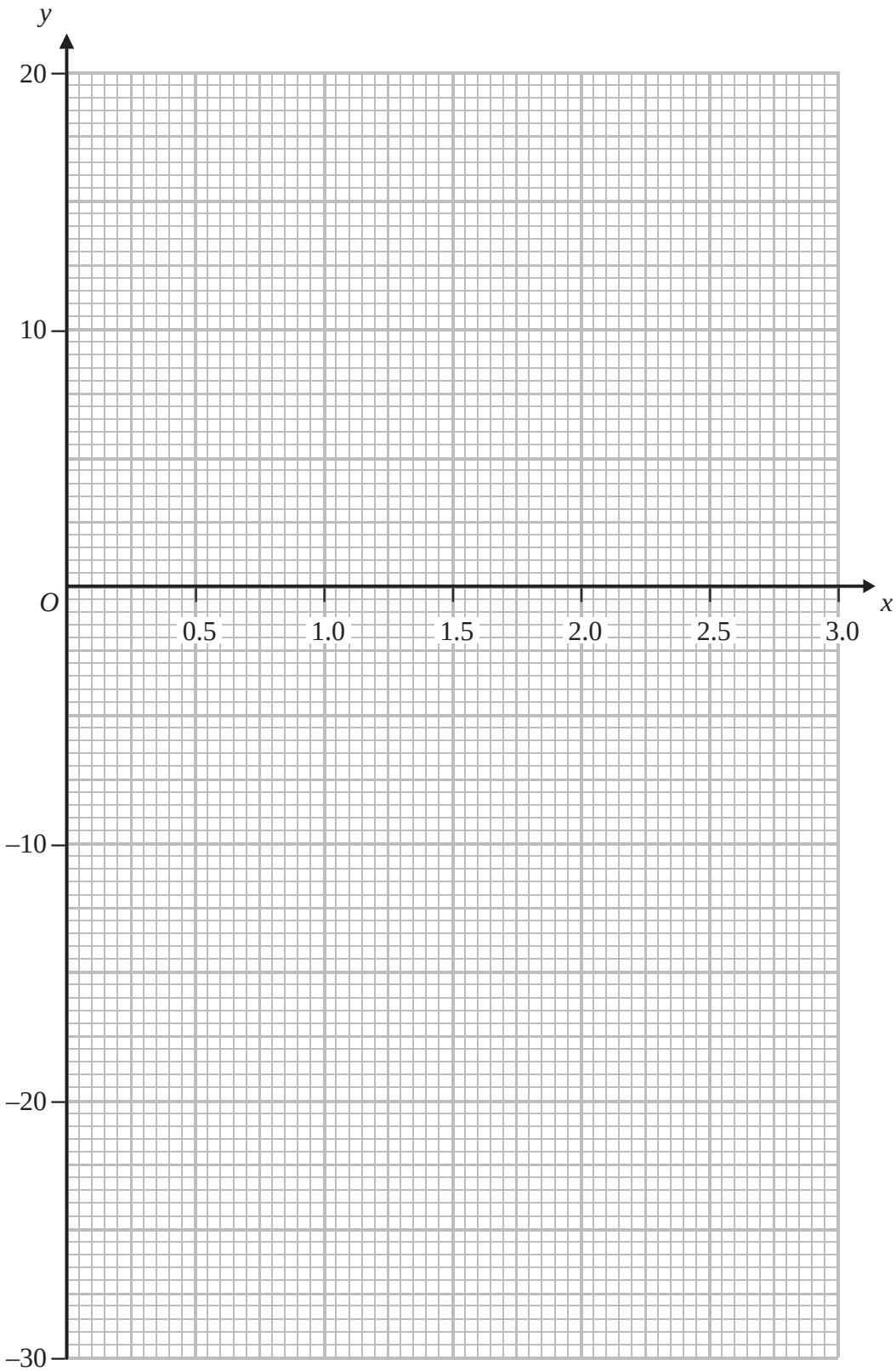
(d) Use your graphs to find the range of values of x in $0 \leqslant x \leqslant 3$ for which $3x^3 - x^2 - 25x + 8 < 0$

(4)

(e) By drawing a suitable straight line on your grid, explain why the equation $3x^3 - x^2 - 20x + 25 = 0$ has no solutions in $0 \leqslant x \leqslant 3$

(2)

Question 11 continued



Question 11 continued

(Total for Question 11 is 13 marks)

TOTAL FOR PAPER IS 100 MARKS