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Other names

Pearson Edexcel
International GCSE

Centre Number

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Candidate Number

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Mathematics B

Paper 2



Tuesday 17 January 2017 – 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.

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Question 1 continued

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(Total for Question 1 is 6 marks)



Question 2 continued

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(Total for Question 2 is 7 marks)



$$3 \quad \mathbf{A} = \begin{pmatrix} \frac{1}{2}y & 0 \\ 0 & 2x \end{pmatrix} \quad \text{where } x \neq 0 \text{ and } y \neq 0$$

(a) Write down the inverse matrix, \mathbf{A}^{-1} , of the matrix \mathbf{A} .

(2)

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

$$\begin{pmatrix} \frac{1}{2}y & 0 \\ 0 & 2x \end{pmatrix} \begin{pmatrix} y-2 \\ 4 \end{pmatrix} = \begin{pmatrix} y \\ x^4 \end{pmatrix}$$

(5)

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



Question 3 continued

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(Total for Question 3 is 7 marks)



Question 5 continued

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(Total for Question 5 is 4 marks)



P 4 8 4 1 3 A 0 1 1 3 6

- 6 John and Peter play a game with a pack of 26 white cards. The pack has 13 cards with a blue spot in the middle of one side of the card and 13 cards with a red spot in the middle of one side of the card.

John and Peter take it in turns to pick at random a card from the pack. The card is not returned to the pack.

The winner of the game is the first person to pick a card with a blue spot.

John picks at random a card from the pack and does not return the card to the pack.

- (a) Write down the probability that John wins the game with his first card. (1)

If John does not win the game with his first card, then Peter picks at random a card from the pack and does not return the card to the pack.

If Peter picks a card with a blue spot then he wins the game.

If Peter does not win the game with his first card, then John picks at random a second card from the pack and does not return the card to the pack.

If John does not win the game with his second card, then Peter picks at random a second card from the pack.

If Peter does not win the game with his second card the game stops and the result is a draw.

The incomplete probability tree diagram, on page 13, represents a game in which John and Peter can pick at most two cards each.

- (b) Complete the probability tree diagram for this game. (4)

- (c) Work out the probability that Peter wins the game with his first card. (2)

- (d) Work out the probability that Peter wins the game. (3)

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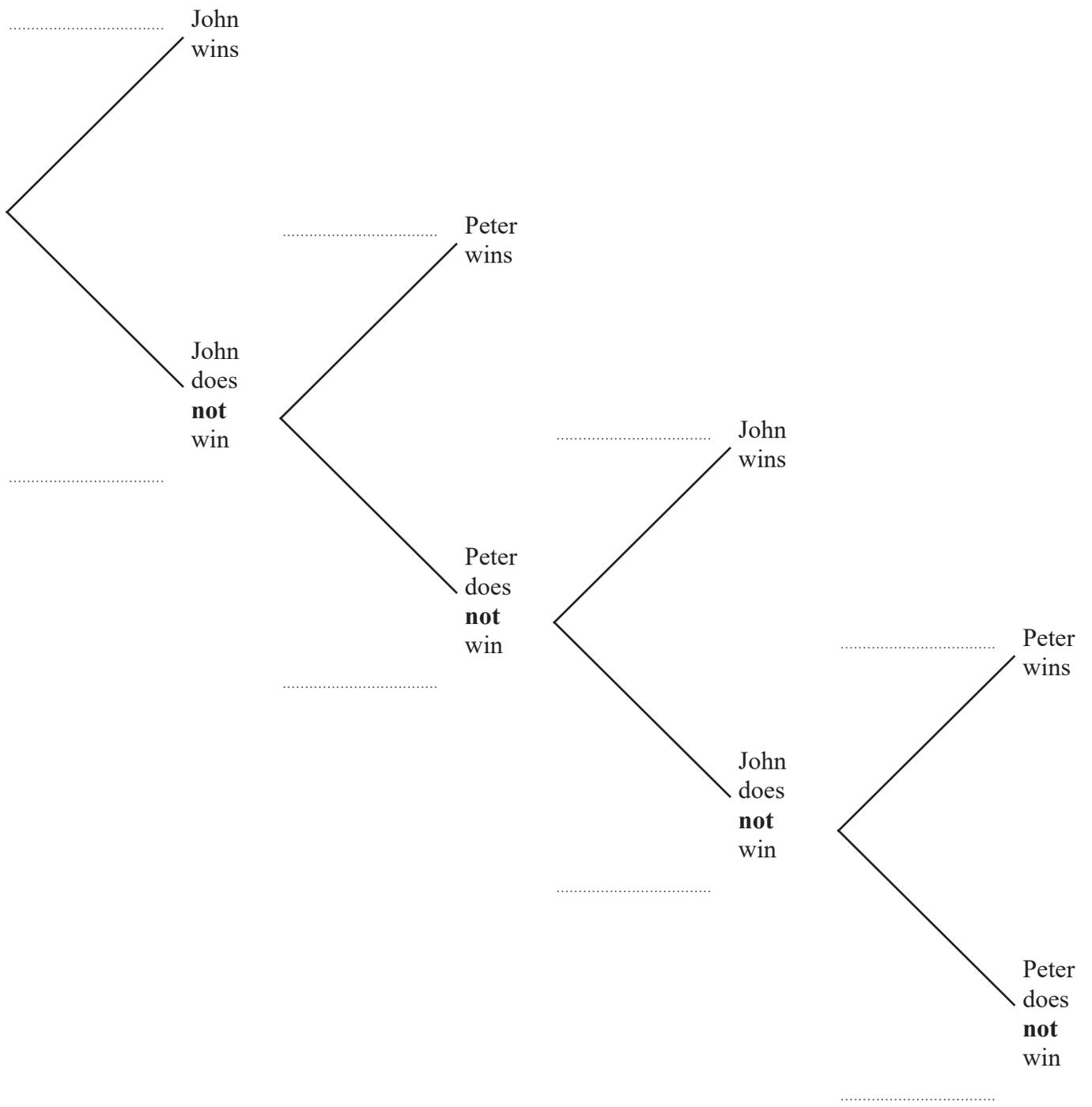


Question 6 continued

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Question 6 continued

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Question 6 continued

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(Total for Question 6 is 10 marks)



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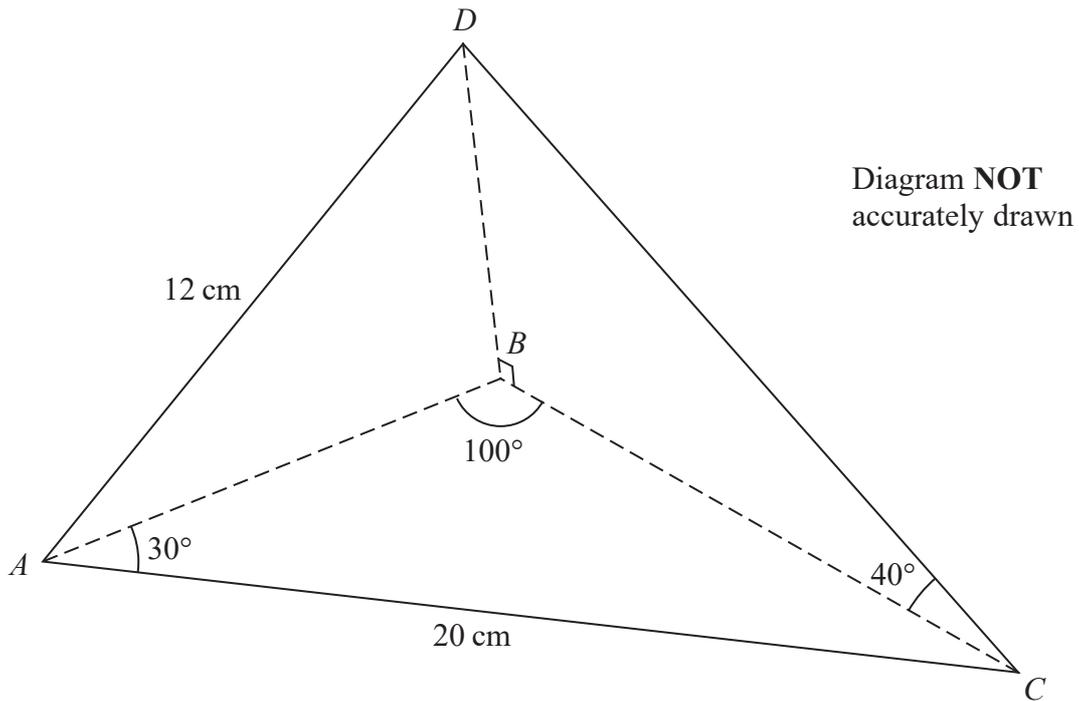


Figure 1

Figure 1 shows a triangular based pyramid $ABCD$ in which the edge BD is perpendicular to the edge BC of the pyramid.

In $\triangle ABC$, $AC = 20$ cm, $\angle BAC = 30^\circ$ and $\angle ABC = 100^\circ$

(a) Calculate the length, in cm to 3 significant figures, of BC . (3)

In $\triangle DCB$, $\angle DCB = 40^\circ$

(b) Calculate the length, in cm to 3 significant figures, of CD . (2)

Given that $AD = 12$ cm, calculate, to the nearest whole number,

(c) the size, in degrees, of $\angle ADC$, (3)

(d) the area, in cm^2 , of $\triangle ADC$. (2)

$$\left(\begin{array}{l} \text{Sine rule: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \\ \text{Cosine rule: } a^2 = b^2 + c^2 - 2bc \cos A \\ \text{Area of triangle} = \frac{1}{2} bc \sin A \end{array} \right)$$

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Question 7 continued

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Question 7 continued

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Question 7 continued

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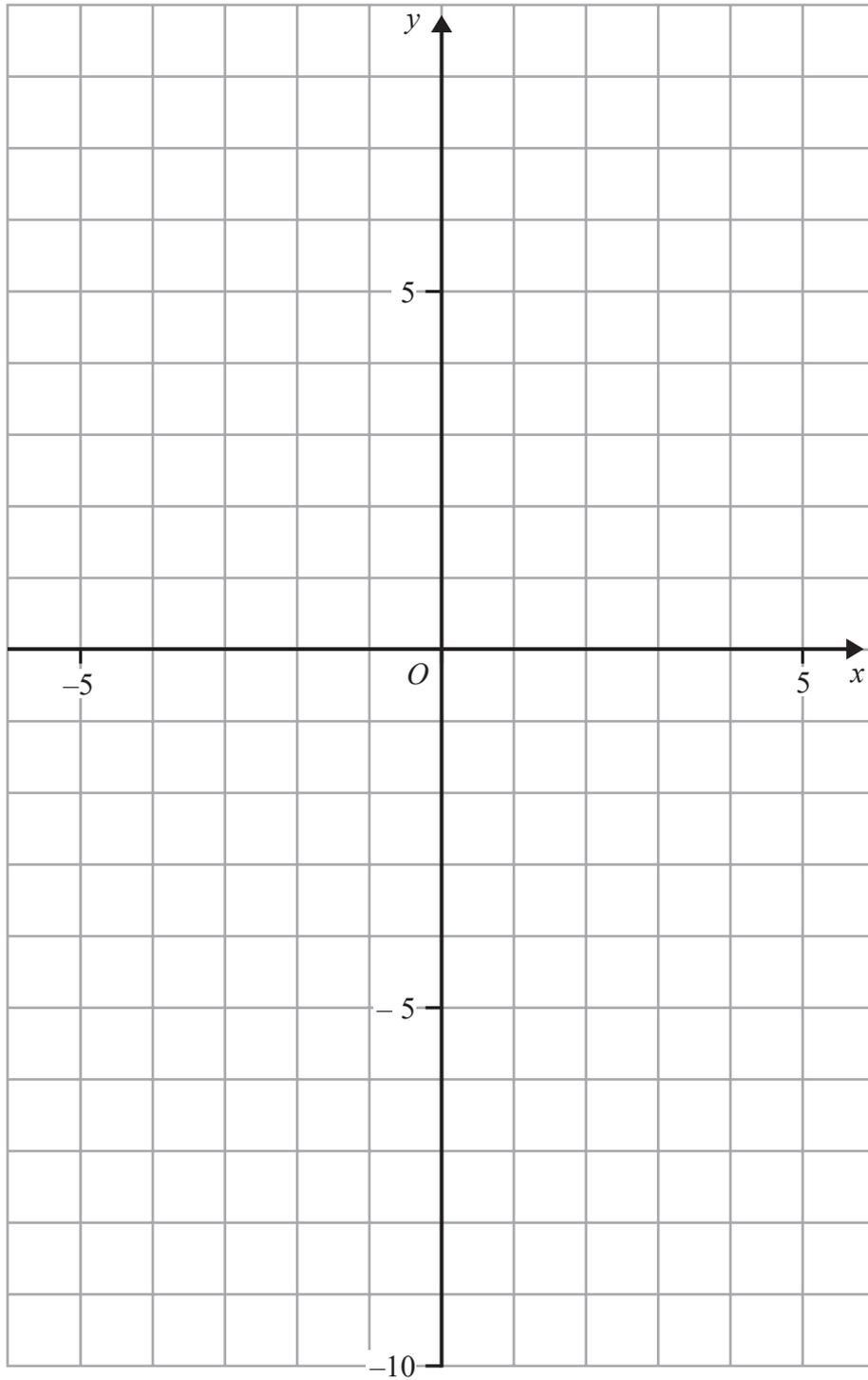
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Question 8 continued

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Question 8 continued

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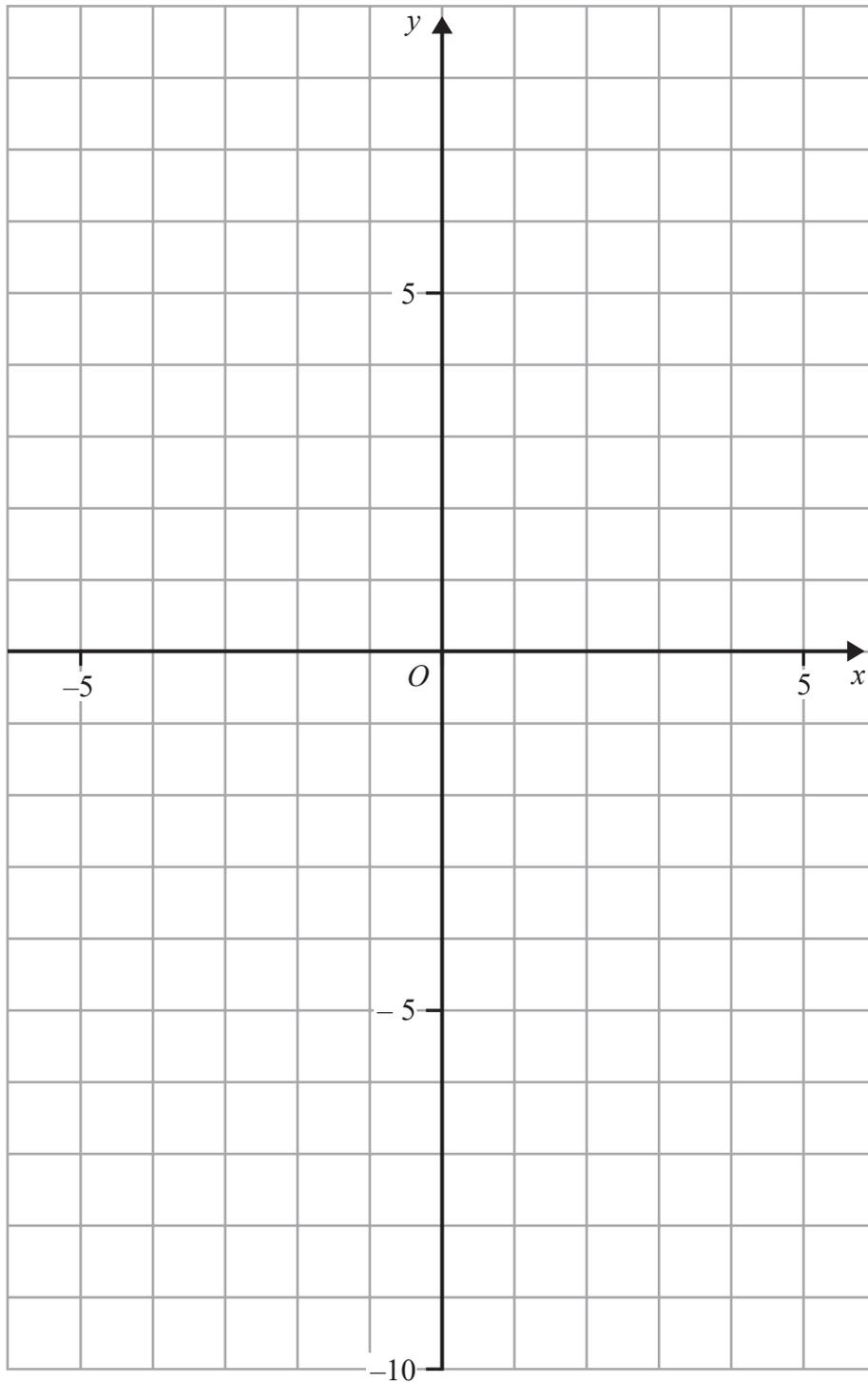
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Question 8 continued

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(Total for Question 8 is 12 marks)



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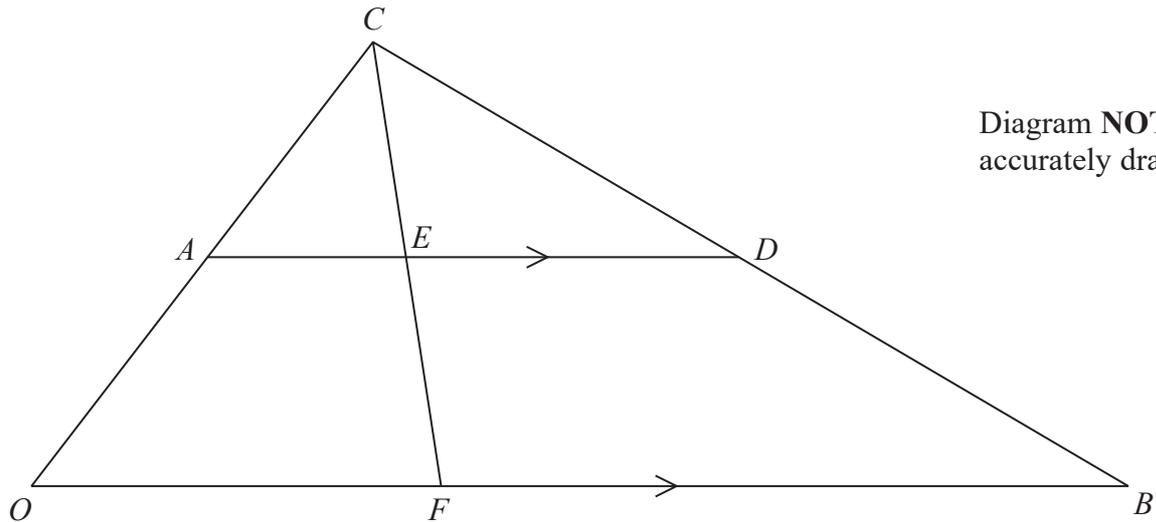


Figure 2

Figure 2 shows the triangle OCB in which $\vec{OC} = 2\mathbf{a}$ and $\vec{OB} = 12\mathbf{c}$

- (a) Find \vec{CB} , giving your answer in terms of \mathbf{a} and \mathbf{c} . (1)

A is the midpoint of OC and D is the point on BC such that AD is parallel to OB and triangles CAD and COB are similar.

- (b) Explain why $\frac{AC}{OC} = \frac{DC}{BC} = \frac{AD}{OB} = \frac{1}{2}$ (2)

- (c) Express in terms of \mathbf{a} or \mathbf{c} or \mathbf{a} and \mathbf{c} ,

- (i) \vec{AD} (ii) \vec{OD} (2)

The point E on AD is such that $AE : ED = 1 : m$, where m is an integer.
The point F on OB is such that CEF is a straight line.

- (d) Show that $\vec{FD} = \mathbf{a} + 6\mathbf{c} - \frac{12}{m+1}\mathbf{c}$ (3)

Given that $\vec{FD} = \mathbf{a} + 3\mathbf{c}$

- (e) find the value of m . (2)

Given that the area of triangle ACD is 10 cm^2

- (f) calculate the area, in cm^2 , of triangle FCB . (3)

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Question 9 continued

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Question 9 continued

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Question 9 continued

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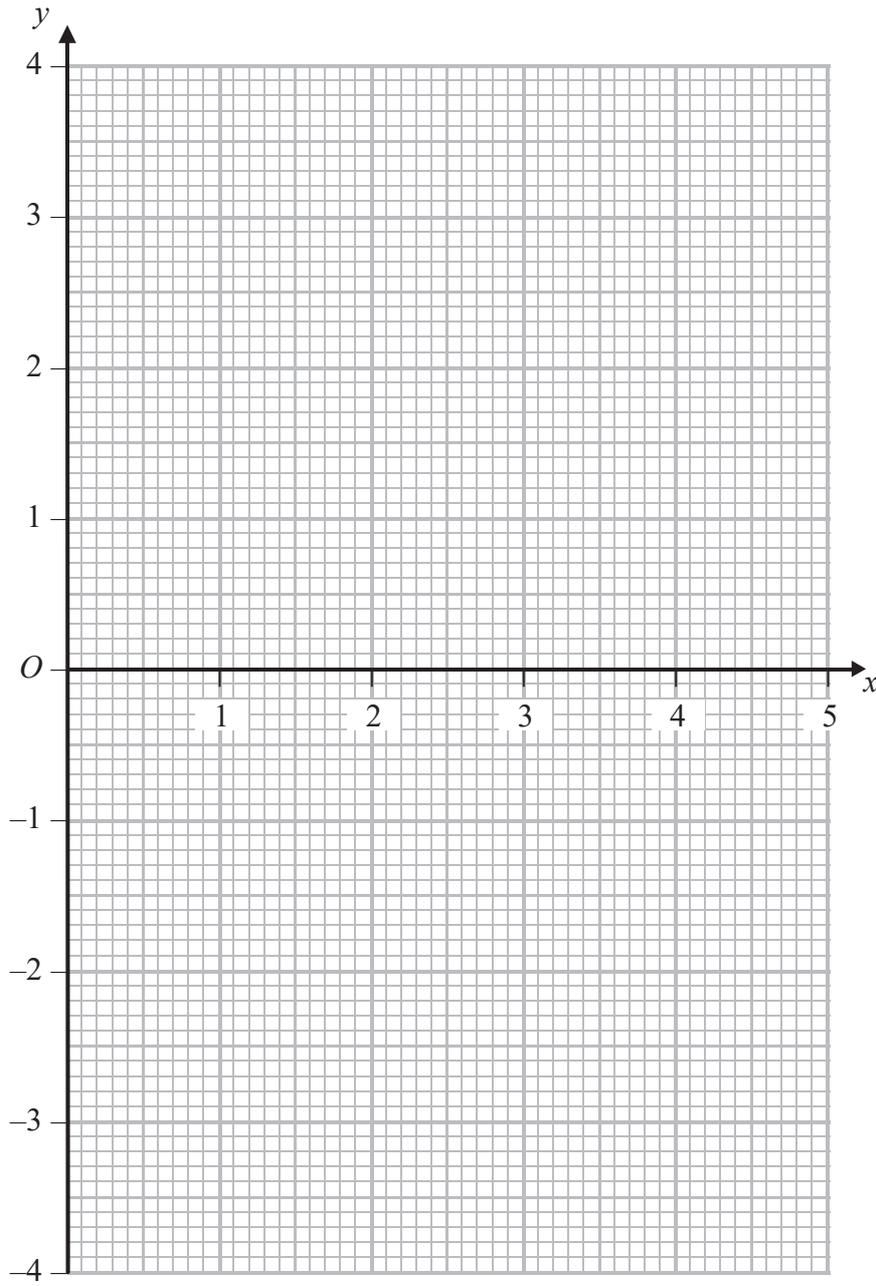
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Question 10 continued



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Question 10 continued

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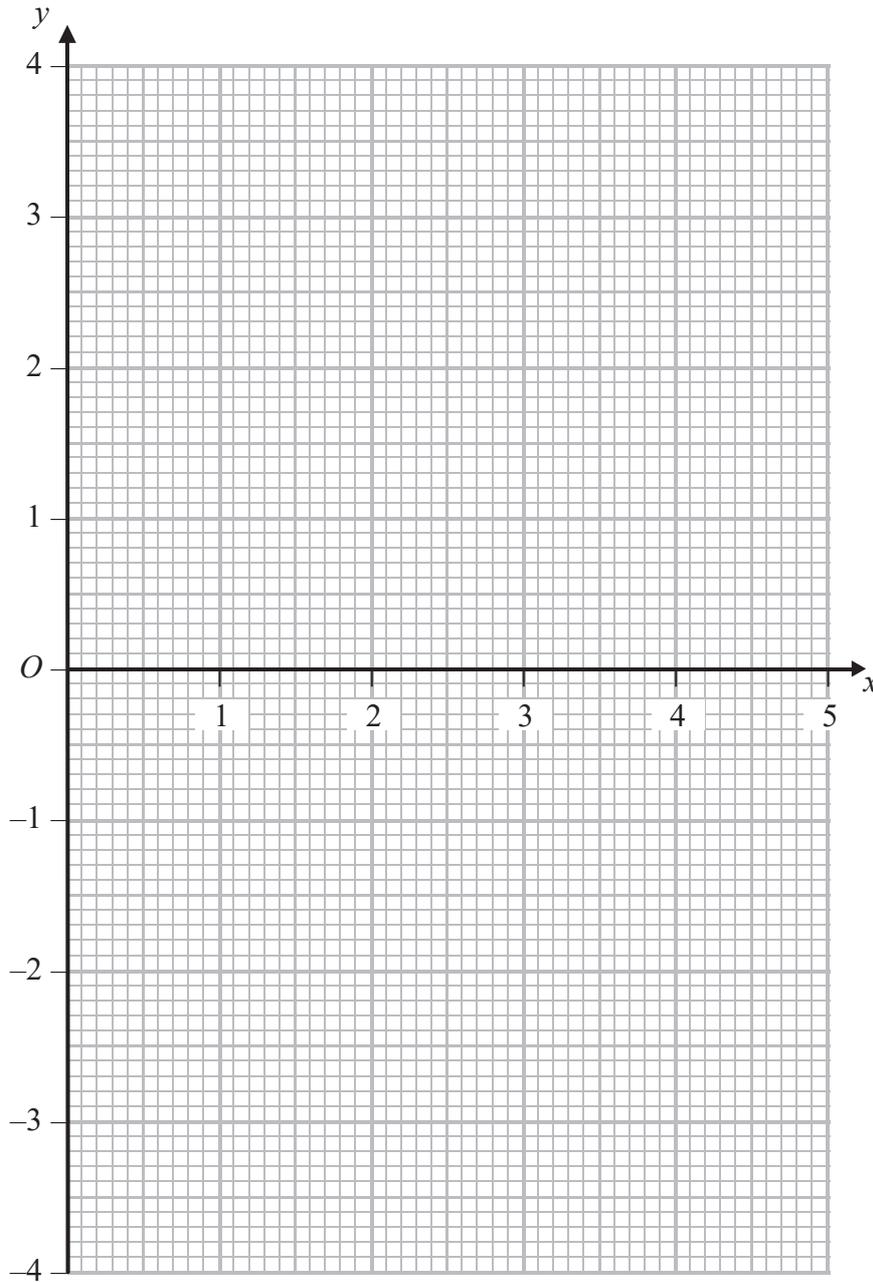
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Question 10 continued

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(Total for Question 10 is 9 marks)



P 4 8 4 1 3 A 0 3 1 3 6

- 11 A solid is made by fixing a solid hemisphere of radius r cm on the flat circular top face of a solid cylinder of radius r cm and height h cm. The centre of the hemisphere coincides with the centre of the flat circular top face of the cylinder as shown in Figure 3.

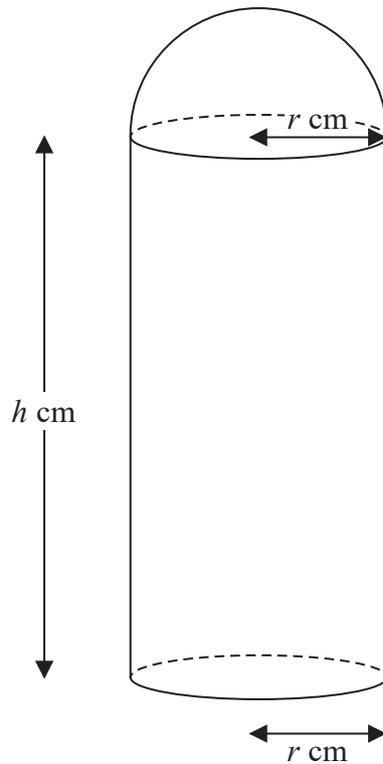


Diagram NOT
accurately drawn

Figure 3

Given that the total external surface area of the solid is S cm²

(a) show that $S = \pi r(3r + 2h)$ (2)

Given that $S = 50$

(b) show that $h = \frac{25}{\pi r} - \frac{3r}{2}$ (2)

The total volume of the solid is V cm³

(c) Show that $V = 25r - \frac{5\pi r^3}{6}$ (4)

(d) Using calculus, find the value of r for which the volume of the solid is a maximum. (5)

$$\left(\begin{array}{l} \text{Area of circle} = \pi r^2 \\ \text{Curved surface area of a right circular cylinder} = 2\pi r h \\ \text{Surface area of sphere} = 4\pi r^2 \\ \text{Volume of sphere} = \frac{4}{3}\pi r^3 \end{array} \right)$$



Question 11 continued

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Question 11 continued

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Question 11 continued

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Question 11 continued

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TOTAL FOR PAPER IS 100 MARKS

