

Write your name here

Surname	Other names
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**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.

Turn over ►

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**Question 1 continued**

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Area with horizontal dotted lines for writing.

**(Total for Question 1 is 6 marks)**





**Question 2 continued**

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**(Total for Question 2 is 7 marks)**





**Question 3 continued**

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**(Total for Question 3 is 7 marks)**

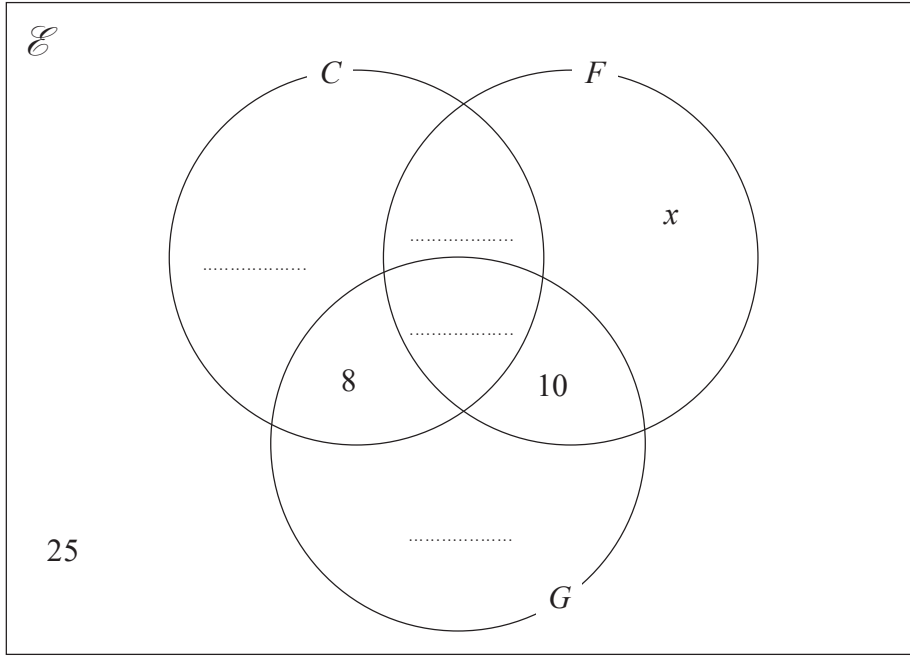


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Question 4 continued



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(Total for Question 4 is 9 marks)



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**Question 5 continued**

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Handwriting practice area with horizontal dotted lines.

**(Total for Question 5 is 4 marks)**



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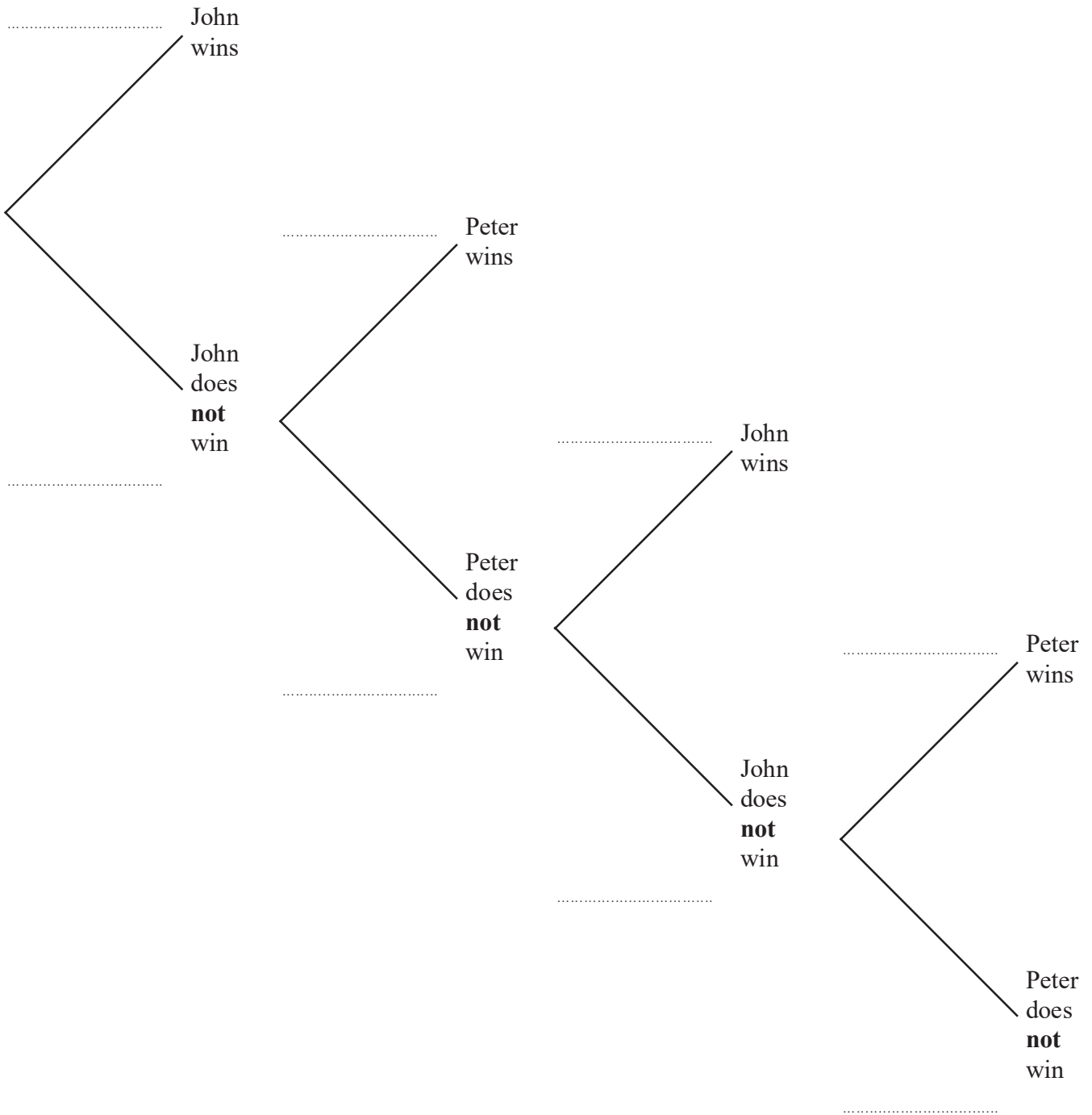


Question 6 continued

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**Question 6 continued**

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**Question 6 continued**

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Area with horizontal dotted lines for writing.

**(Total for Question 6 is 10 marks)**



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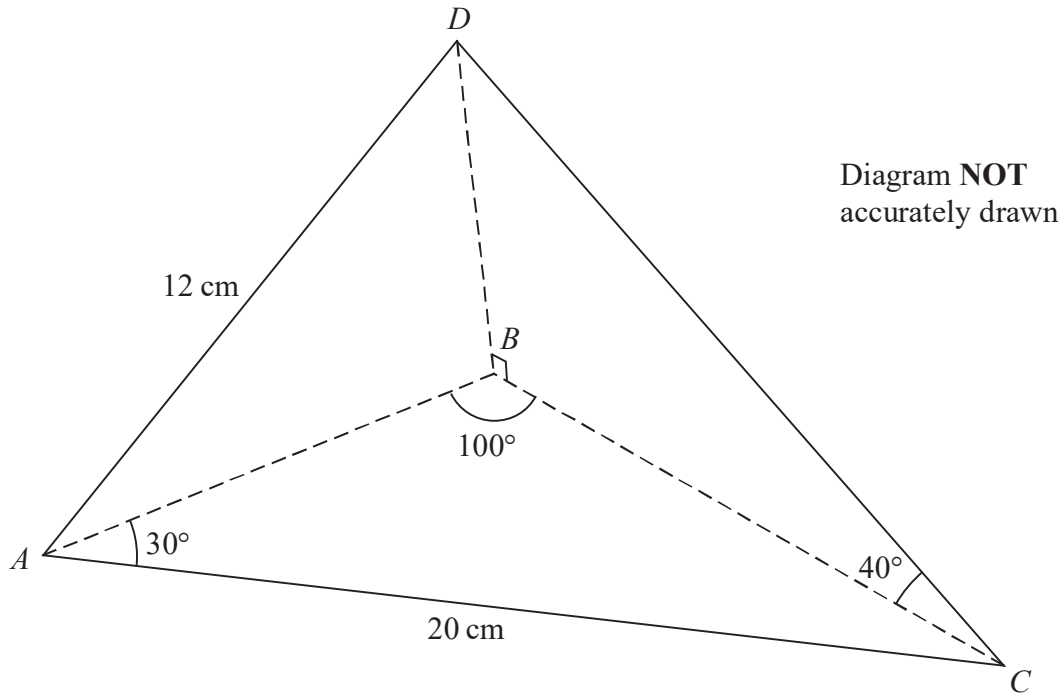


Figure 1

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  $\text{cm}^2$ , 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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Handwriting practice area with horizontal dotted lines.



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**Question 7 continued**

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**Question 7 continued**

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Handwriting practice area with horizontal dotted lines.

**(Total for Question 7 is 10 marks)**



P 4 8 4 1 3 A 0 1 9 3 6

8 The points  $(-3, -2)$ ,  $(-2, 0)$  and  $(-1, -1)$  are the vertices of triangle  $A$ .

(a) On the grid, draw and label triangle  $A$ .

(1)

Triangle  $A$  is transformed to triangle  $B$  under the transformation with matrix  $\mathbf{P}$  where

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

(b) On the grid, draw and label triangle  $B$ .

(3)

Triangle  $B$  is transformed to triangle  $C$  under the translation  $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$

(c) On the grid, draw and label triangle  $C$ .

(2)

Triangle  $C$  is transformed to triangle  $D$  under the transformation with matrix  $\mathbf{Q}$  where

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

(d) On the grid, draw and label triangle  $D$ .

(3)

(e) Describe fully the single transformation which maps triangle  $A$  onto triangle  $D$ .

(3)

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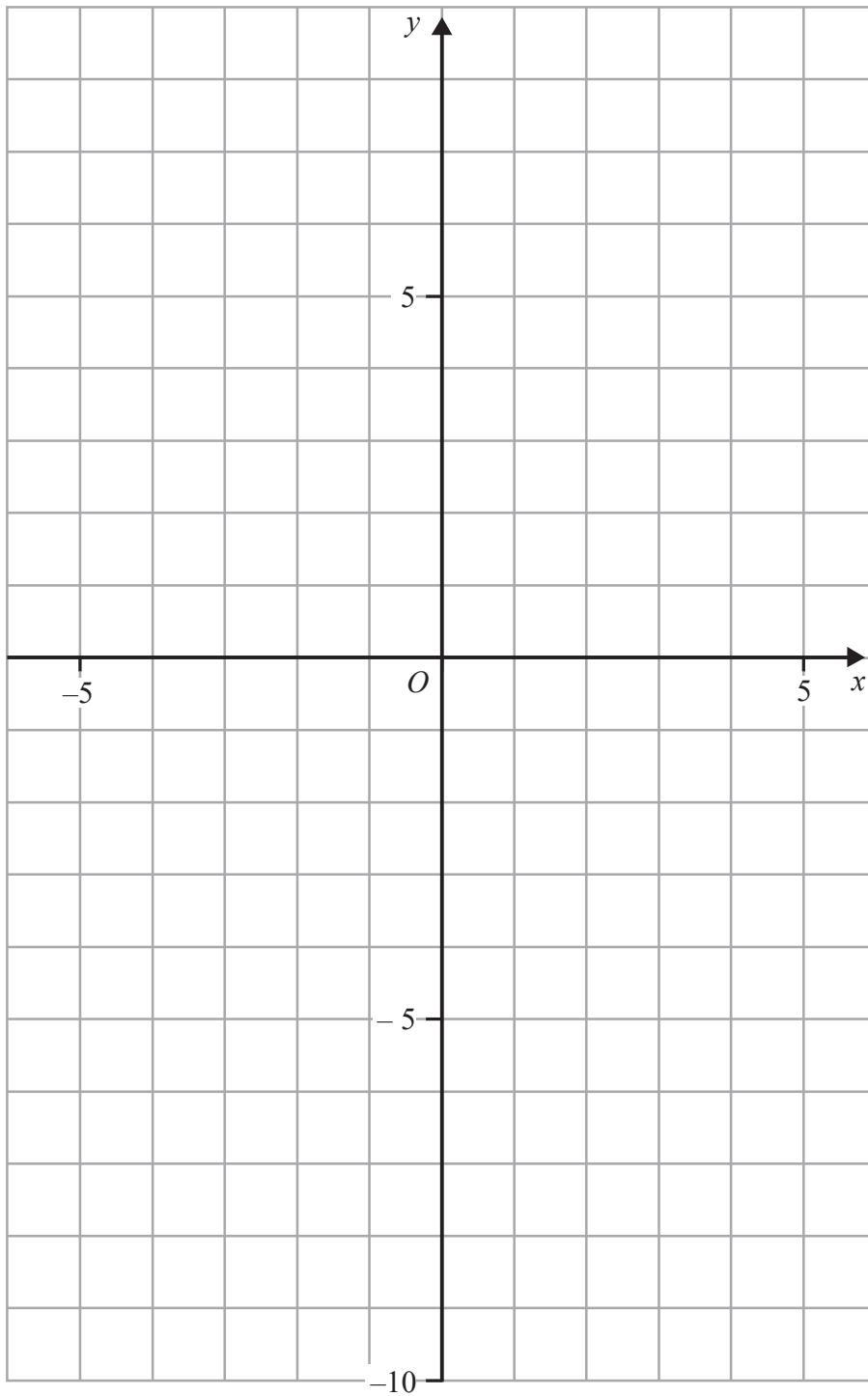


Question 8 continued

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Turn over for a spare grid if you need to redraw your triangles.



**Question 8 continued**

Handwriting practice area with 20 horizontal dotted lines.

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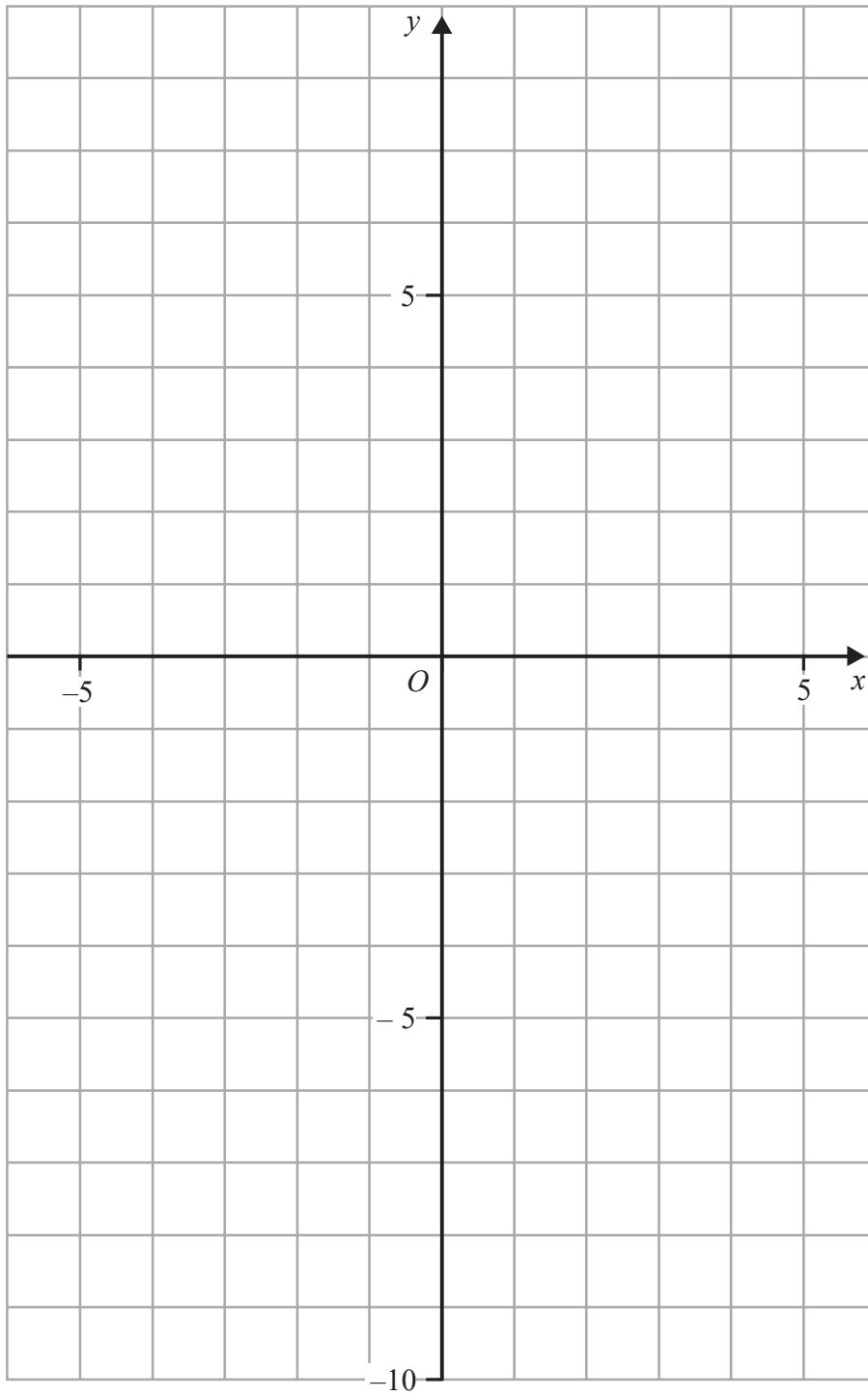
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Question 8 continued

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(Total for Question 8 is 12 marks)



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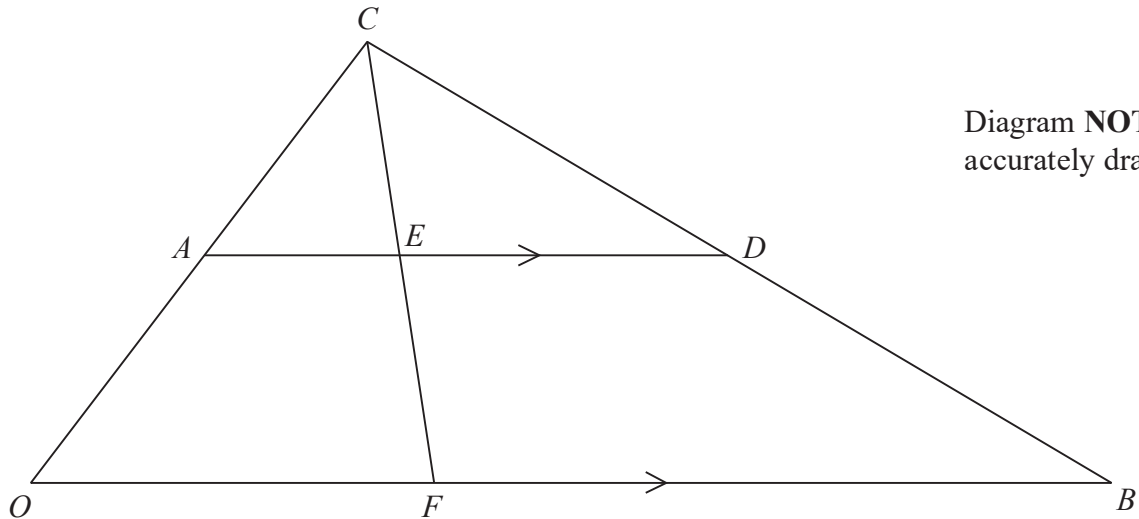


Figure 2

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  $10 \text{ cm}^2$

- (f) calculate the area, in  $\text{cm}^2$ , of triangle  $FCB$ . (3)

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**Question 9 continued**

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Handwriting practice area with 25 horizontal dotted lines.



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**Question 9 continued**

Handwriting practice area with 20 horizontal dotted lines.

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**Question 9 continued**

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Area with horizontal dotted lines for writing.

**(Total for Question 9 is 13 marks)**



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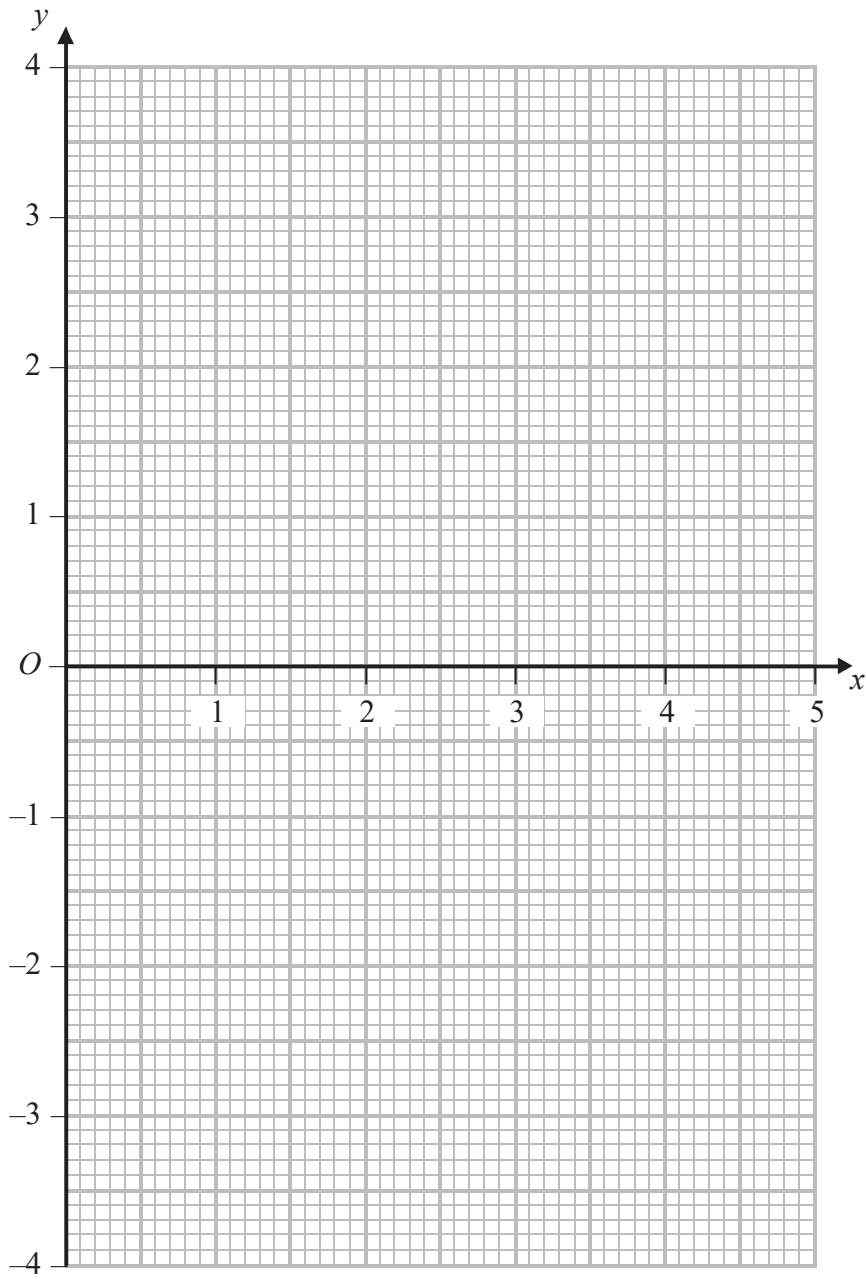


Question 10 continued

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**Question 10 continued**

Handwriting practice area with 20 horizontal dotted lines.

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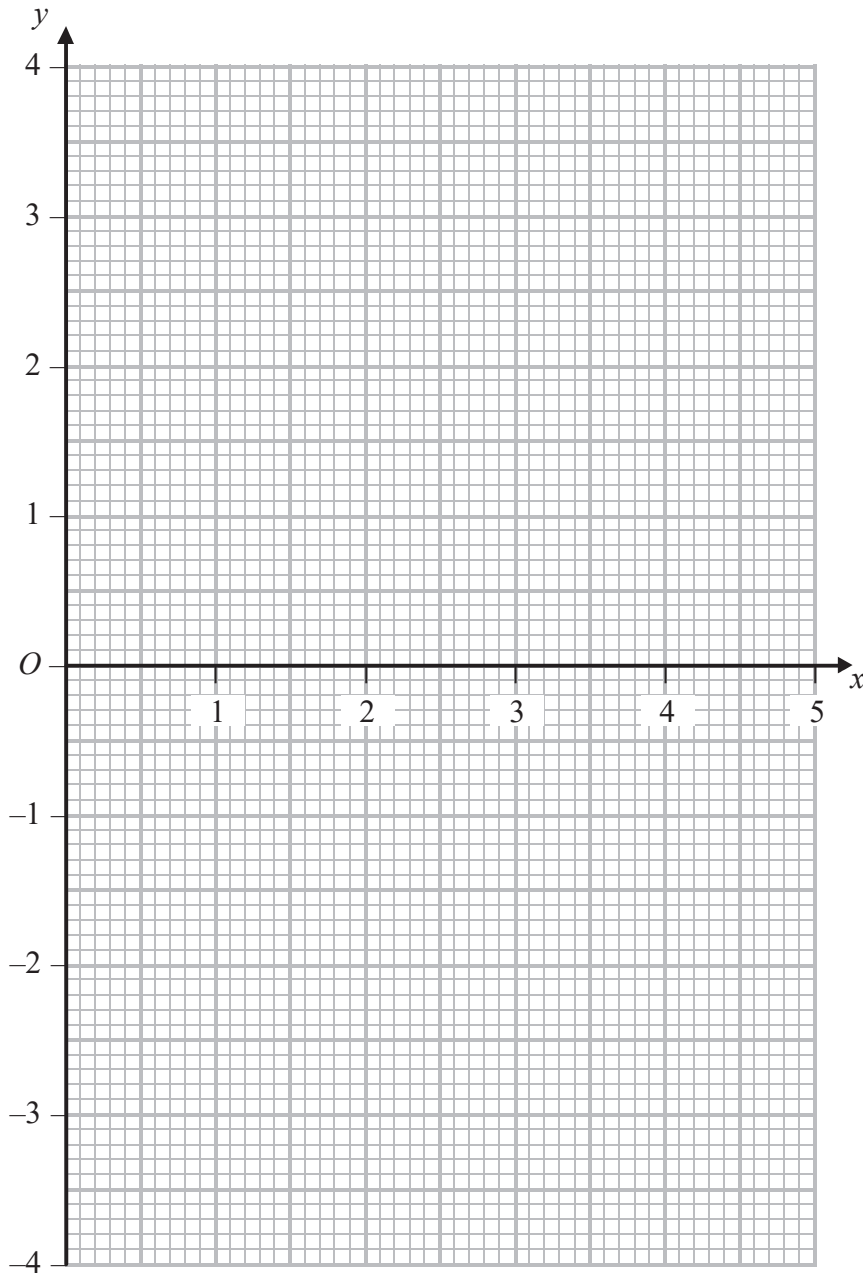
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Question 10 continued

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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.

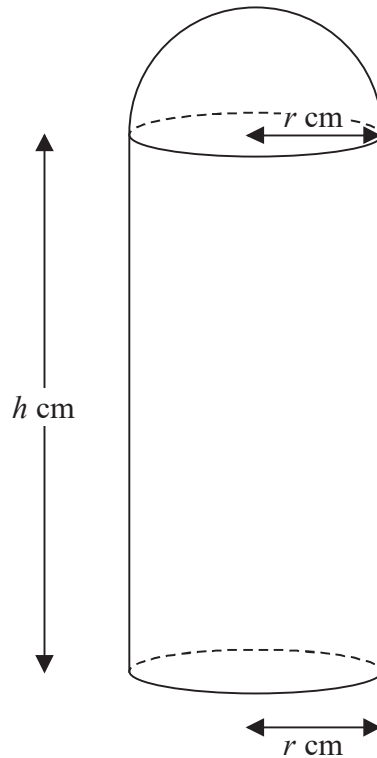


Diagram NOT  
accurately drawn

Figure 3

Given that the total external surface area of the solid is  $S$  cm<sup>2</sup>

(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  $V$  cm<sup>3</sup>

(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)

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

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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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**Question 11 continued**

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**(Total for Question 11 is 13 marks)**

**TOTAL FOR PAPER IS 100 MARKS**

