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Surname

Other names

**Pearson Edexcel  
International GCSE**

Centre Number

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Candidate Number

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# Mathematics B

**Paper 2R**



Tuesday 16 January 2018 – Morning

**Time: 2 hours 30 minutes**

Paper Reference

**4MB0/02R**

**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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2 Solve the simultaneous equations

$$3y = 2 - 2x$$

$$5y = 8 - 3x$$

Show clear algebraic working.

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(Total for Question 2 is 4 marks)





4 Given that  $x > 0$  and that

$$\begin{pmatrix} -1 & 2 \\ -3 & -4 \\ 5 & -6 \end{pmatrix} \begin{pmatrix} 7 & -1 & xz \\ x^2 & x + 2y & -y \end{pmatrix} = \begin{pmatrix} 1 & 1 & -4 \\ -37 & 3 & -22 \\ 11 & -5 & 24 \end{pmatrix}$$

find the value of  $x$ , the value of  $y$  and the value of  $z$ .

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(Total for Question 4 is 6 marks)



- 5 150 tourists in London took part in a survey to see how popular three tourist attractions are.

Each tourist was asked to say whether they had visited *Buckingham Palace* ( $B$ ), *Hampton Court* ( $H$ ) or the *Tower of London* ( $T$ ).

25 of the 150 tourists had not visited any of the three tourist attractions.

Of the other tourists who were asked

20 had visited all three attractions

25 had visited *Buckingham Palace* and *Hampton Court*

35 had visited *Hampton Court* and the *Tower of London*

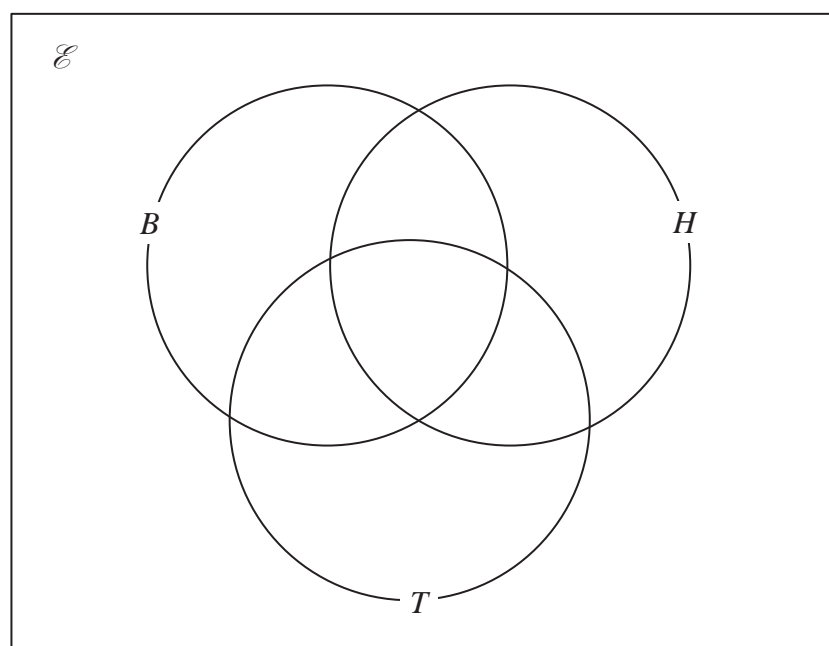
30 had visited *Buckingham Palace* and the *Tower of London*

45 had visited *Buckingham Palace* only

$x$  had visited *Hampton Court* only

The results of the survey also showed that the number of visitors who had visited the *Tower of London* only was 4 times the number of visitors who had visited *Hampton Court* only.

- (a) Show all this information on the Venn diagram.



(4)

- (b) Use the information in the Venn diagram to write down an equation in  $x$ .

(1)

- (c) Hence find the value of  $x$ .

(2)

One of the tourists who took part in the survey was picked at random.

Given that this tourist had visited *Buckingham Palace*,

- (d) write down the probability that this tourist had visited the *Tower of London*.

(1)

**Turn over for a spare Venn diagram if you need to redraw your diagram.**



**Question 5 continued**

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**Question 5 continued**

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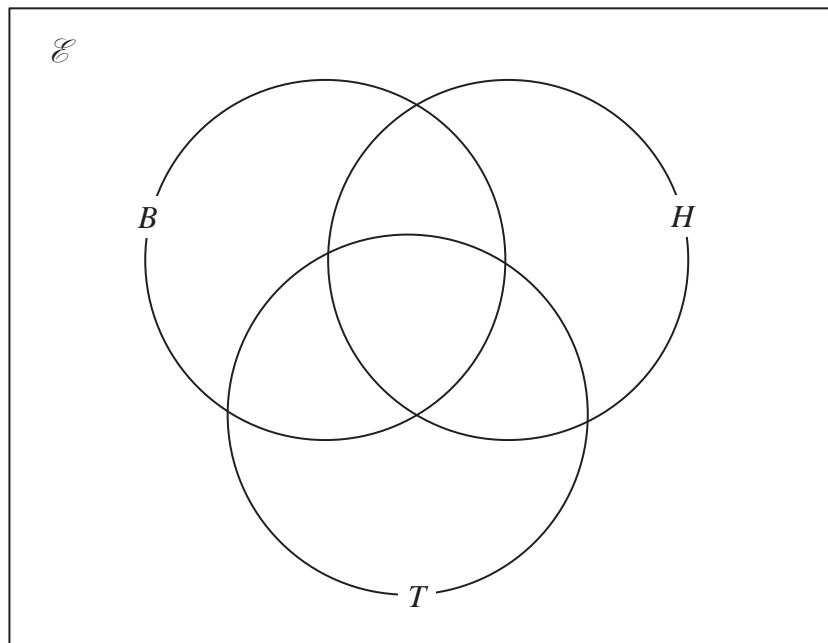
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Question 5 continued

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(Total for Question 5 is 8 marks)



6 The functions  $f$  and  $g$  are defined as

$$f: x \mapsto 3x - 1$$

$$g: x \mapsto \frac{3}{x} \quad x \neq 0$$

(a) Find  $gf(2)$

(1)

The function  $h$  is such that  $h(x) = \frac{6}{2x - 3}$

(b) State the value of  $x$  that needs to be excluded from any domain of  $h$

(1)

(c) Express the inverse function  $h^{-1}$  in the form  $h^{-1}: x \mapsto \dots$

(2)

(d) Solve the equation  $fh(x) = g(x)$

Give your solutions to 3 significant figures.

(5)

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



**Question 6 continued**

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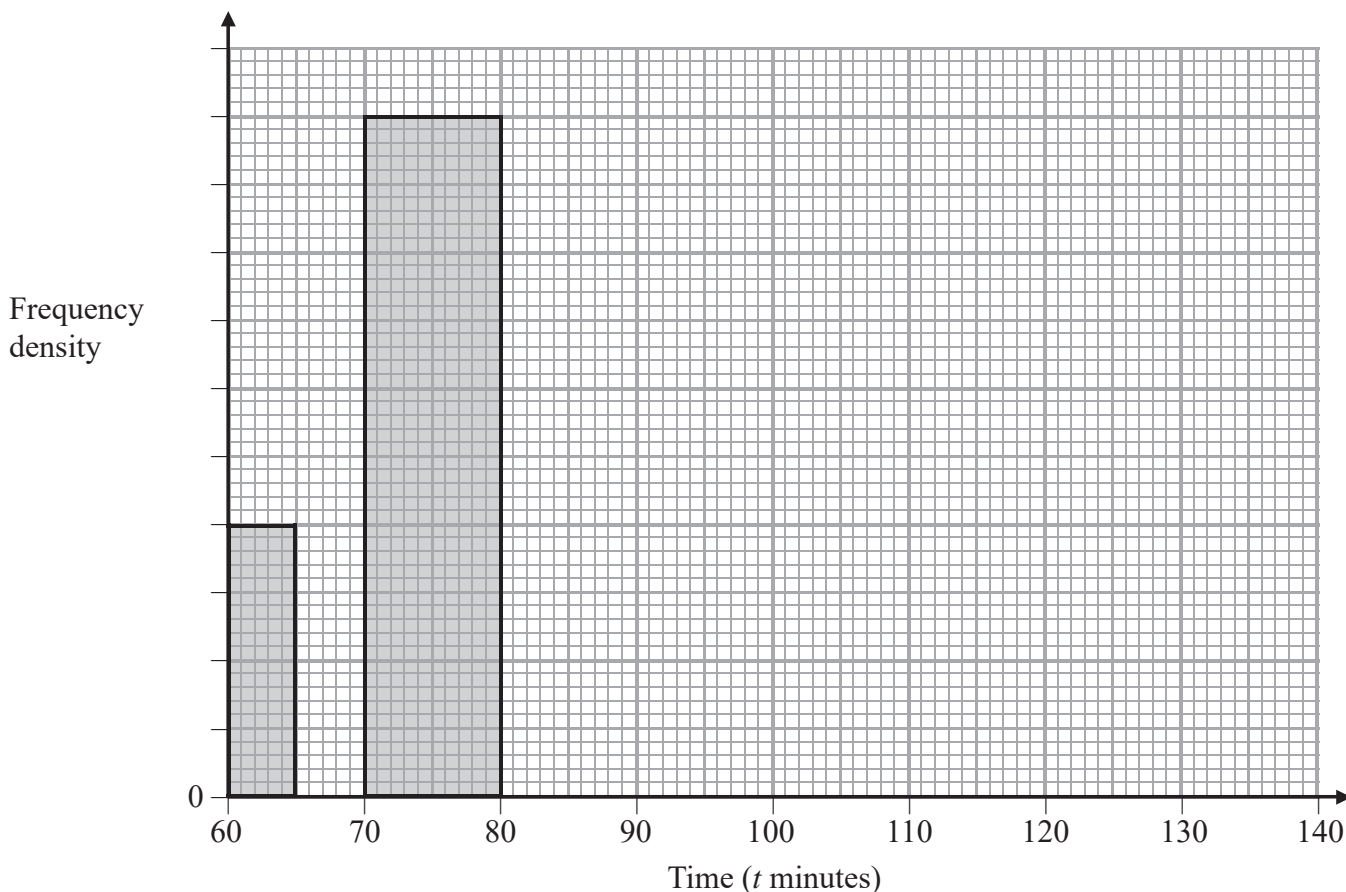
**(Total for Question 6 is 9 marks)**



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7 Information about the times, in minutes, taken by 305 runners to complete a half marathon is given in the incomplete table and the incomplete histogram.

<b>Time (<math>t</math> minutes)</b>	$60 < t \leq 65$	$65 < t \leq 70$	$70 < t \leq 80$	$80 < t \leq 95$	$95 < t \leq 115$	$115 < t \leq 140$
<b>Frequency</b>	10	20		60	90	



- (a) Complete the table and the histogram. (5)
- (b) Write down the class interval that contains the median. (1)
- (c) Calculate an estimate of the mean time, to the nearest minute, taken by the 305 runners to complete the half marathon. (4)

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



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**Question 7 continued**

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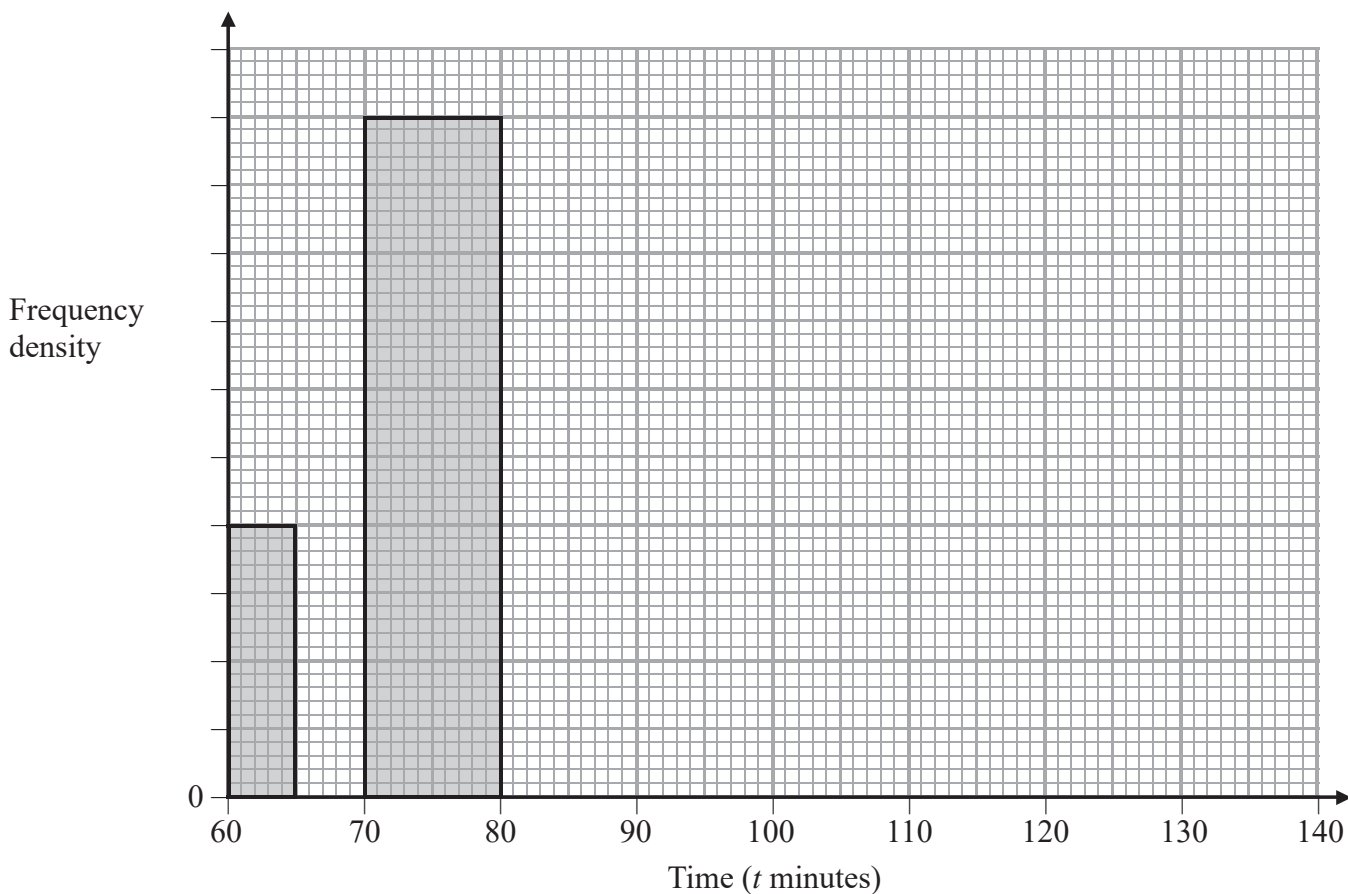
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Question 7 continued

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<b>Time (<math>t</math> minutes)</b>	$60 < t \leq 65$	$65 < t \leq 70$	$70 < t \leq 80$	$80 < t \leq 95$	$95 < t \leq 115$	$115 < t \leq 140$
<b>Frequency</b>	10	20		60	90	



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**Question 7 continued**

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



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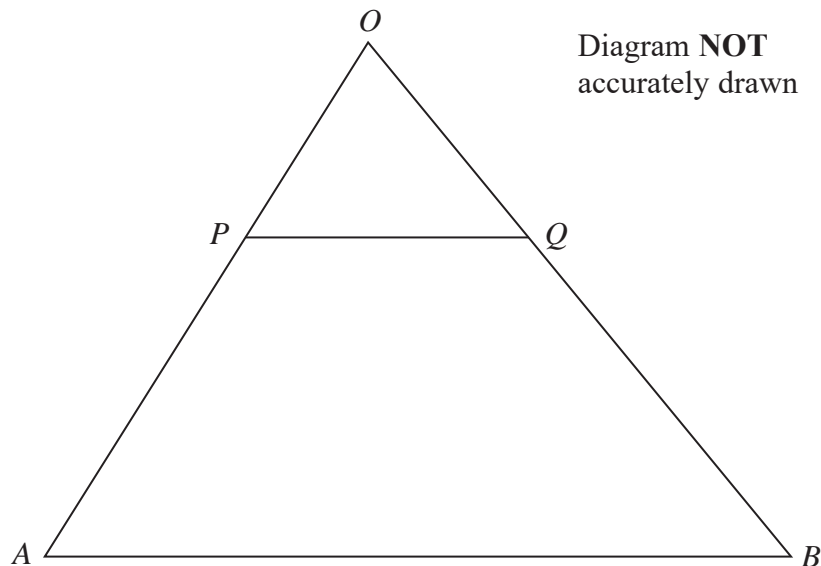


Diagram **NOT**  
accurately drawn

Figure 1

Figure 1 shows triangle  $OAB$  in which  $\vec{OA} = 4\mathbf{a}$  and  $\vec{OB} = 8\mathbf{b}$

$P$  is the point on  $OA$  such that  $OP : OA = 1 : 4$

(a) Express in terms of  $\mathbf{a}$  or  $\mathbf{b}$  or  $\mathbf{a}$  and  $\mathbf{b}$  where appropriate,

(i)  $\vec{AB}$                       (ii)  $\vec{PO}$

(2)

$Q$  is the point on  $OB$  such that  $OQ : OB = 1 : m$  where  $m$  is a constant.

$\vec{PQ} = \alpha \vec{AB}$  where  $\alpha$  is a scalar.

(b) Using vectors, find the value of  $m$  and the value of  $\alpha$ .

(3)

$R$  is the point on  $AB$  such that  $AR : AB = 1 : n$  where  $n$  is a constant.

(c) Find and simplify an expression for  $\vec{PR}$  in terms of  $n$ ,  $\mathbf{a}$  and  $\mathbf{b}$ .

(2)

Given that  $PR$  is parallel to  $OB$ ,

(d) find the value of  $n$ .

(2)

The area of  $APQB$  is  $150 \text{ cm}^2$

(e) Calculate the area of triangle  $OPQ$ .

(3)

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**Question 8 continued**

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**Question 8 continued**

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**Question 8 continued**

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**(Total for Question 8 is 12 marks)**



9 The points (4, 2), (4, 3) and (6, 3) are the vertices of triangle  $S$ .

(a) On the grid opposite, draw and label triangle  $S$ . (1)

Triangle  $T$  is the image of triangle  $S$  under a reflection in the line with equation  $y = x$

(b) On the grid opposite, draw and label triangle  $T$ . (2)

Triangle  $U$  is the image of triangle  $T$  under a rotation through  $180^\circ$  about the point  $(-2, 2)$

(c) On the grid opposite, draw and label triangle  $U$ . (3)

Triangle  $U$  is transformed to triangle  $V$  under the translation  $\begin{pmatrix} 5 \\ -1 \end{pmatrix}$

(d) On the grid opposite, draw and label triangle  $V$ . (2)

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

$$\mathbf{P} = \begin{pmatrix} -3 & 1 \\ 1 & 1 \end{pmatrix}$$

(e) On the grid opposite, draw and label triangle  $W$ . (3)

(f) Find the determinant of the matrix  $\mathbf{P}$ . (1)

(g) Write down the ratio (area of triangle  $S$ ) : (area of triangle  $W$ ) in the form  $1 : n$  (1)

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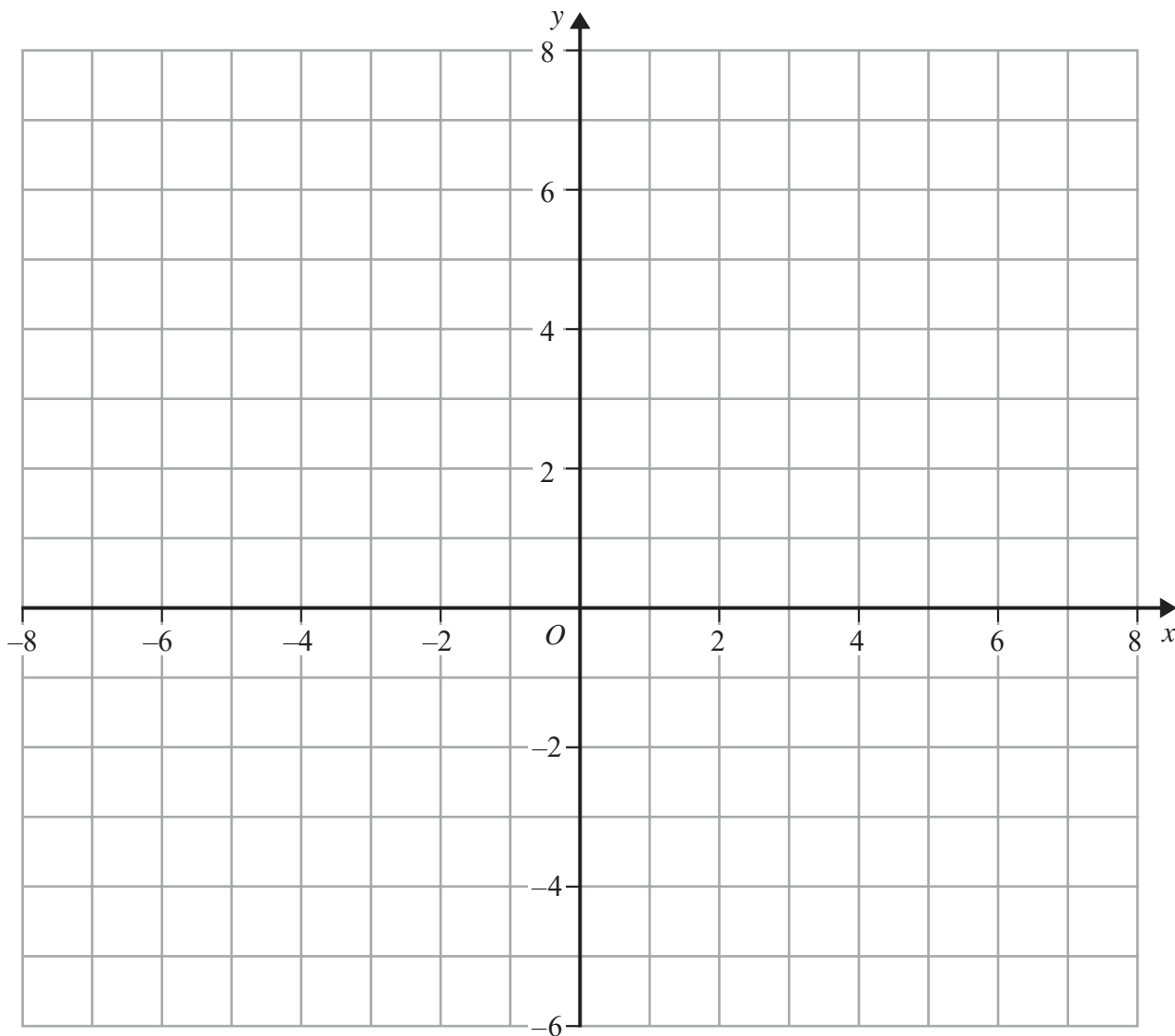
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$$\left[ \text{Determinant of matrix} \begin{pmatrix} a & b \\ c & d \end{pmatrix} = ad - bc \right]$$



Question 9 continued



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**Question 9 continued**

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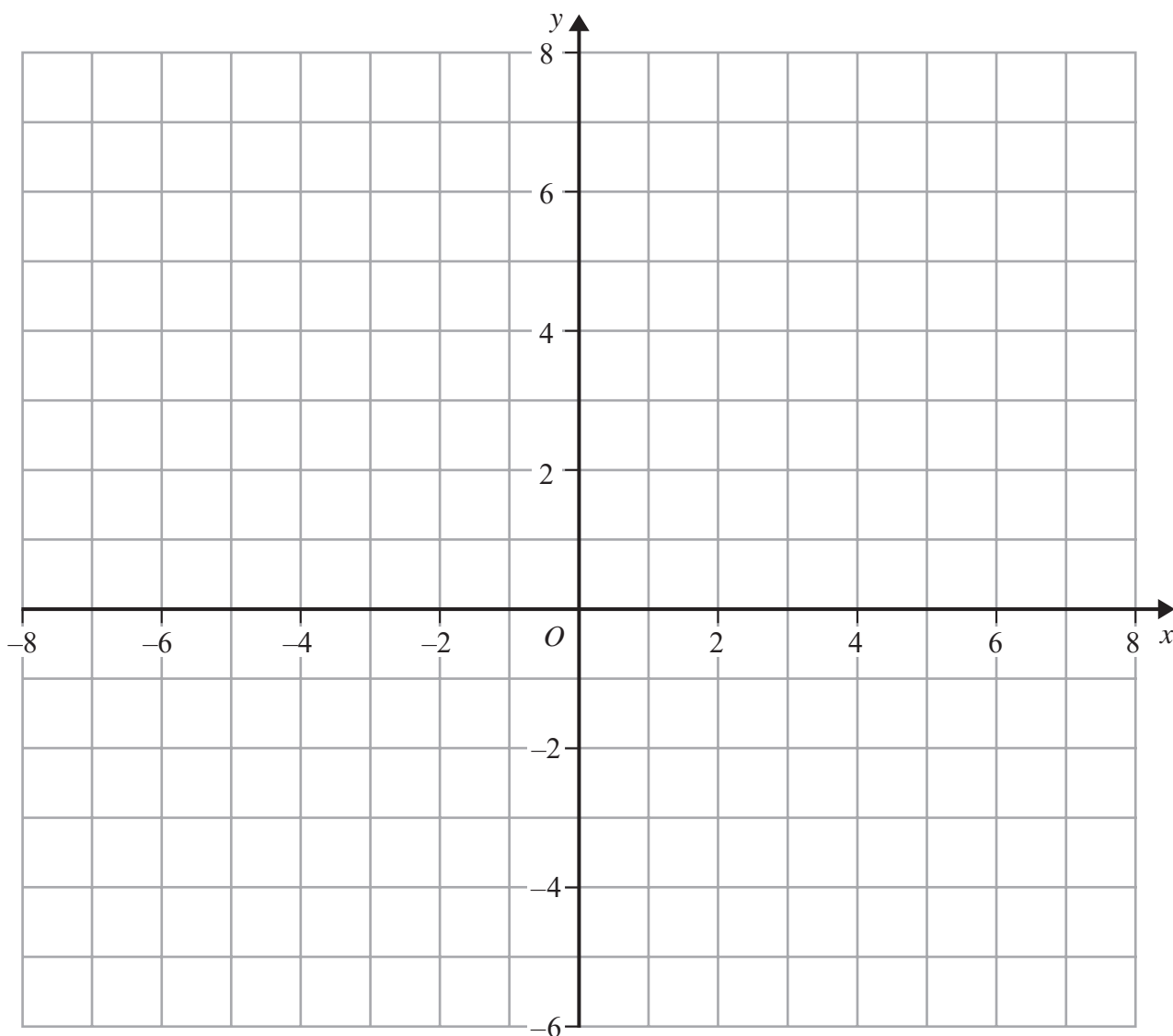
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Question 9 continued

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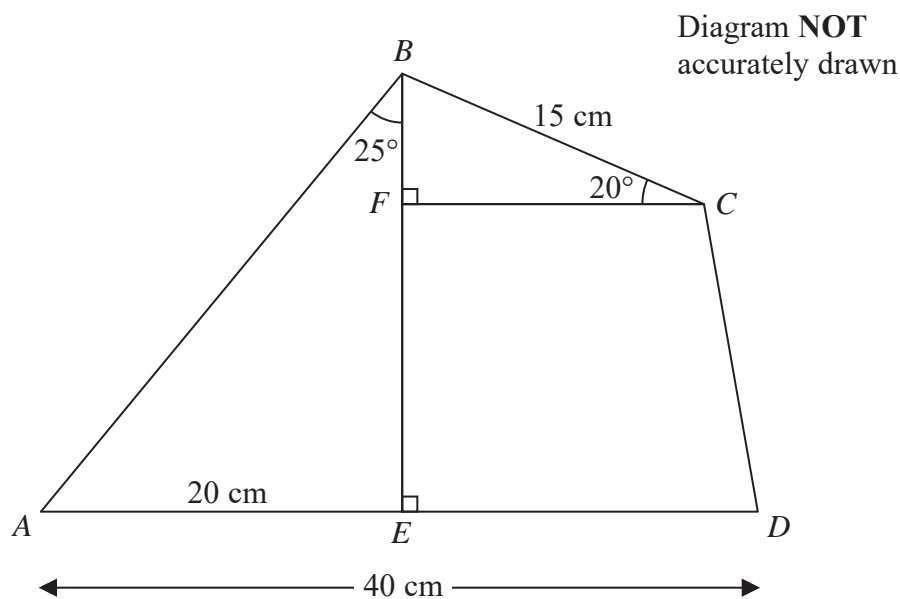
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(Total for Question 9 is 13 marks)



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Figure 2 shows quadrilateral  $ABCD$  in which  $BC = 15$  cm and  $AD = 40$  cm.

The point  $E$  on  $AD$  is such that  $BE$  is perpendicular to  $AD$  with  $AE = 20$  cm and  $\angle ABE = 25^\circ$

(a) Calculate the length, in cm to 3 significant figures, of  $AB$ . (2)

The point  $F$  on  $BE$  is such that  $FC$  is perpendicular to  $BE$  with  $\angle BCF = 20^\circ$

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

(b)  $FC$ , (2)

(c)  $AC$ . (3)

(d) Calculate the area, in  $\text{cm}^2$  to 3 significant figures, of quadrilateral  $ABCD$ . (6)

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





**Question 10 continued**

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**Question 10 continued**

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**Question 10 continued**

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**(Total for Question 10 is 13 marks)**



11 Given that for all values of  $x$ ,

$$(3x - 2)(x^3 - 3x^2 + 3) = 3x^4 + ax^3 + 6x^2 + 9x - 6$$

(a) show that  $a = -11$  (2)

(b) Find the coordinates of the stationary points on the curve with equation  $y = x^3 - 3x^2 + 3$  (4)

(c) Complete the following table of values for  $y = x^3 - 3x^2 + 3$

$x$	-1	0	1	1.5	2	2.5	2.75	3
$y$	-1		1					3

(3)

(d) On the grid opposite, plot the points from your completed table and plot the stationary points from part (b) and join them to form a smooth curve. (3)

(e) Use your graph to write down estimates, to 2 decimal places, of the solutions of the equation  $3x^4 - 11x^3 + 6x^2 + 9x - 6 = 0$  (4)

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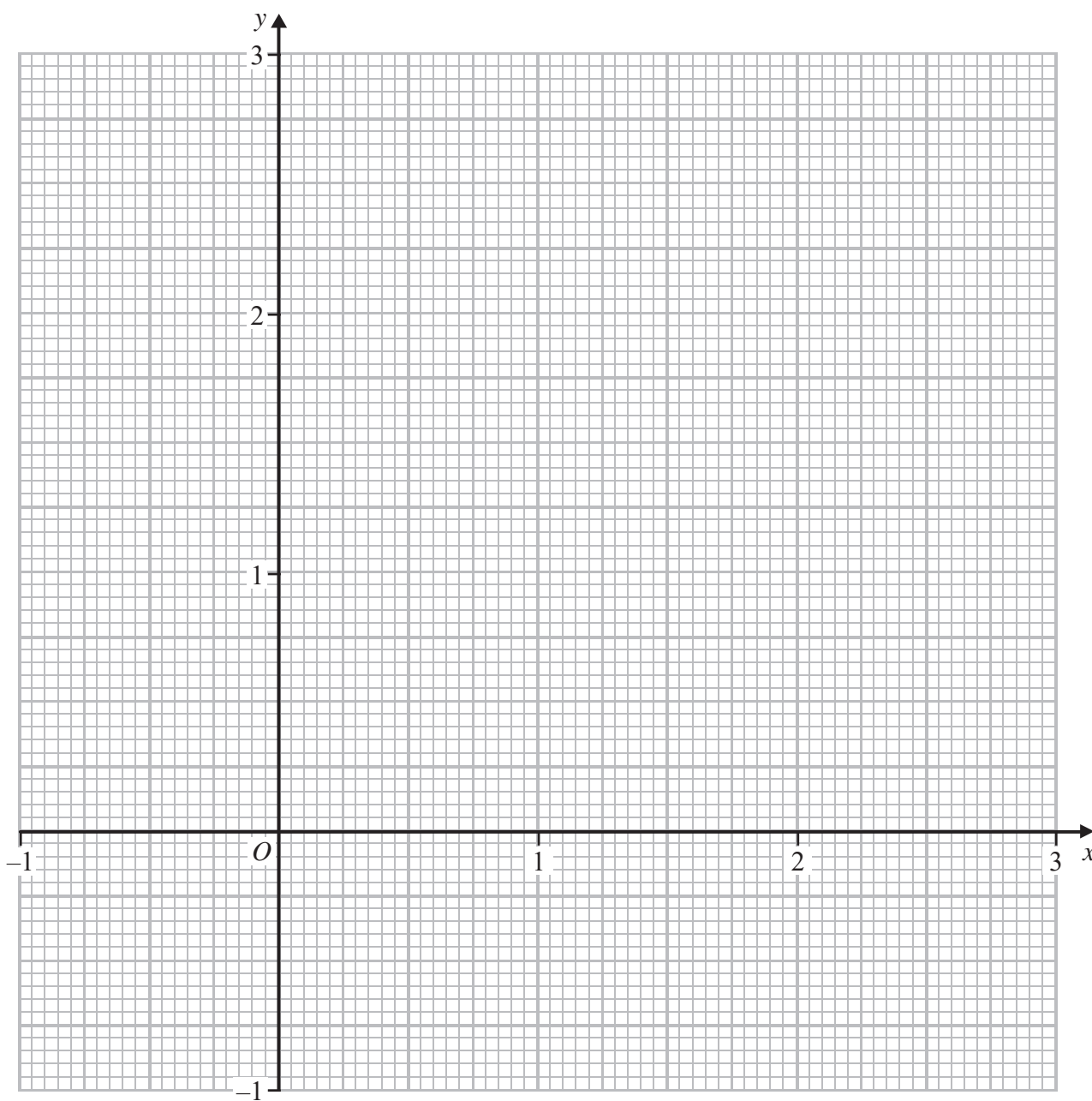


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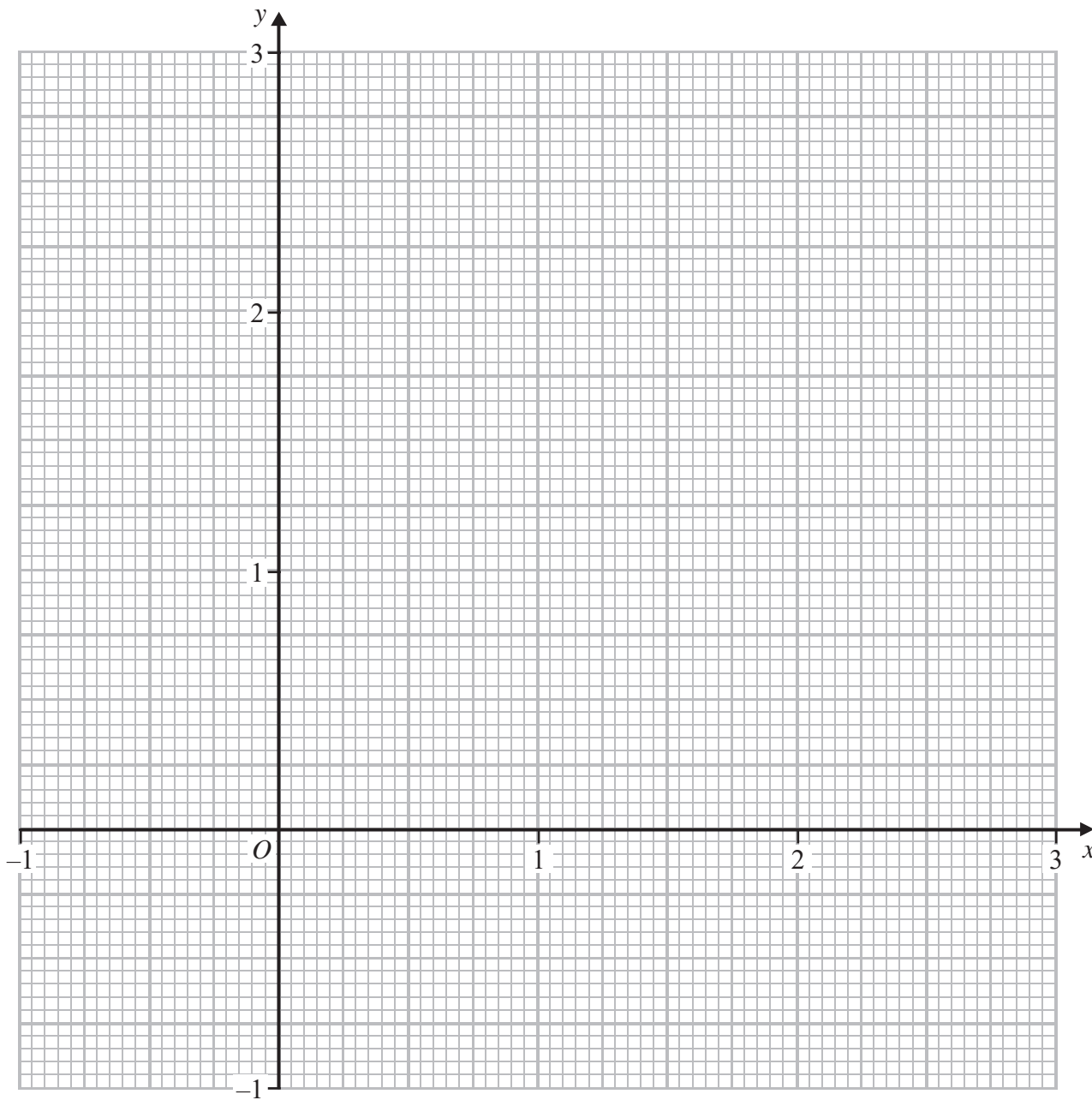
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**(Total for Question 11 is 16 marks)**

**TOTAL FOR PAPER IS 100 MARKS**

