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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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P 5 3 3 0 9 A 0 1 3 2



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2 Solve the simultaneous equations

$$3y = 2 - 2x$$

$$5y = 8 - 3x$$

Show clear algebraic working.

(Total for Question 2 is 4 marks)



P 5 3 3 0 9 A 0 3 3 2

3 f varies inversely as the cube of r .

$$f = 576 \text{ when } r = \frac{1}{2}$$

(a) Find a formula for f in terms of r .

(3)

$$\text{Given that } f = 5 + \frac{1}{t} \text{ when } r = 2$$

(b) find the value of t .

(2)

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(Total for Question 3 is 5 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 .

(Total for Question 4 is 6 marks)



P 5 3 3 0 9 A 0 5 3 2

- 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*

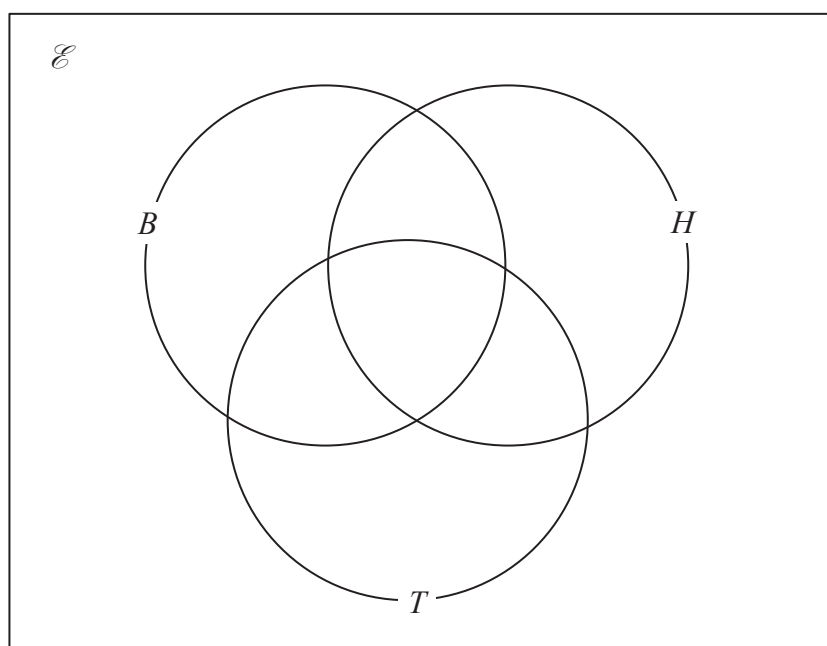
30 had visited *Buckingham Palace* and the *Tower of London*

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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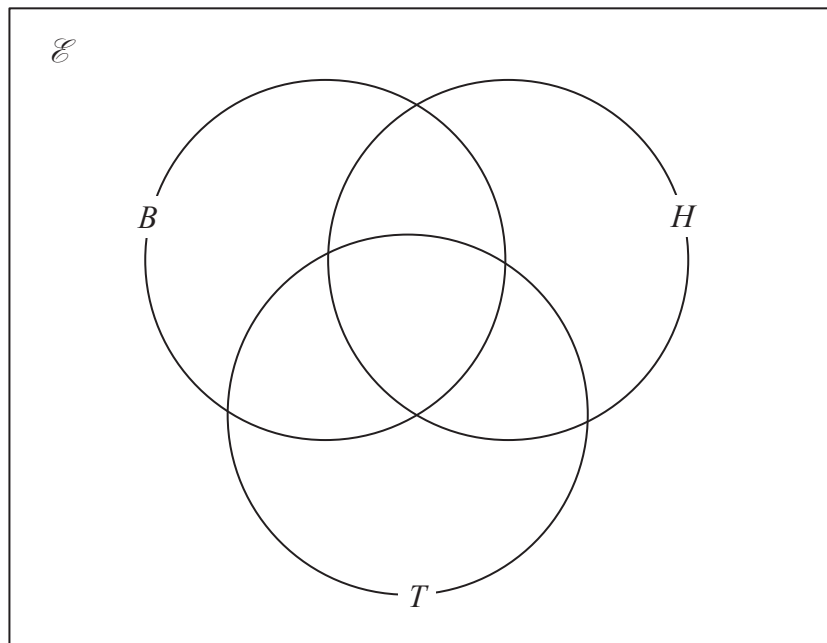
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Question 5 continued

Only use this diagram if you need to redraw your Venn diagram.



(Total for Question 5 is 8 marks)



P 5 3 3 0 9 A 0 9 3 2

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 $f \circ h(x) = g(x)$

Give your solutions to 3 significant figures.

(5)

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



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Question 6 continued

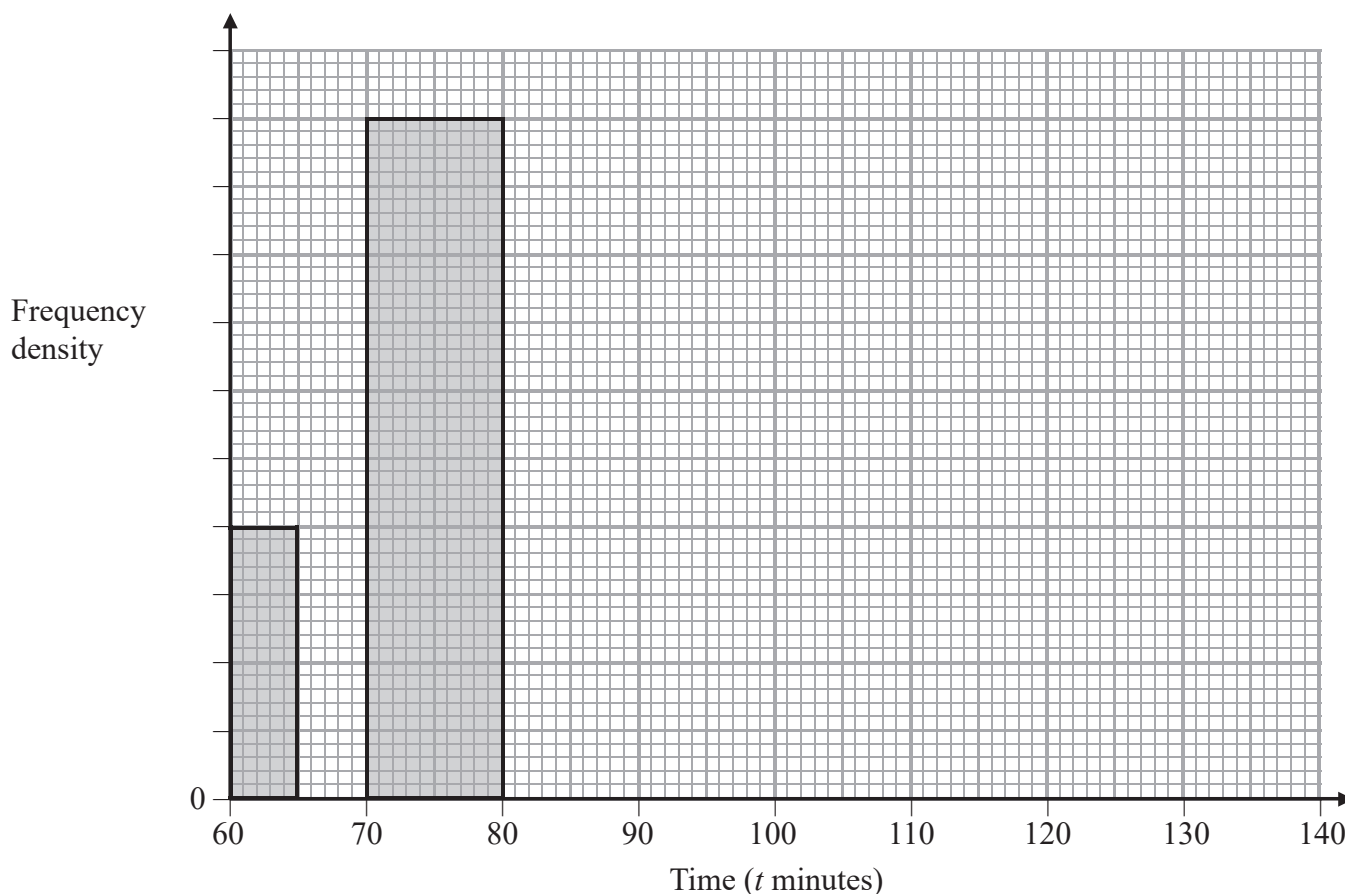
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(Total for Question 6 is 9 marks)



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.

Time (t minutes)	$60 < t \leq 65$	$65 < t \leq 70$	$70 < t \leq 80$	$80 < t \leq 95$	$95 < t \leq 115$	$115 < t \leq 140$
Frequency	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

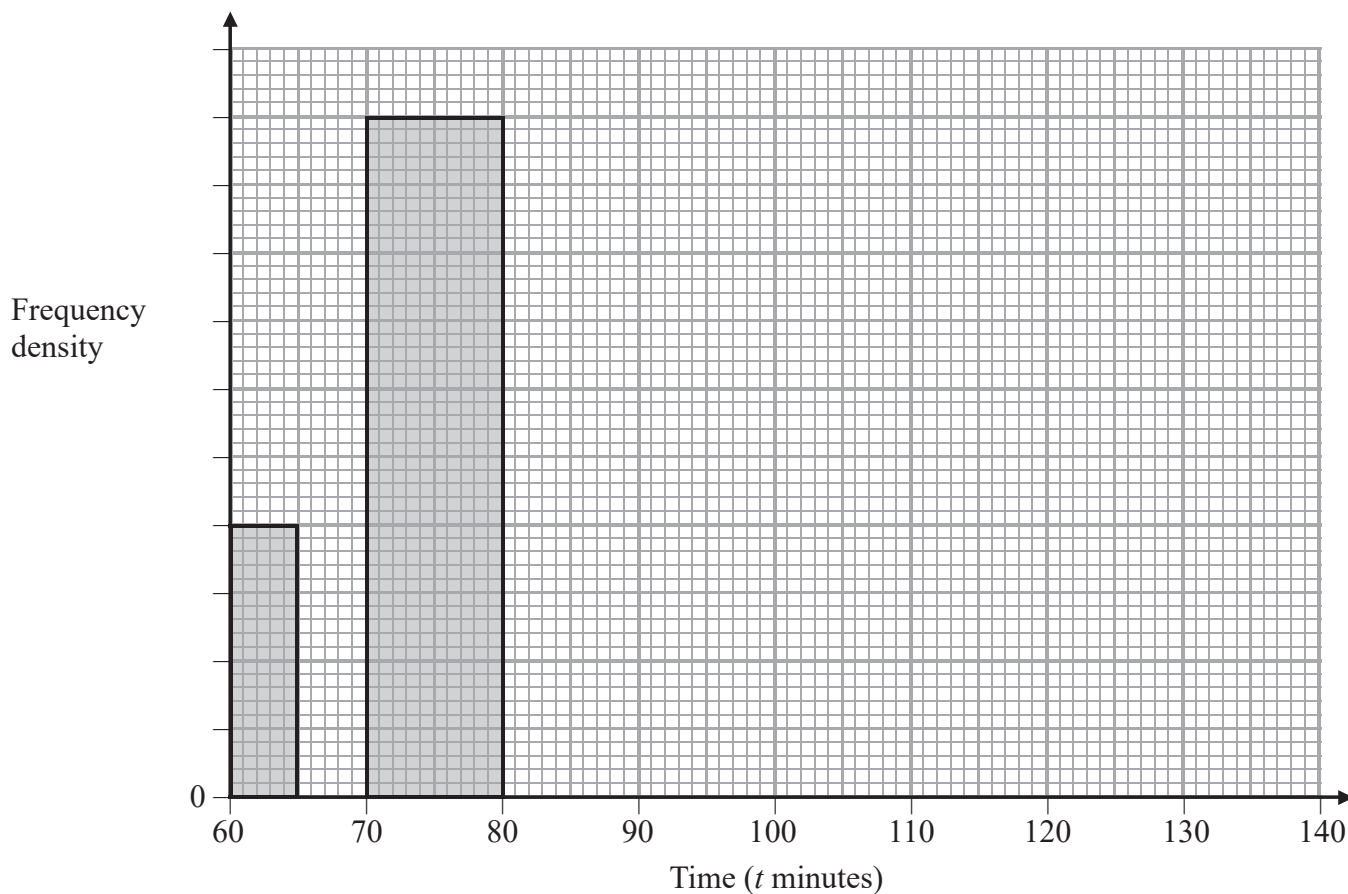
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Question 7 continued

Only use this grid if you need to redraw your histogram.

Time (t minutes)	$60 < t \leq 65$	$65 < t \leq 70$	$70 < t \leq 80$	$80 < t \leq 95$	$95 < t \leq 115$	$115 < t \leq 140$
Frequency	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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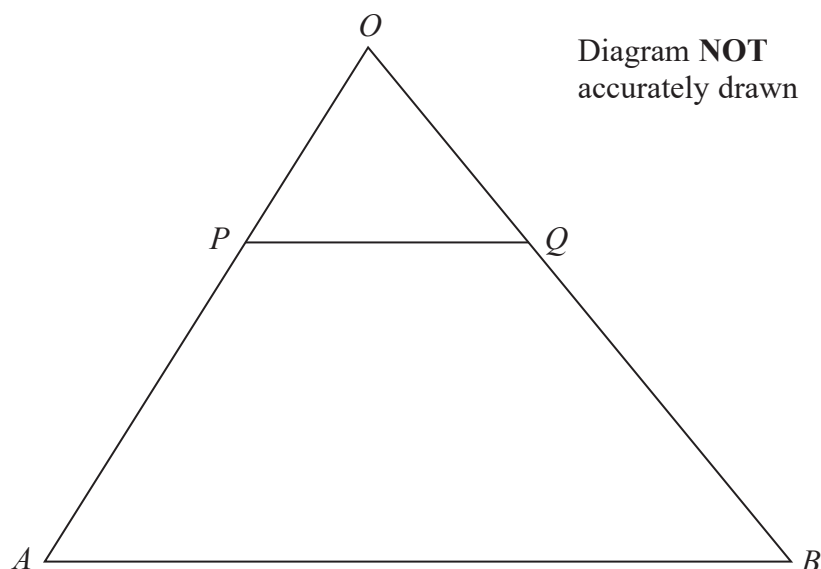


Figure 1

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 α is a scalar.

(b) Using vectors, find the value of m and the value of α .

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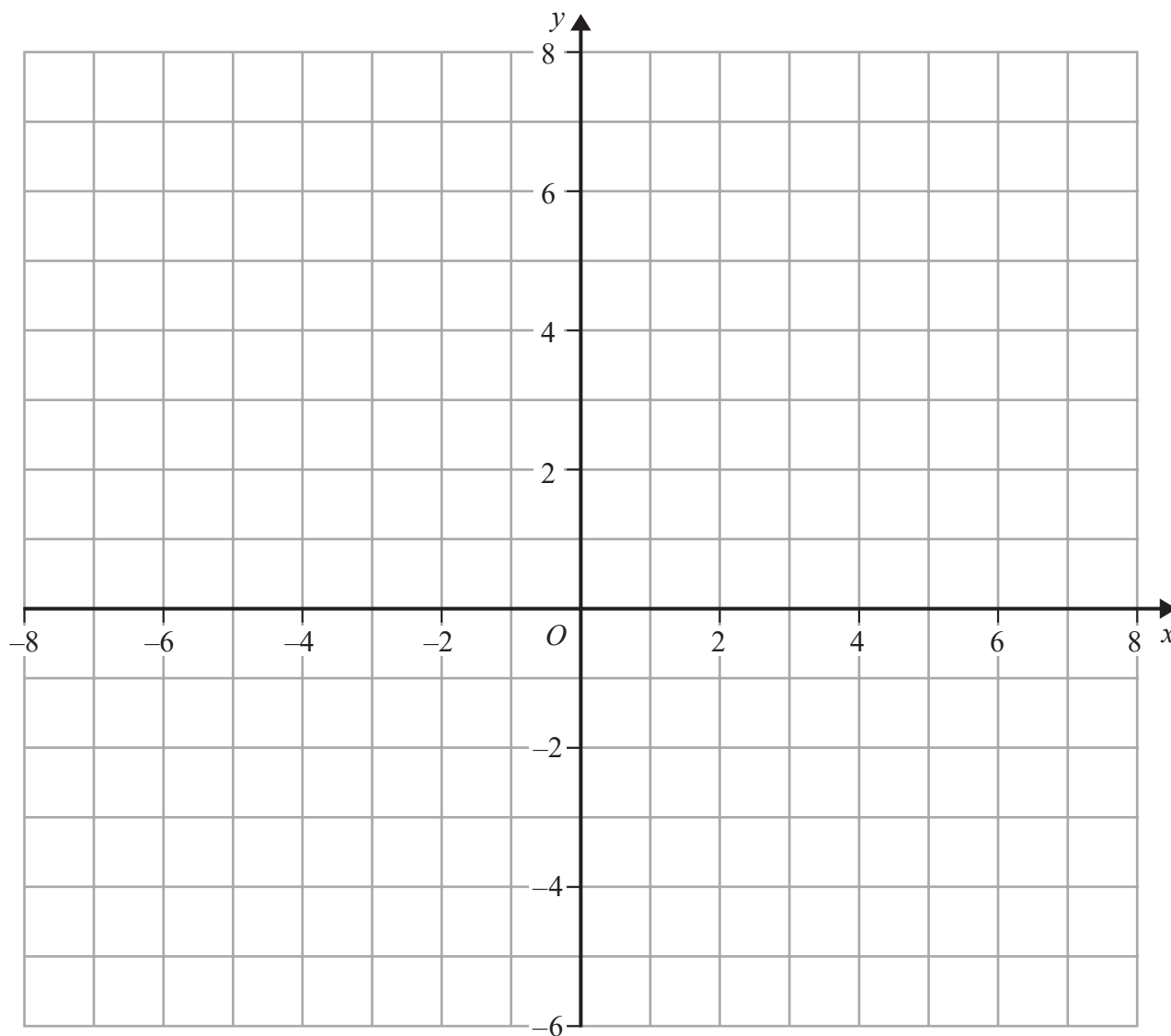
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$$\left[\text{Determinant of matrix} \begin{pmatrix} a & b \\ c & d \end{pmatrix} = ad - bc \right]$$



Question 9 continued



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



Question 9 continued

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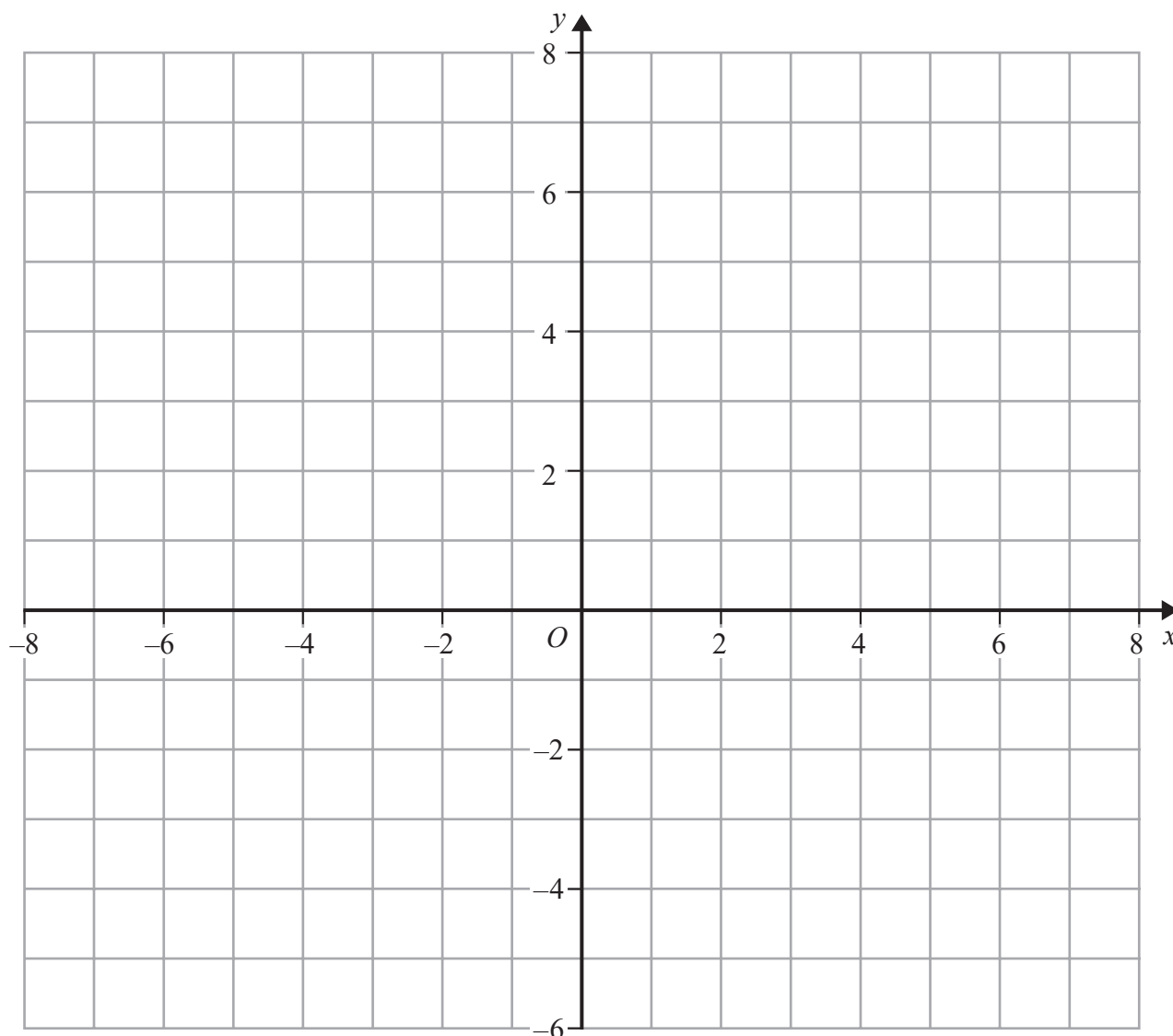
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Question 9 continued

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(Total for Question 9 is 13 marks)



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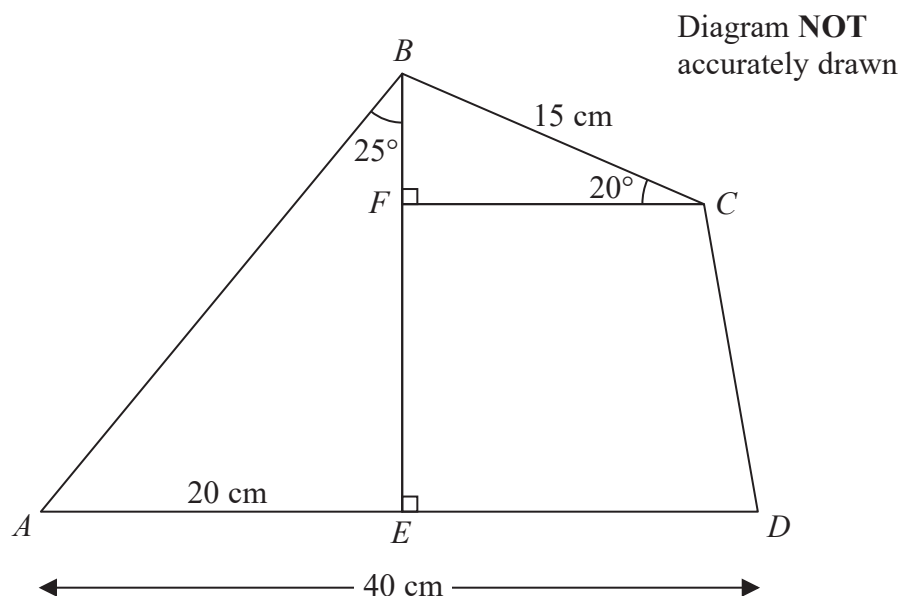


Figure 2

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 cm^2 to 3 significant figures, of quadrilateral $ABCD$. (6)

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

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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)

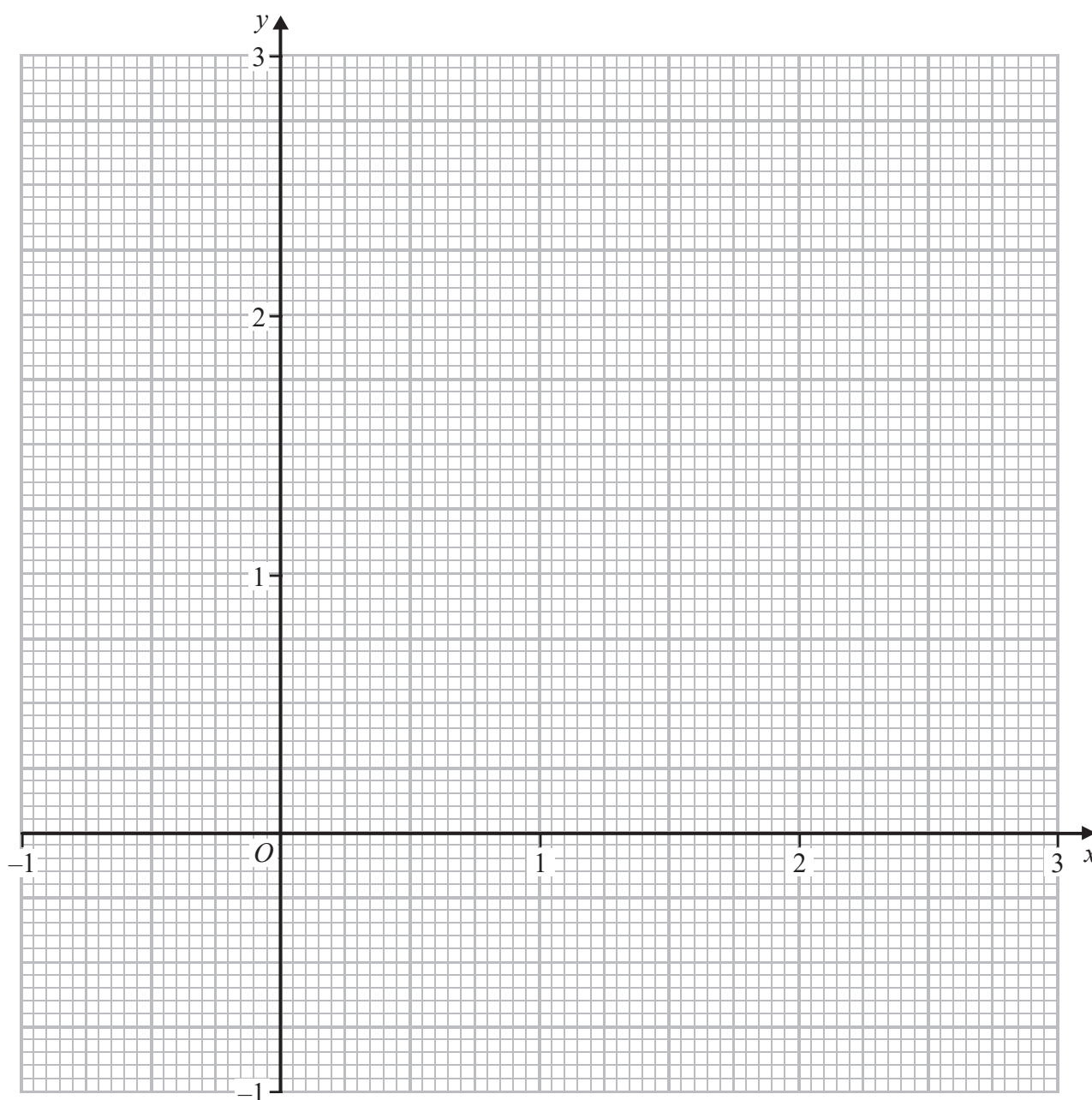
(d) On the grid opposite, plot the points from your completed table and plot the stationary points from part (b) and join them to form a smooth curve.

(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)

Question 11 continued



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



Question 11 continued

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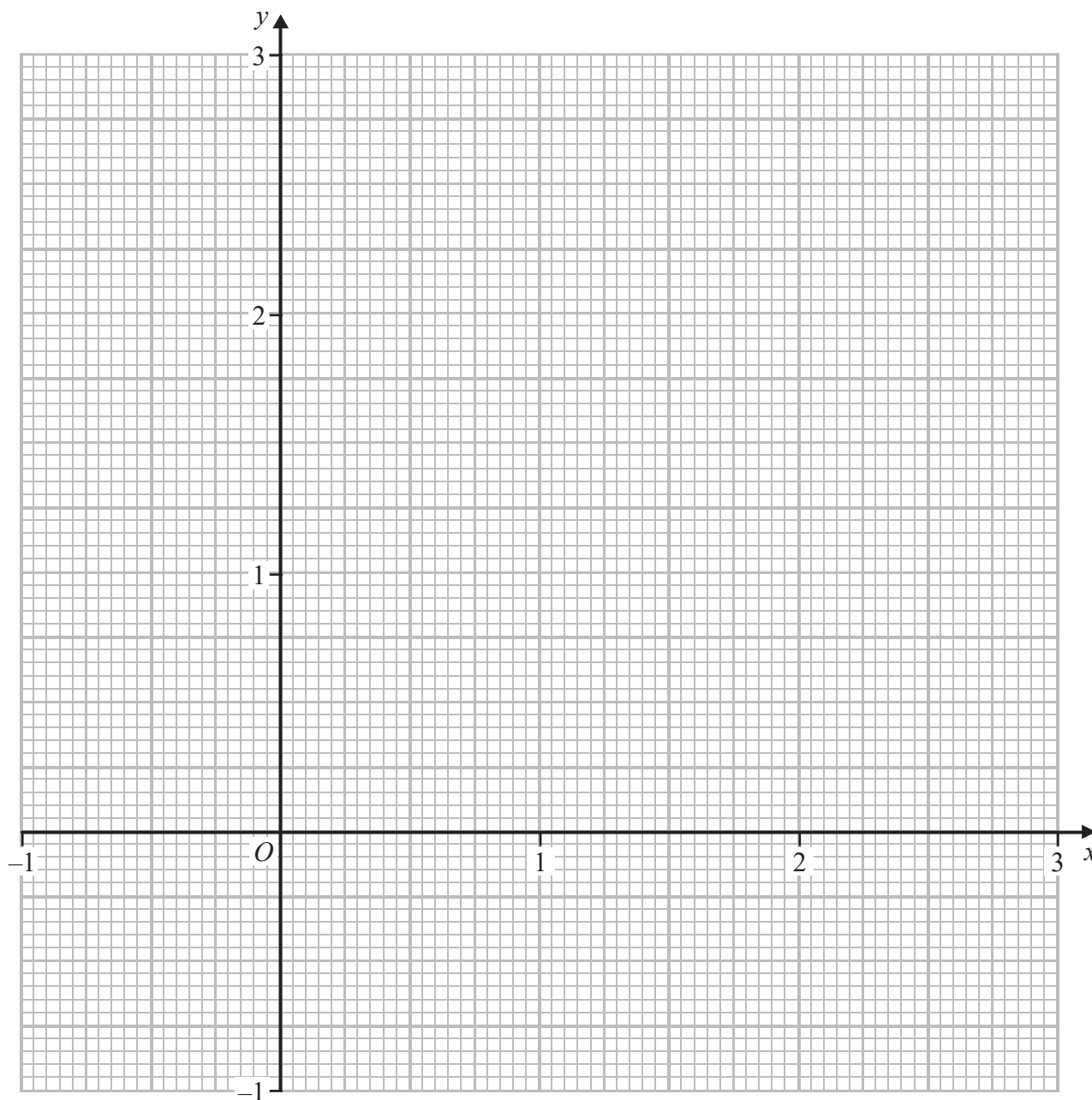
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Question 11 continued

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Question 11 continued

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(Total for Question 11 is 16 marks)

TOTAL FOR PAPER IS 100 MARKS

