Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

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

Pearson

Answer ALL ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Chi received $348 in pay after tax was deducted.

Tax was deducted at a rate of 40%

(a) Calculate Chi's pay, in $, before the tax was deducted.

(2)

The tax should have been deducted at a rate of 25% and **not** 40%

(b) Calculate by how much, in $, Chi was underpaid.

(2)

(Total for Question 1 is 4 marks)

2 Solve the simultaneous equations

$$3y = 2 - 2x$$
$$5y = 8 - 3x$$

Show clear algebraic working.

(Total for Question 2 is 4 marks)

3 f varies inversely as the cube of r.

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

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

(3)

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

(b) find the value of t.

(2)

(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)

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*

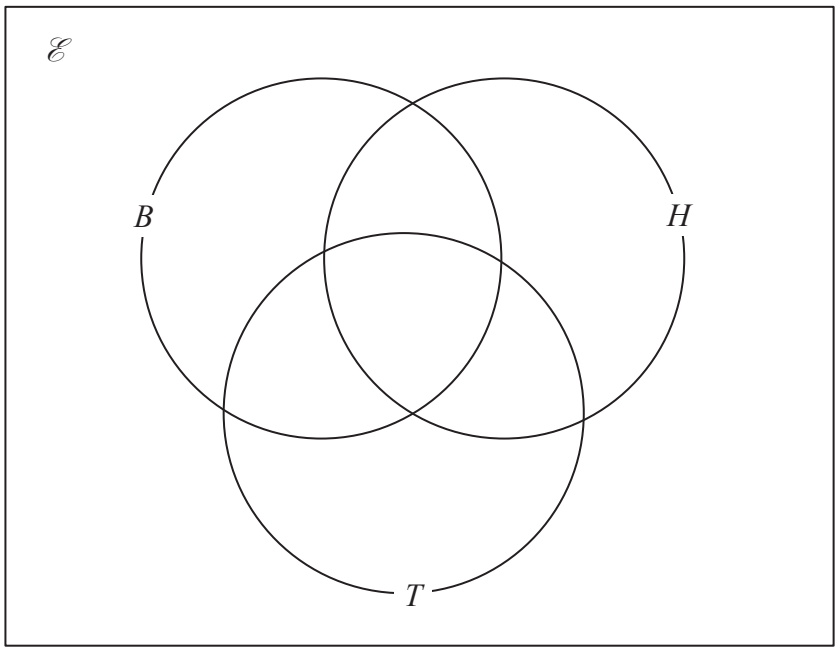
30 had visited *Buckingham Palace* and the *Tower of London*

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

Question 5 continued

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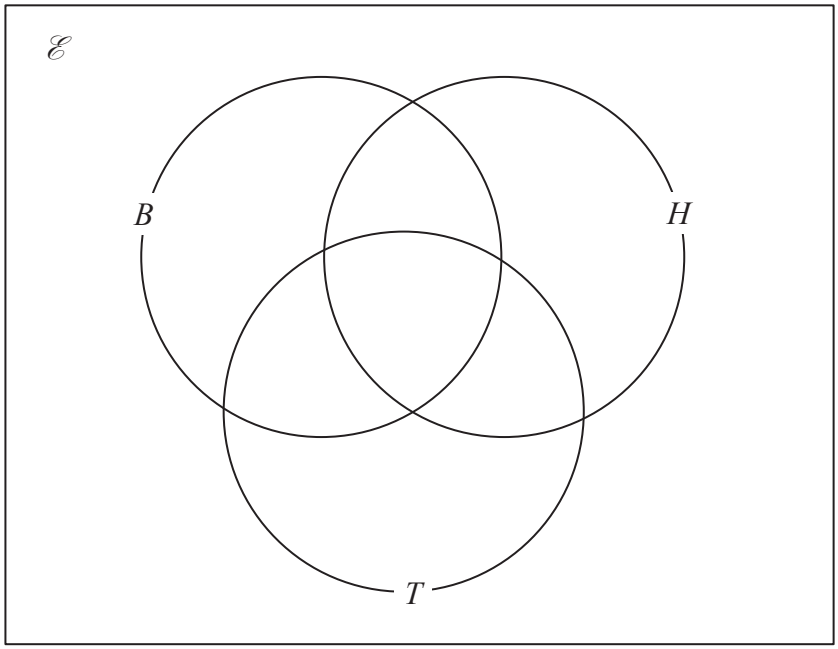
Question 5 continued

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



(Total for Question 5 is 8 marks)

6 The functions f and g are defined as

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

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

(a) Find gf(2)

(1)

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

(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 $h^{-1} : x \mapsto \ldots$

(2)

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

Give your solutions to 3 significant figures.

(5)

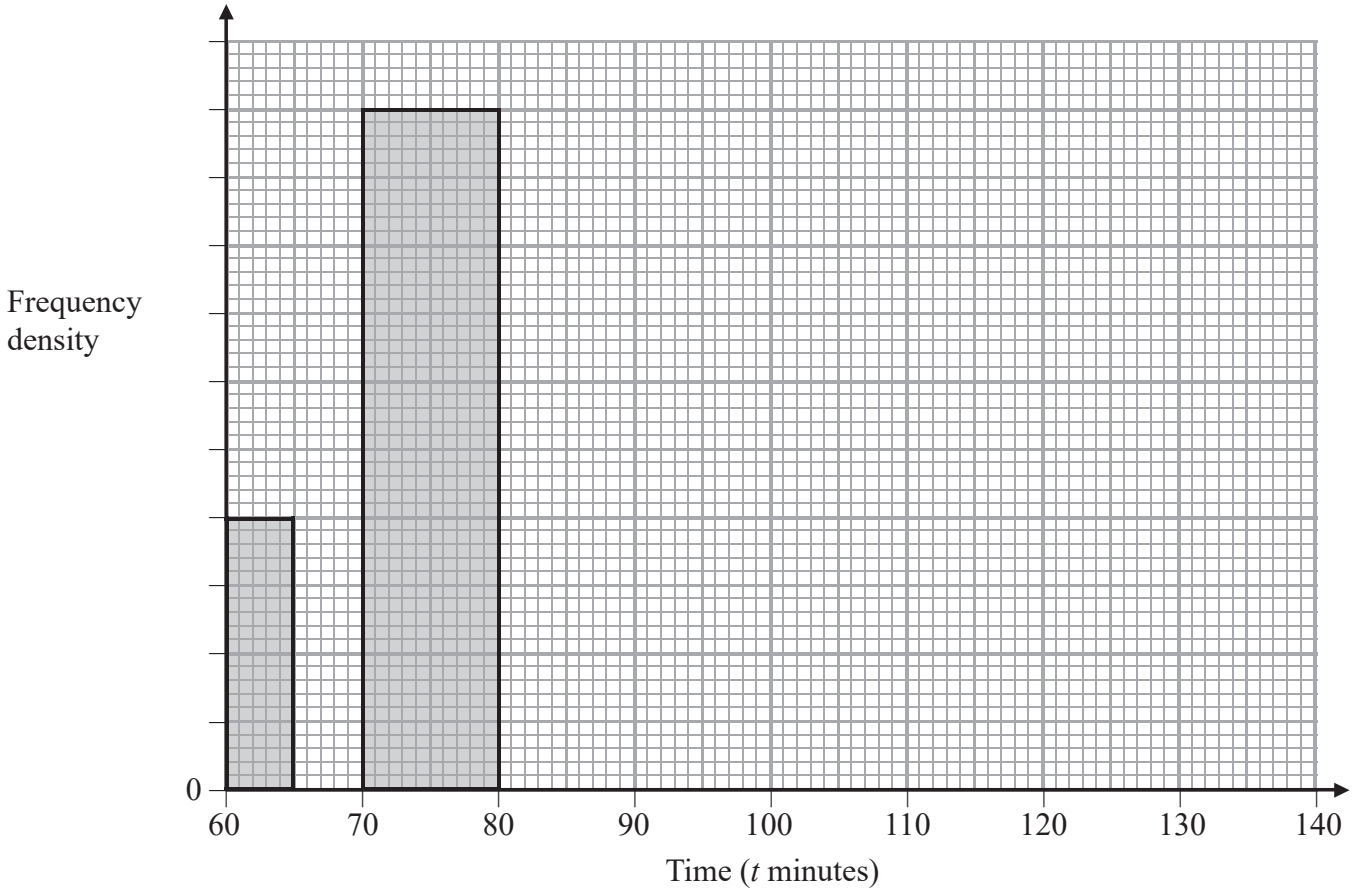
$$\left[\text{Solutions of } ax^2 + bx + c = 0 \text{ are } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\right]$$

Question 6 continued

(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)	$60 < t \leqslant 65$	$65 < t \leqslant 70$	$70 < t \leqslant 80$	$80 < t \leqslant 95$	$95 < t \leqslant 115$	$115 < t \leqslant 140$
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)

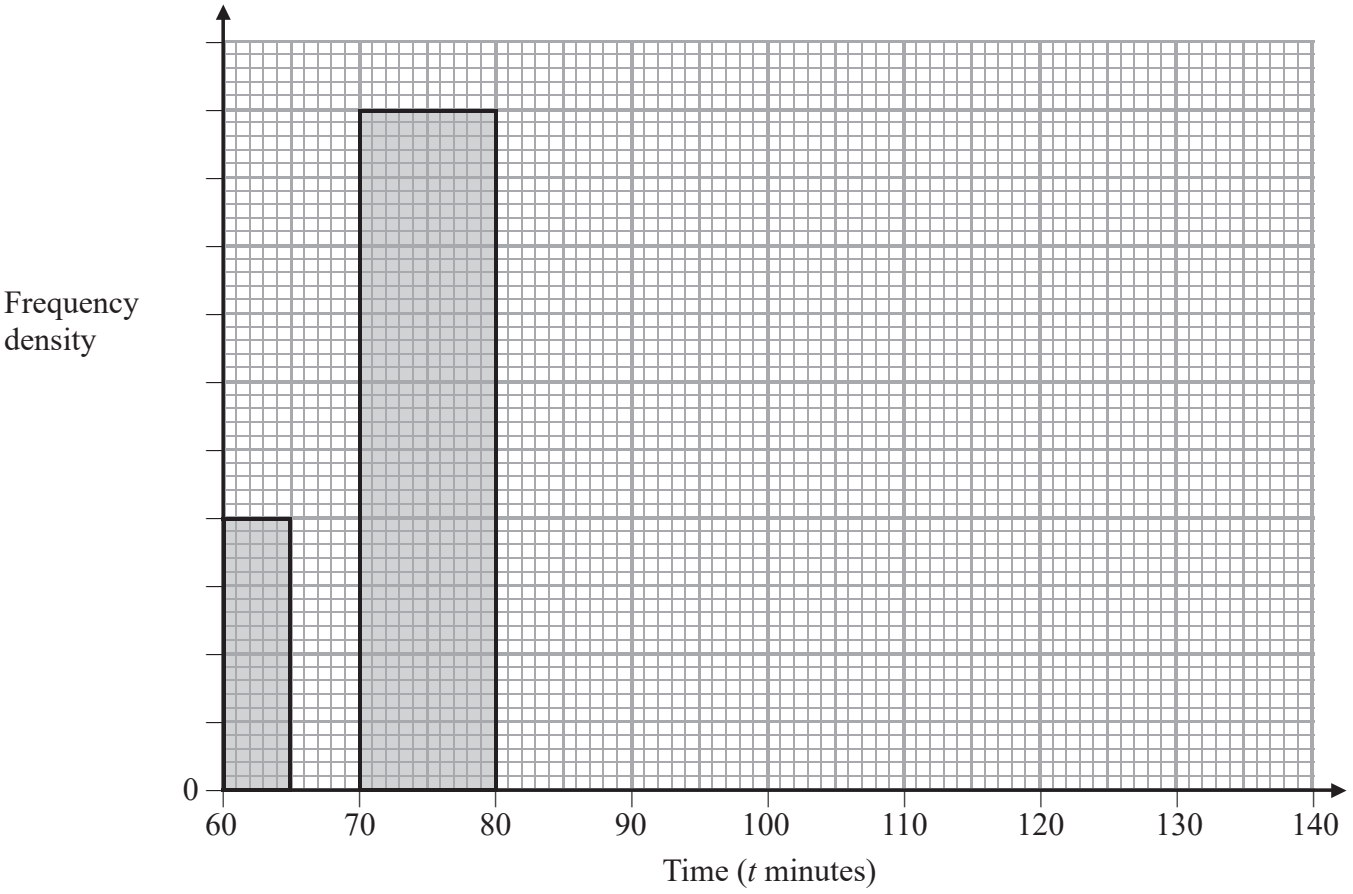
Turn over for a spare grid if you need to redraw your histogram.

Question 7 continued

Question 7 continued

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

Time (t minutes)	$60 < t \leqslant 65$	$65 < t \leqslant 70$	$70 < t \leqslant 80$	$80 < t \leqslant 95$	$95 < t \leqslant 115$	$115 < t \leqslant 140$
Frequency	10	20		60	90	



Question 7 continued

(Total for Question 7 is 10 marks)

8

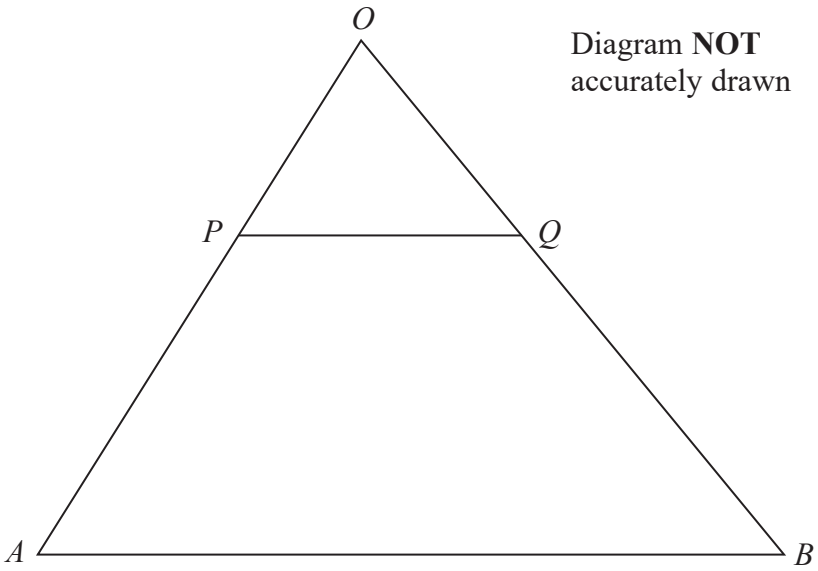


Diagram **NOT** accurately drawn

Figure 1

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

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

(a) Express in terms of **a** or **b** or **a** and **b** where appropriate,

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

(2)

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

$\overrightarrow{PQ} = \alpha \overrightarrow{AB}$ 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 $\overrightarrow{PR}$ in terms of n, **a** and **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)

Question 8 continued

Question 8 continued

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Question 8 continued

(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 **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 **P**.

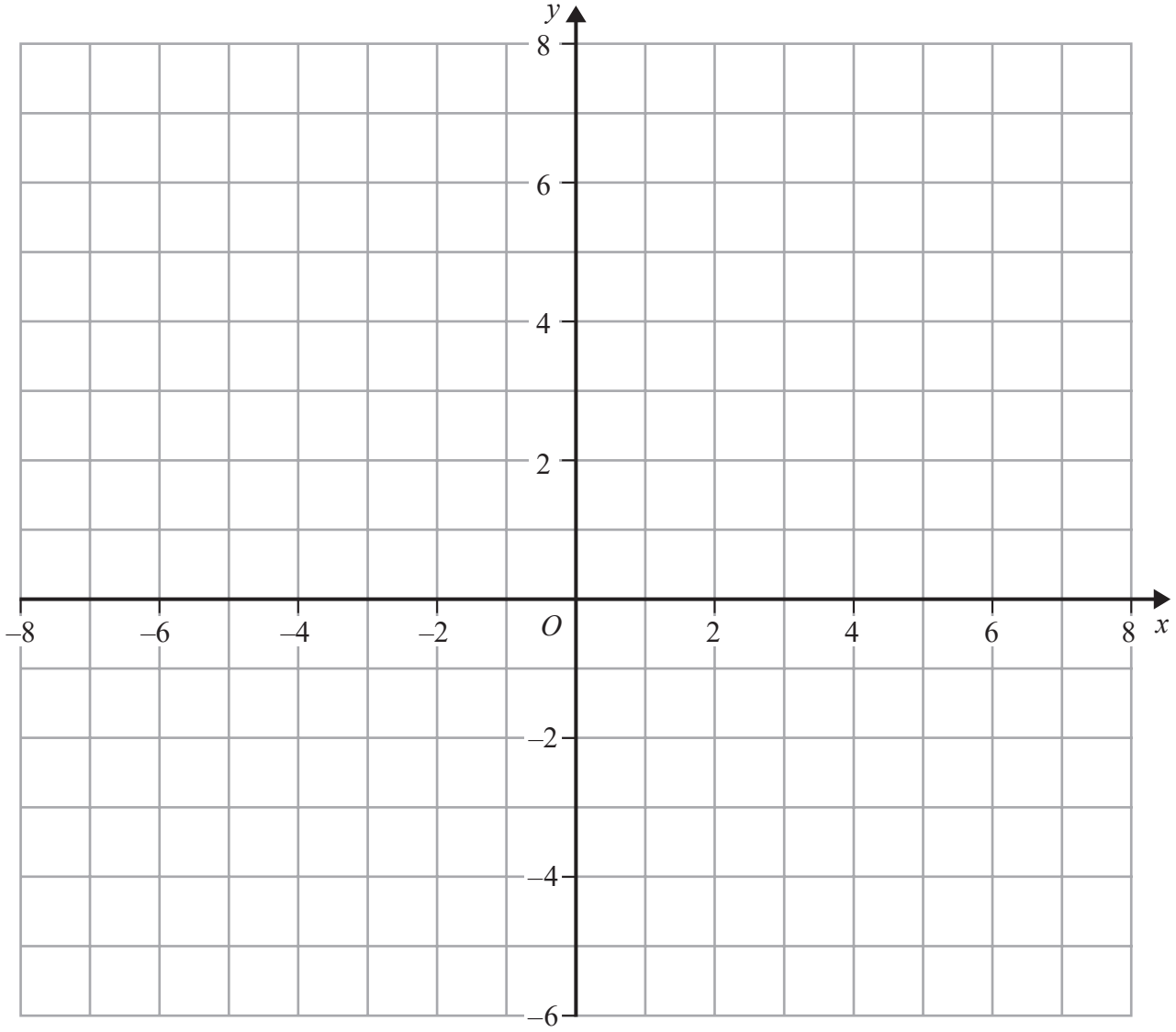
(1)

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

(1)

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

Question 9 continued



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

Question 9 continued

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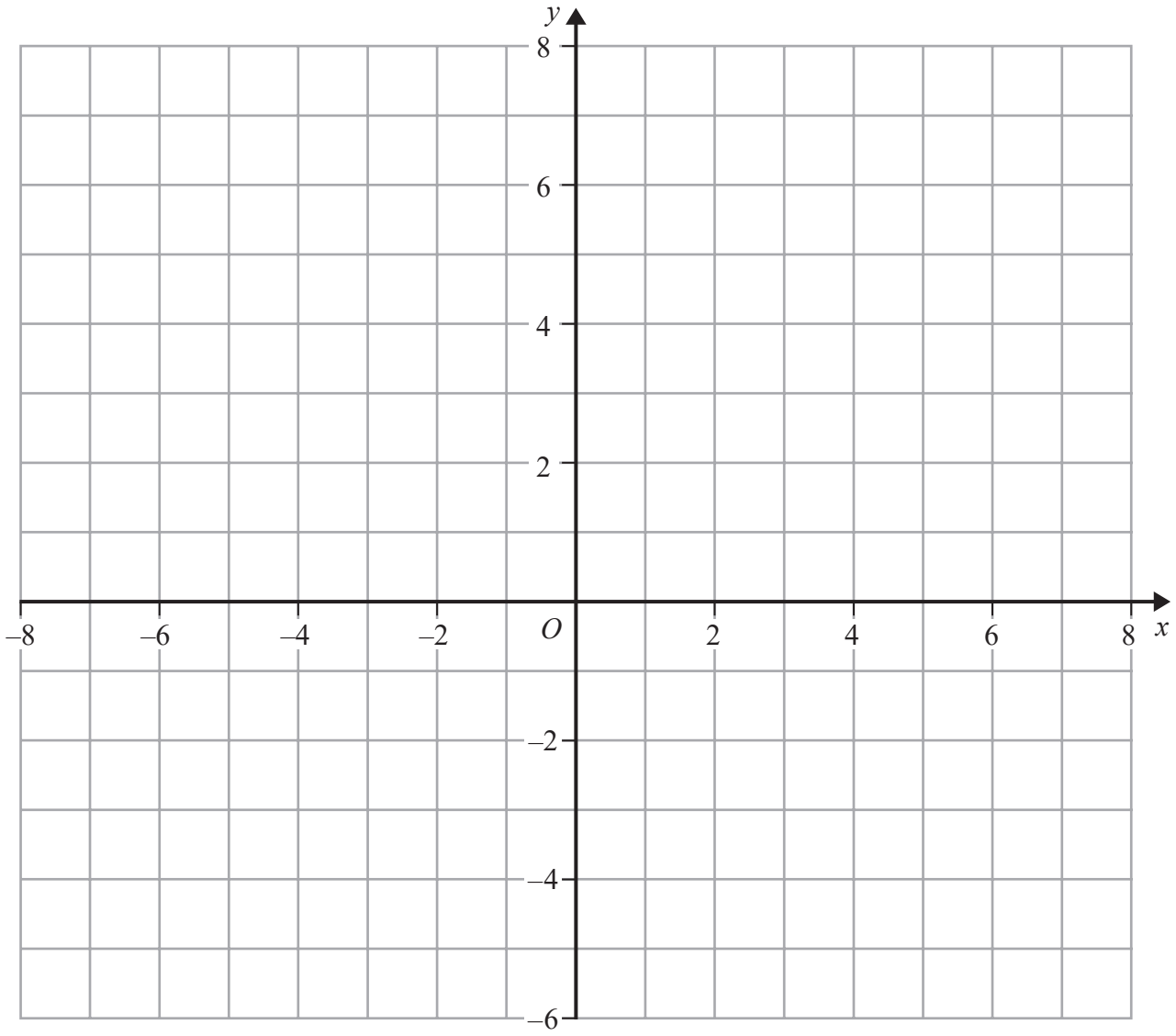
Question 9 continued

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



(Total for Question 9 is 13 marks)

10

Diagram **NOT** accurately drawn

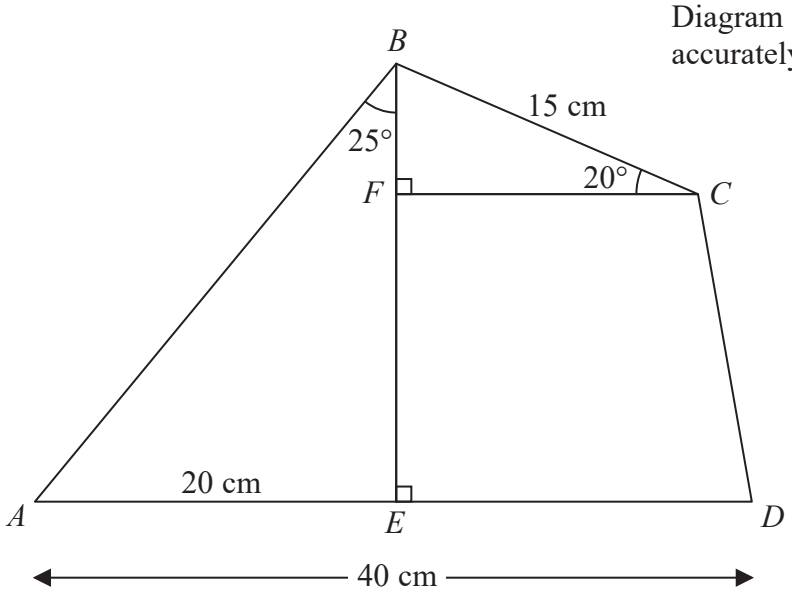


Figure 2

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 $\angle ABE = 25°$

(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 $\angle BCF = 20°$

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)

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

Question 10 continued

Question 10 continued

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Question 10 continued

(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)

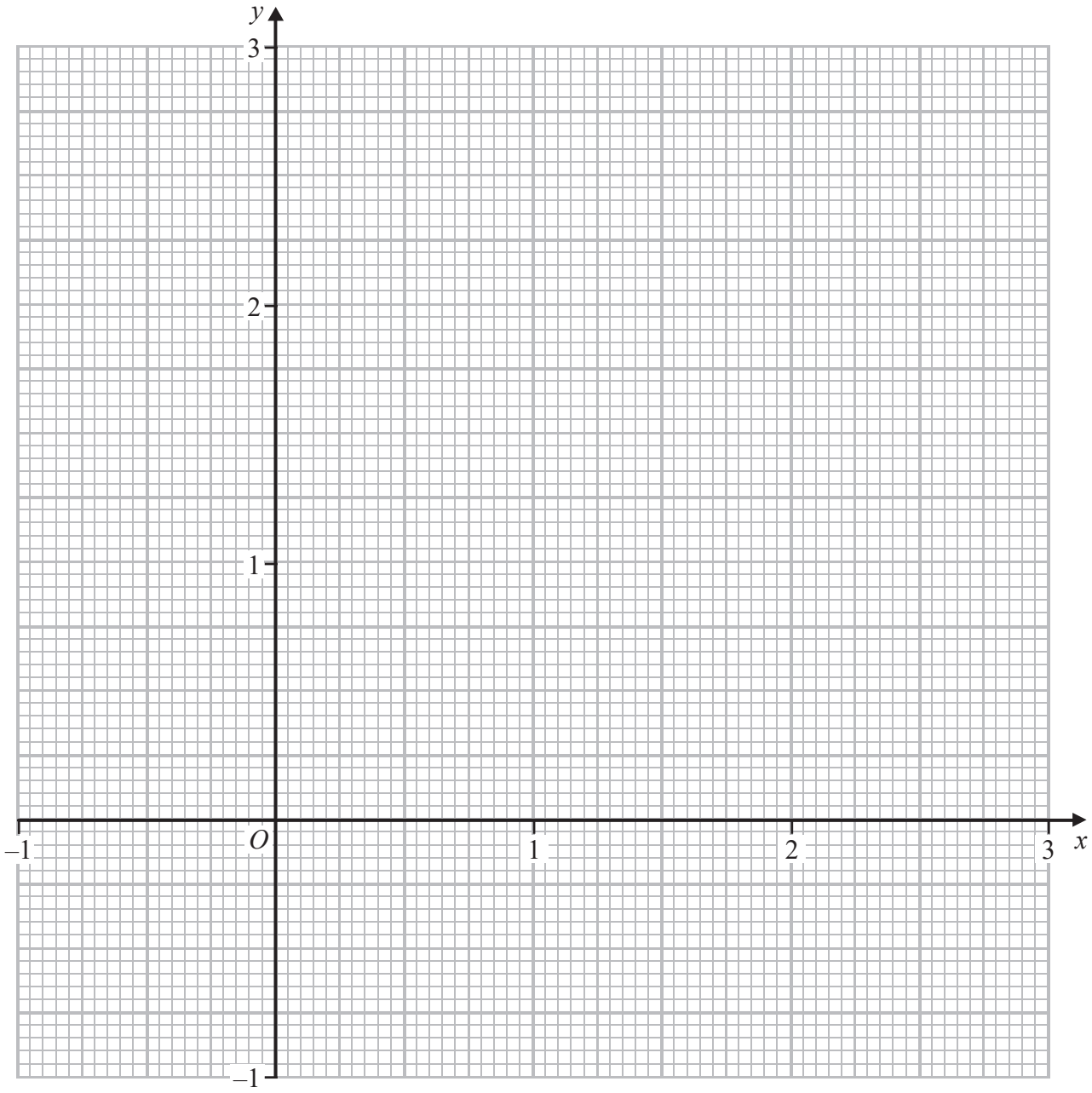
(d) On the grid opposite, plot the points from your completed table and plot the stationary points from part (b) and join them to form a smooth curve.

(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



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

Question 11 continued

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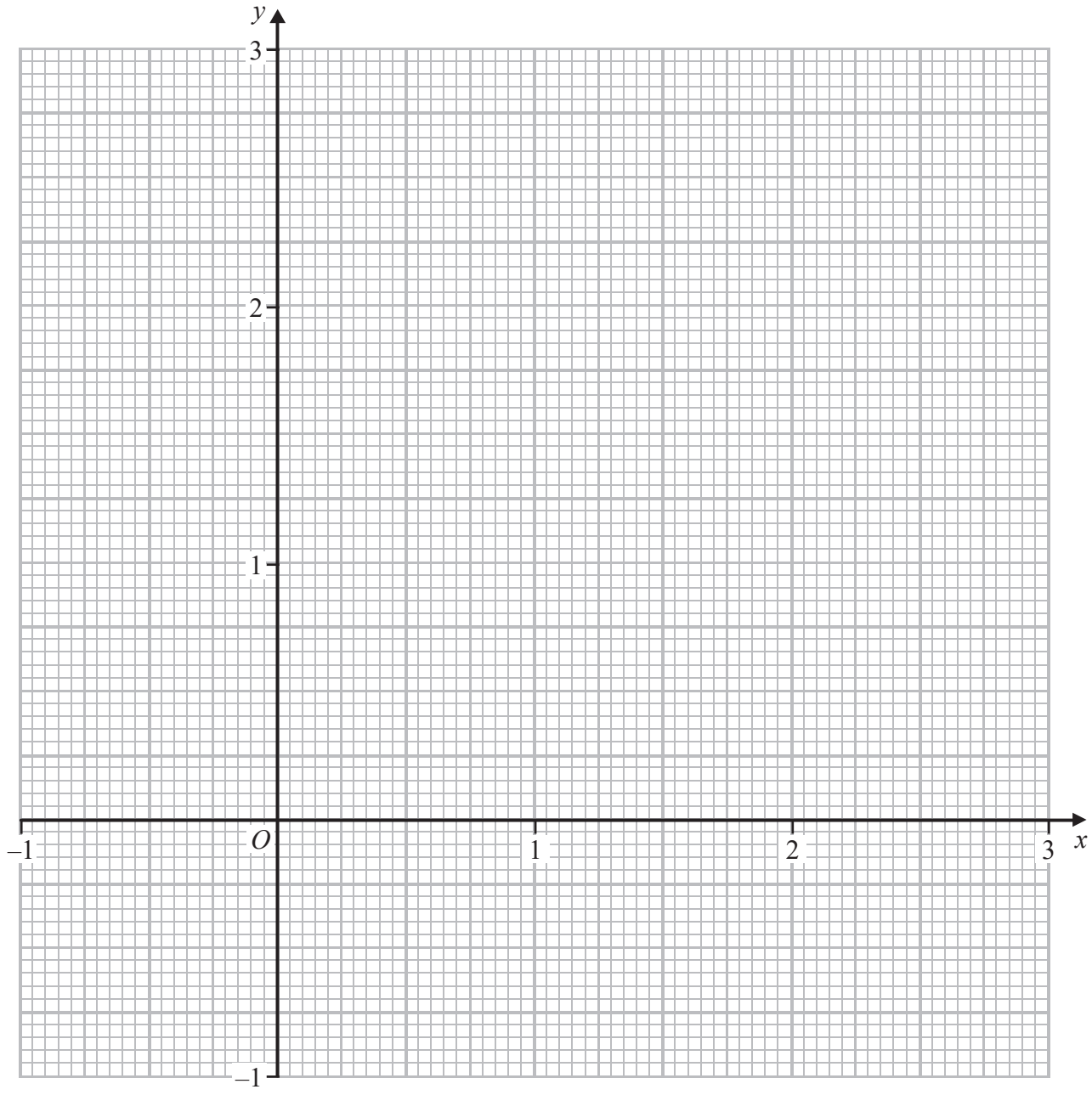
Question 11 continued

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



Question 11 continued

(Total for Question 11 is 16 marks)

TOTAL FOR PAPER IS 100 MARKS