Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number	Candidate Number

Mathematics B

Paper 2

Thursday 7 June 2018 – Morning
Time: 2 hours 30 minutes

Paper Reference
4MB1/02

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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P 5 4 6 9 7 R A 0 1 3 6

Pearson

Answer ALL ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 For concerts in a theatre, people can buy tickets in the Stalls, in the Dress Circle and in the Balcony.

The number of seats in the Stalls is S, the number of seats in the Dress Circle is D and the number of seats in the Balcony is B where $S : D : B = 12 : 9 : 4$

Given that $B = 600$

(a) find the total number of seats in the theatre.

(2)

The following table gives information about the cost of tickets and the number of tickets sold for a concert held in the theatre in 2017

	Cost of each ticket	**Number of tickets sold**
Stalls	\$65	S
Dress Circle	\$40	90% of D
Balcony	\$25	$\frac{1}{4}B$

(b) Calculate the total amount of money, in \$, paid for all the tickets sold for this concert.

(3)

For a concert held in 2018, the total amount of money paid for all the tickets sold was \$175 000

For this concert in 2018, the costs of each ticket for a seat in the Stalls, in the Dress Circle and in the Balcony were the same as the costs in 2017

Also for this concert, the number of tickets sold for seats in the Stalls was the same as in 2017 and the number of tickets sold for seats in the Dress Circle was the same as in 2017

(c) Calculate the number of tickets sold for seats in the Balcony for the concert in 2018

(2)

Question 1 continued

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Question 1 continued

Question 1 continued

(Total for Question 1 is 7 marks)

2

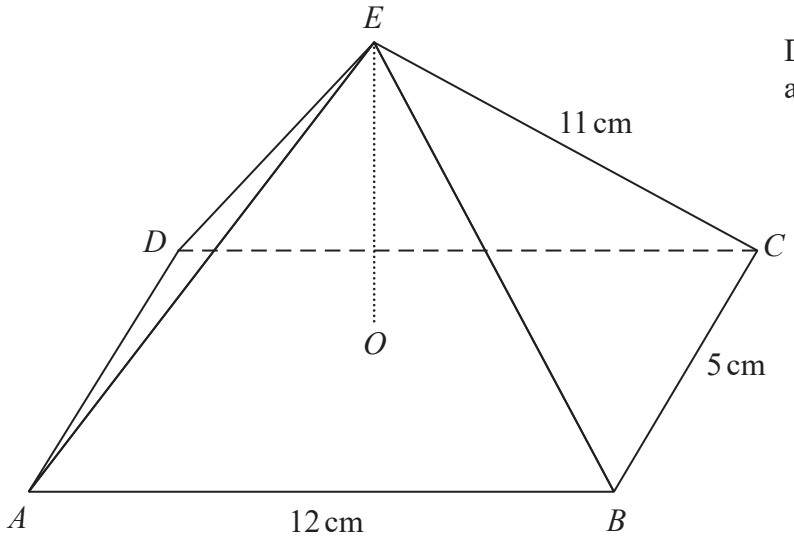


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a rectangular based right pyramid, *ABCDE*. The point *O* is the centre of the rectangular base so that *OE* is the perpendicular height of the pyramid.

AB = 12 cm and *BC* = 5 cm

AE = *BE* = *CE* = *DE* = 11 cm

Calculate the **exact** volume of the pyramid.

Give your answer in the form $p\sqrt{q}$ cm^3 where *p* and *q* are integers.

$$\left[\text{Volume of pyramid} = \frac{1}{3} \times \text{base area} \times \text{height}\right]$$

Question 2 continued

(Total for Question 2 is 5 marks)

3 $\mathbf{A} = \begin{pmatrix} a & 3 \\ 4 & -1 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 13 & 3 \\ 4 & 10 \end{pmatrix}$

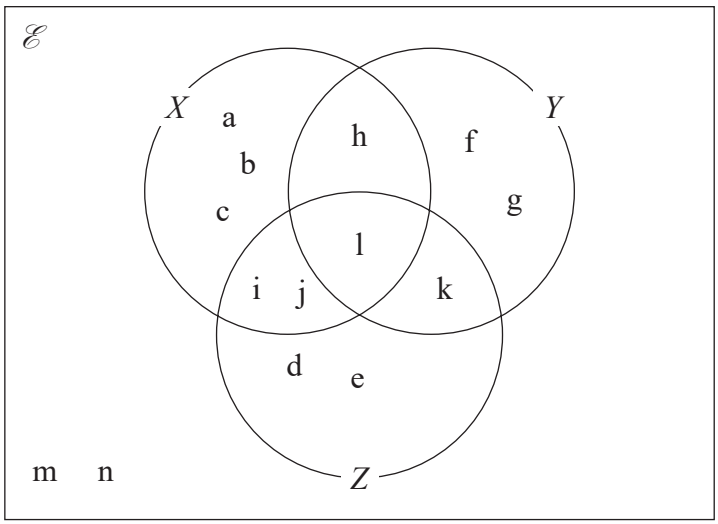
Given that $\mathbf{A}^2 - \mathbf{B} = \lambda\mathbf{I}$ where λ is an integer and $\mathbf{I} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

find the value of a and the value of λ.

Question 3 continued

(Total for Question 3 is 5 marks)

4 The Venn diagram shows information about the elements in a universal set, $\mathscr{E}$, and the three sets X, Y and Z.



Using the information in the Venn diagram, write down the elements in

(a) $X \cap Y$

(1)

(b) $(X \cup Y) \cap Z'$

(1)

Find

(c) $n([X \cup Y]')$

(1)

(d) $n([X \cap Z] \cup Y')$

(1)

Here are five symbols used in connection with sets.

$$\in \quad \varnothing \quad \subset \quad \notin \quad \cap$$

(e) Use one of these symbols to complete the following statement correctly

$$\{d, e\} \ \ldots\ldots\ldots\ldots\ldots\ldots\ Z$$

(1)

A letter is chosen at random from $\mathscr{E}$

(f) Find the probability that this letter is in set Y given that it is in set X.

(1)

Question 4 continued

(Total for Question 4 is 6 marks)

5 f and g are two functions such that

$$f: x \mapsto 3 + 5x \qquad \text{where } x < 0$$

$$g: x \mapsto \frac{5 - 4x}{3x - 2}$$

(a) Find the value of a for which $f(a) = 0$

(2)

(b) Write down the range of f

(1)

(c) State the value of x that must be excluded from any domain of g

(1)

(d) Find the value of x for which $f(x) = g(x)$
Show your working clearly.
Give your answer to 3 significant figures.

(5)

(e) Express the inverse function g^{-1} in the form $g^{-1} : x \mapsto \ldots$

(4)

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

Question 5 continued

Question 5 continued

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Question 5 continued

(Total for Question 5 is 13 marks)

6 The six numbers

$$x \quad y \quad y \quad 12 \quad (x + y) \quad 12$$

are in ascending order of size.

The mode of the six numbers is 12 and the mean of the six numbers is 9.5

(a) Find the value of x and the value of y.

(5)

(b) Hence find the median of the six numbers.

(2)

Question 6 continued

(Total for Question 6 is 7 marks)

7 The points (1, 1), (1, 3) and (0, 3) are the vertices of triangle A.

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

(1)

Triangle A is transformed to triangle B by a reflection in the line with equation $x = -2$

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

(2)

Triangle B is transformed to triangle C under the translation $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$

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

(2)

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

$$\mathbf{M} = \begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$$

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

(3)

(e) Find the inverse matrix, $\mathbf{M}^{-1}$, of the matrix $\mathbf{M}$

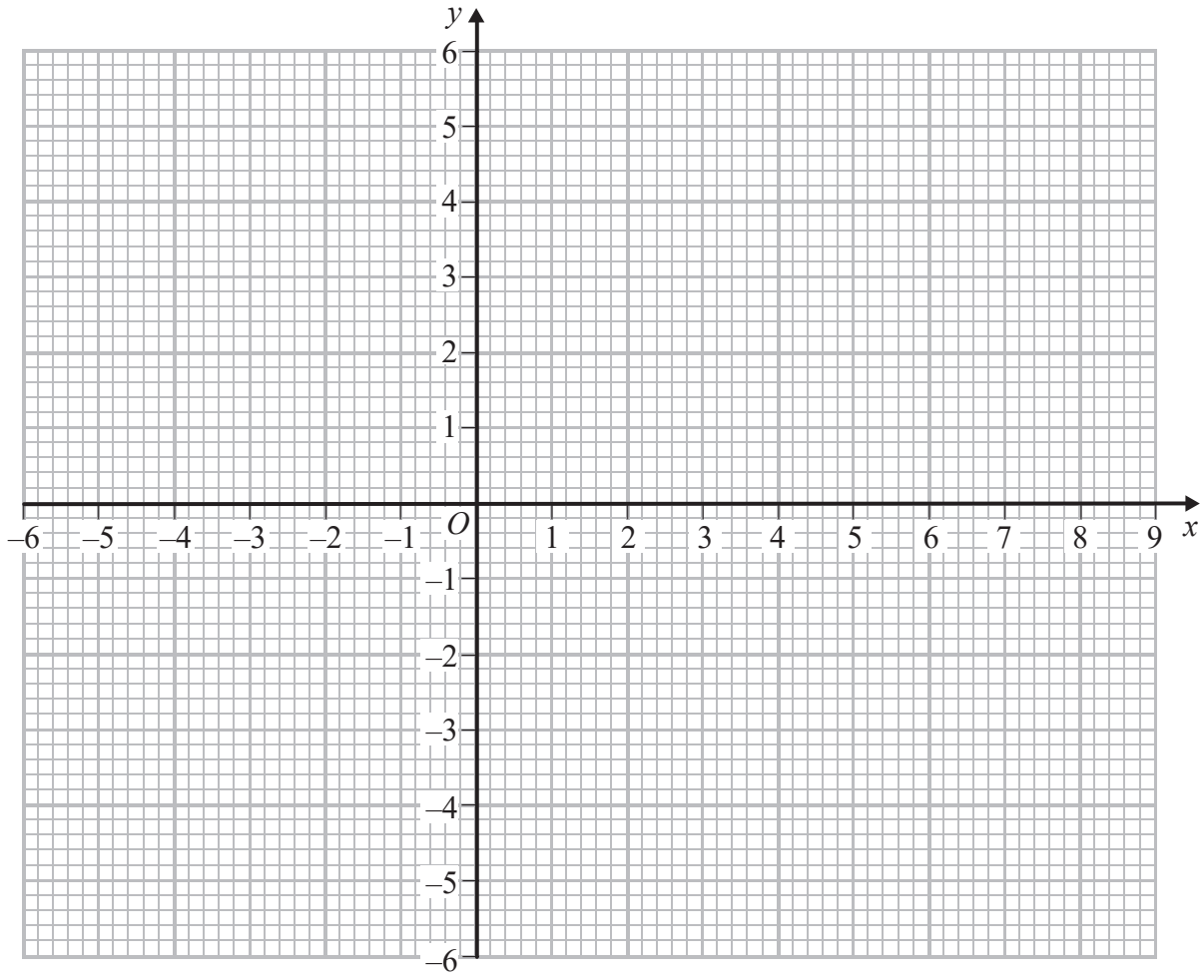
(2)

(f) Describe fully the **single** transformation represented by the matrix $\mathbf{M}^{-1}$

(3)

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

Question 7 continued



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

Question 7 continued

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Question 7 continued

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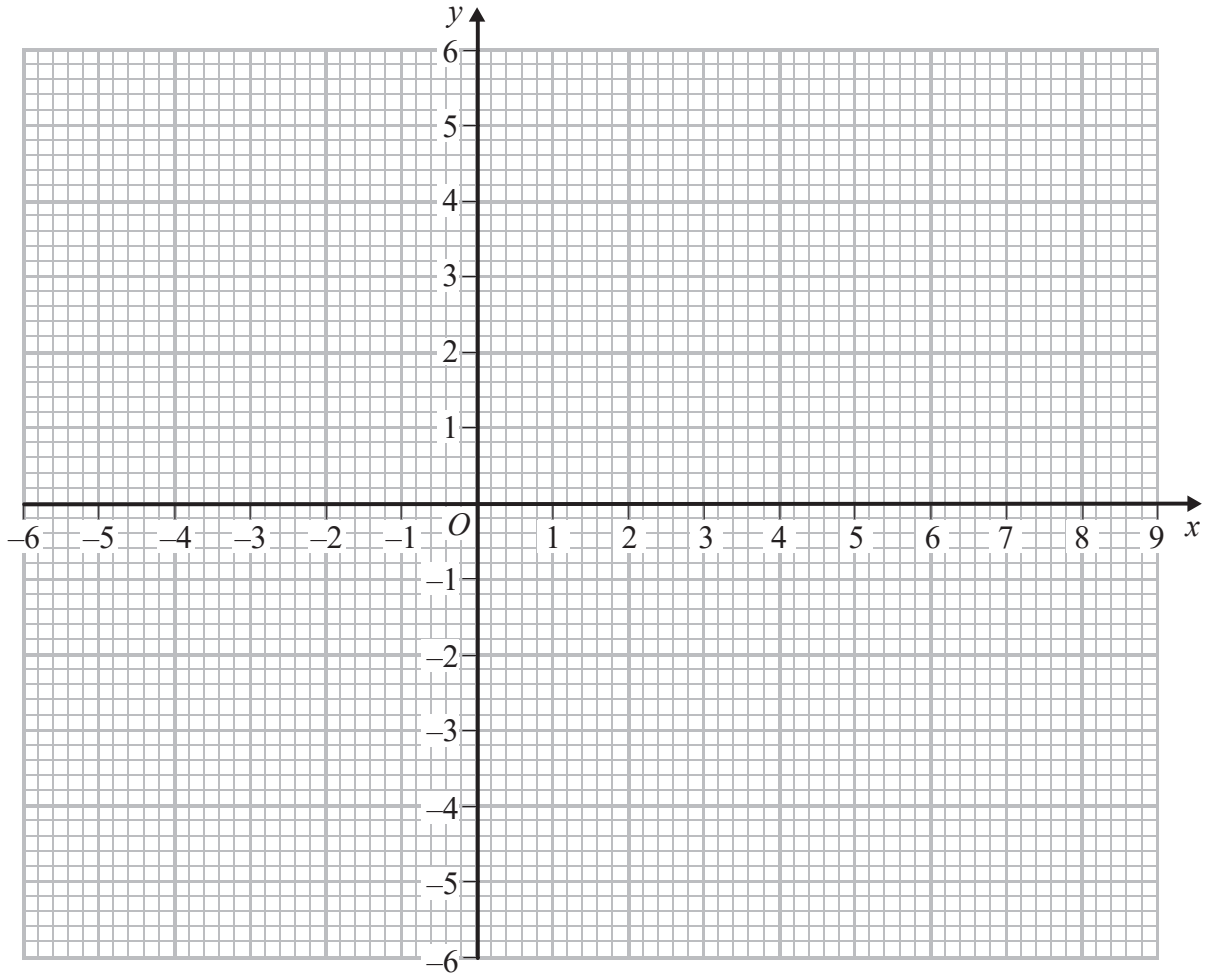

(Total for Question 7 is 13 marks)

8 The equation of a curve is $y = \frac{1}{2}x^2(x^2 - 1) - \frac{5}{3}x^3 + 11x + \frac{1}{3}$

The point A on the curve has coordinates (p, q)

The gradient of the curve at A is 5

(a) Show that p is a root of the equation

$$2p^3 - 5p^2 - p + 6 = 0$$

(3)

(b) Show that $(2p - 3)$ is a factor of $2p^3 - 5p^2 - p + 6$

(2)

(c) Hence factorise completely $2p^3 - 5p^2 - p + 6$

(4)

Given that $p > \frac{3}{2}$

(d) find the value of q.

(2)

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Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 11 marks)

9

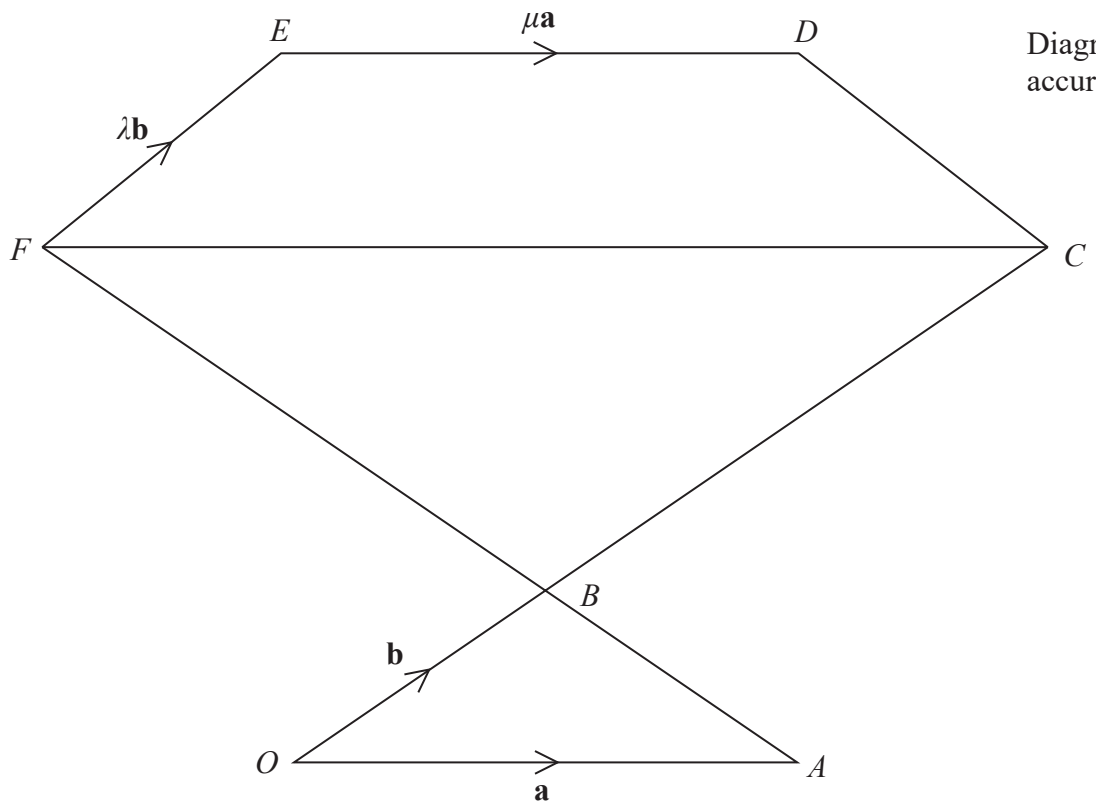

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Figure 2

In Figure 2, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$, $\overrightarrow{FE} = \lambda\mathbf{b}$ and $\overrightarrow{ED} = \mu\mathbf{a}$, where λ and μ are positive constants.

B is the point of intersection of OC and AF such that $OB : OC = AB : AF = 1 : 3$

(a) Find, in terms of **a** or **b** or **a** and **b**, simplifying your answers where possible,

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

(2)

(b) Find, in terms of **a**, **b**, λ and where necessary μ, simplifying your answers where possible,

(i) $\overrightarrow{CD}$ (ii) $\overrightarrow{AE}$

(3)

Given that $\overrightarrow{AE} = 4\overrightarrow{CD}$

(c) find the value of μ and the value of λ.

(4)

Given also that $|\mathbf{a}| = 4\,\text{cm}$, $|\mathbf{b}| = 1\,\text{cm}$ and that the area of the trapezium $CDEF$ is $5\,\text{cm}^2$

(d) calculate the size, in degrees to 3 significant figures, of $\angle CFE$.

(4)

$$\left[\text{Area of trapezium} = \frac{1}{2}(a+b)h\right]$$

Question 9 continued

Question 9 continued

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Question 9 continued

(Total for Question 9 is 13 marks)

10 The equation of a curve is given by

$$y = x^2 - 5x + \frac{8}{x}$$

(a) Complete the table of values for y, giving your values of y to 2 decimal places where necessary.

x	0.8	1	2	3	4	5	6
y		4	–2		–2		7.33

(3)

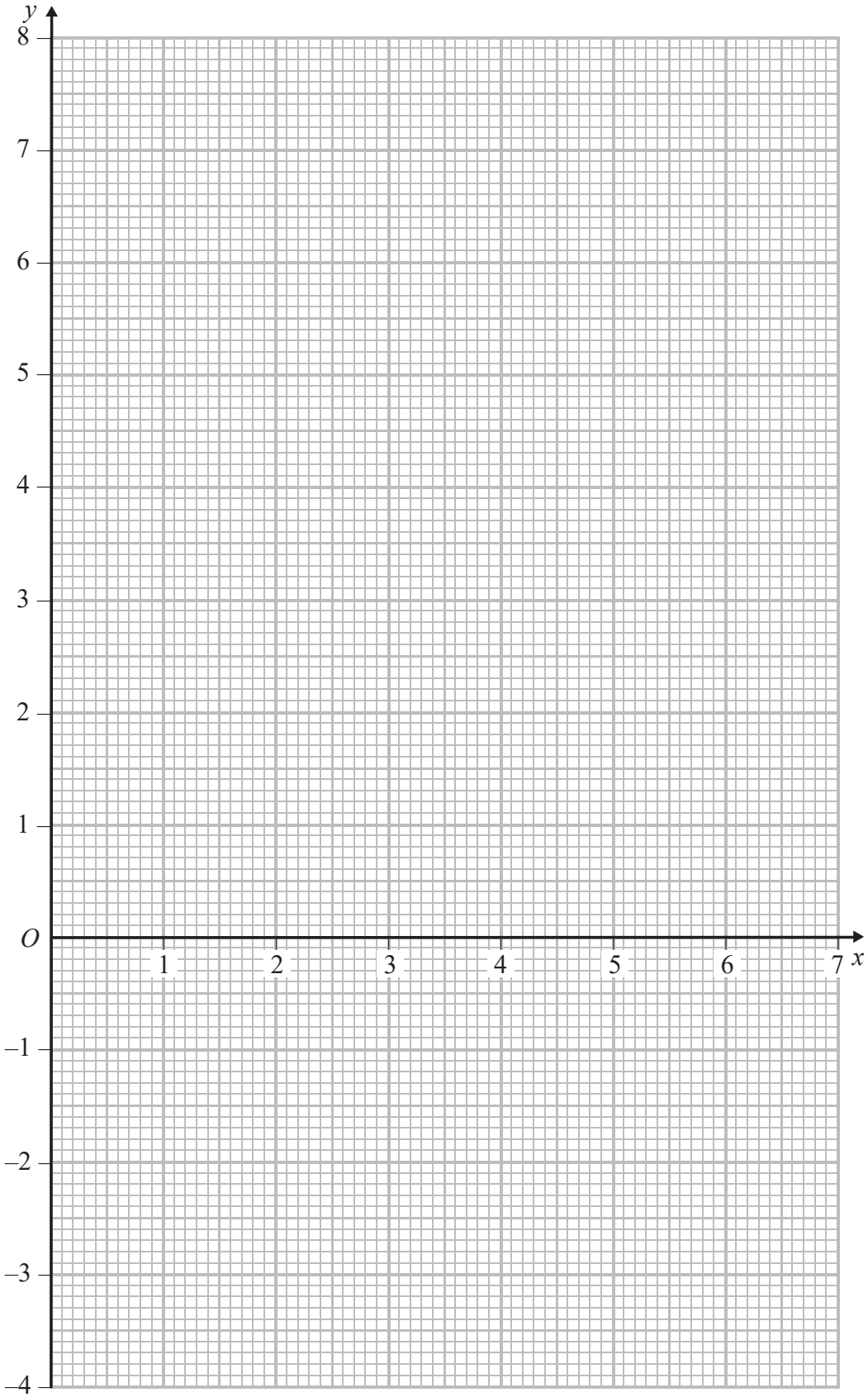
(b) On the grid, plot the points from your completed table and join them to form a smooth curve.

(3)

(c) **By drawing a suitable straight line on the grid**, find an estimate, to 1 decimal place, for the range of values of x in $0.8 \leqslant x \leqslant 6$ for which $4x^3 - 21x^2 - 12x + 32 < 0$

(5)

Question 10 continued



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Question 10 continued

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Question 10 continued

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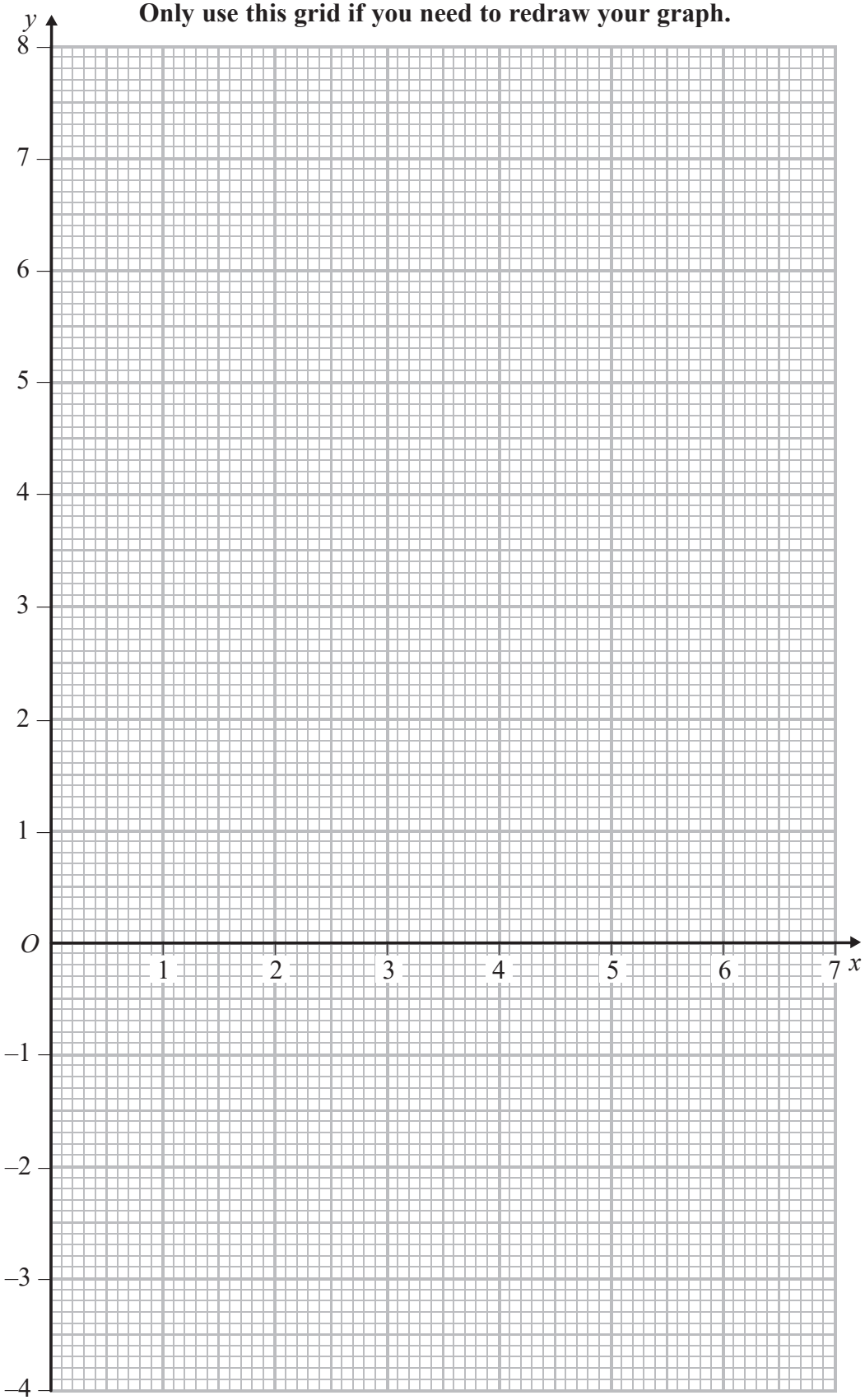


(Total for Question 10 is 11 marks)

11 A bag contains 6 five cent coins and 9 ten cent coins.

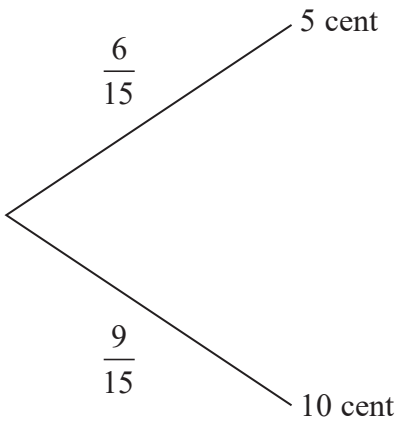
Coins are taken at random from the bag, one at a time without replacement, until the total value of the coins taken from the bag is at least 15 cents.

No more coins are then taken from the bag.

(a) Complete the probability tree diagram.

(3)

First coin **Second coin** **Third coin**



(b) Calculate the probability that exactly **two** coins are taken from the bag.

(3)

A is the event that the total value of the coins taken from the bag is 15 cents.
B is the event that the total value of the coins taken from the bag is 20 cents.

(c) Determine which of the events, A or B, is the more likely.
Show your working clearly.

(3)

Question 11 continued

Question 11 continued

(Total for Question 11 is 9 marks)

TOTAL FOR PAPER IS 100 MARKS