Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics B

Paper 2R

Thursday 9 June 2016 – 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 4 6 2 2 5 A 0 1 3 2

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Answer ALL ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Given that $\begin{pmatrix} x^2 & 3y \\ y & x \end{pmatrix}\begin{pmatrix} 1 \\ -2 \end{pmatrix} = \begin{pmatrix} 9-6y \\ 5 \end{pmatrix}$

(a) calculate the two possible values of x.

(3)

(b) Hence calculate the possible values of y.

(3)

Question 1 continued

(Total for Question 1 is 6 marks)

2

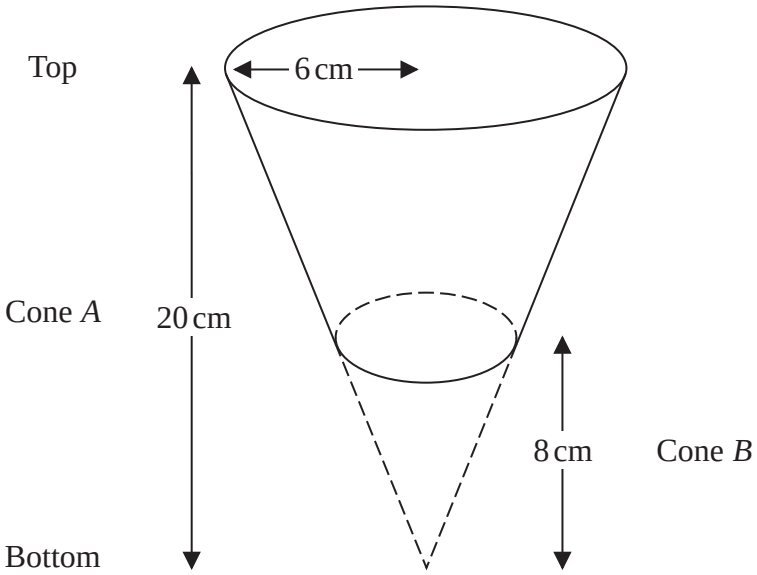

Diagram **NOT** accurately drawn

Figure 1

A hollow right circular cone, *A*, has height 20 cm and radius 6 cm.
The cone is held with its axis vertical and its vertex at the bottom.

A funnel is formed by removing the right circular cone, *B*, of height 8 cm from the bottom of *A*, as shown in Figure 1.

(a) Calculate the radius, in cm, of cone *B*.

(2)

(b) Calculate the volume, in cm^3 to 3 significant figures, of the funnel.

(2)

$$\left[\begin{array}{c} \text{Area of a circle} = \pi r^2 \\ \text{Volume of a right circular cone} = \frac{1}{3}\pi r^2 h \end{array}\right]$$

Question 2 continued

Figure 2, below, shows the funnel placed on a sheet of metal.

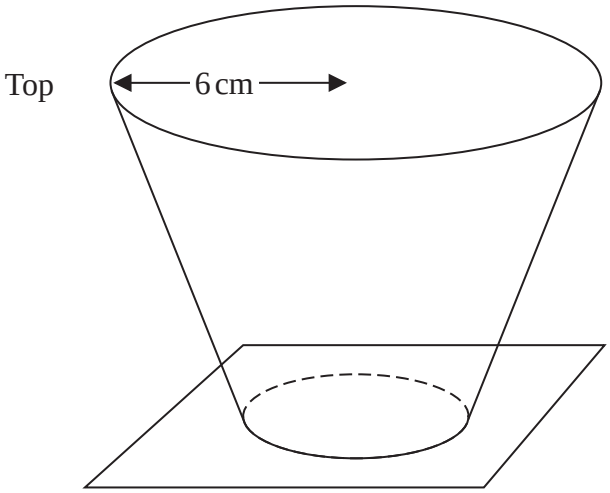

Diagram **NOT** accurately drawn

Figure 2

The funnel is completely filled with water and no water escapes from the bottom of the funnel.
The sheet of metal is suddenly removed.

Given that water flows out of the funnel at a constant rate of $54\,cm^3/s$

(c) calculate the time, to the nearest second, to completely empty the funnel of water.

(2)

Question 2 continued

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Question 2 continued

(Total for Question 2 is 6 marks)

3 The equation of a curve C is $y = 2x^3 - 4x^2 + 5$ where $x > 0$
The point A is the stationary point on C.

(a) Show that the x coordinate of A is $x = \frac{4}{3}$

(4)

(b) Determine whether A is a maximum point or a minimum point.

(3)

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Question 3 continued

(Total for Question 3 is 7 marks)

4 In February, a motor vehicle salesman sold 600 vehicles.
40% of these vehicles were vans.

(a) Find the number of vans sold in February.

(1)

All the other vehicles sold by the salesman in February were either lorries or cars.
The ratio of the number of lorries sold to the number of cars sold was 1 : 4

(b) Calculate the number of lorries sold and the number of cars sold in February.

(3)

In March, the salesman sold $\frac{1}{9}$ **more cars** than he sold in February but he sold $12\frac{1}{2}\%$ **fewer lorries** than he sold in February. He sold the same number of vans in March as he sold in February.

The salesman sold more vehicles in March than he sold in February.

(c) Express this increase as a percentage, to the nearest percent, of the total number of vehicles sold by the salesman in February.

(3)

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Question 4 continued

(Total for Question 4 is 7 marks)

5 The functions f, g and h are defined as

$$f: x \mapsto \frac{1+x}{x} \qquad x \neq 0$$

$$g: x \mapsto \frac{2}{x} \qquad x \neq 0$$

$$h: x \mapsto x + 3$$

(a) (i) Express the inverse function f^{-1} in the form $f^{-1}: x \mapsto ...$

(ii) State the value of x which must be excluded from any domain of f^{-1}

(4)

(b) Solve the equation $hg(x) = 4f^{-1}(x)$

(5)

Question 5 continued

(Total for Question 5 is 9 marks)

6 The vertices of triangle *A* are the points with coordinates (1, 1), (2, 3) and (–1, 2).

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

(1)

Triangle *A* is transformed to triangle *B* under the transformation with matrix **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 transformation with matrix **Q** where

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

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

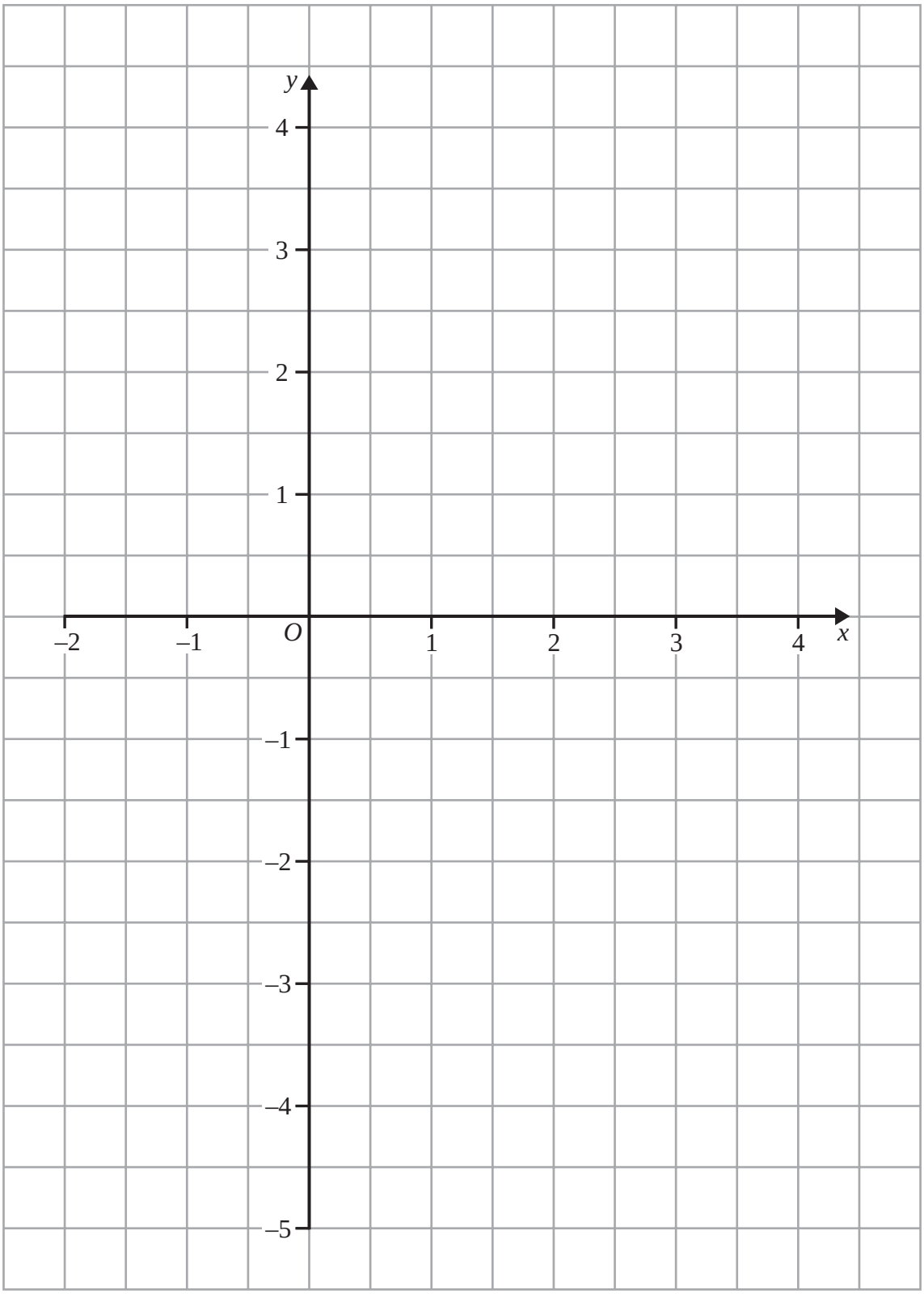
(3)

Triangle *C* is the image of triangle *A* under a **single** transformation.

(d) Describe fully this transformation.

(3)

Question 6 continued



(Total for Question 6 is 10 marks)

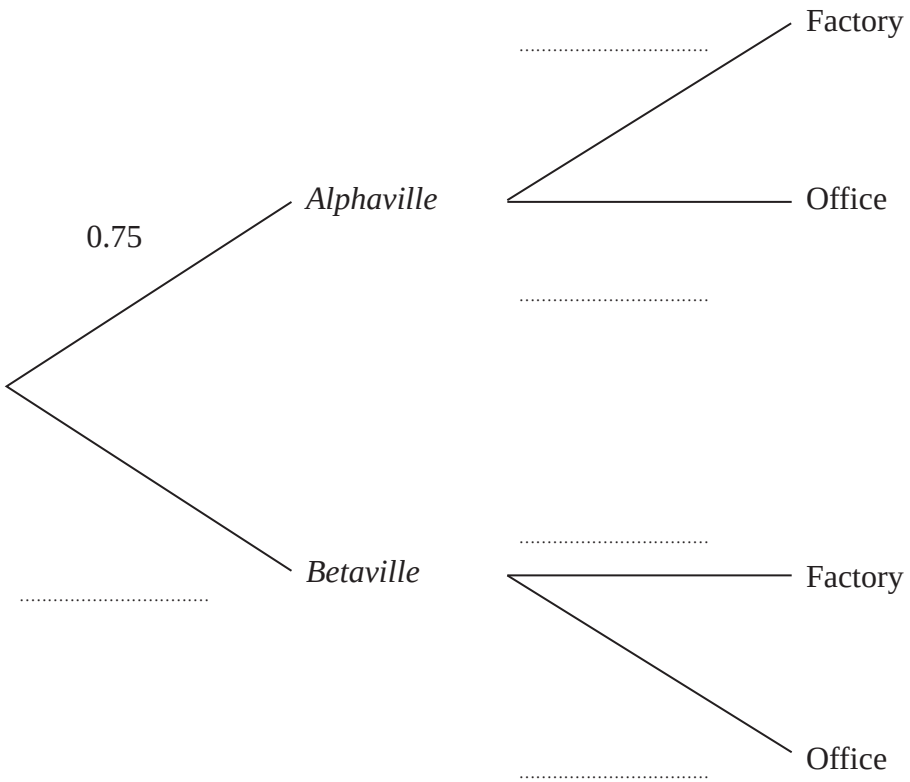
7 *Alphaville* and *Betaville* are two towns on an island.
All the adults on the island either work in *Alphaville* or in *Betaville*.

75% of the adults on the island work in *Alphaville*.

All the adults on the island either work in a factory or in an office.
70% of the adults on the island who work in *Alphaville* work in a factory.
40% of the adults on the island who work in *Betaville* work in an office.

(a) Complete the probability tree diagram for this information.

Question 7 continued



(3)

An adult on the island is to be chosen at random.

(b) Find the probability that this adult

(i) works in an office in *Betaville*,

(ii) works in an office.

(5)

Given that the adult chosen works in an office,

(c) find the probability that this adult works in *Betaville*.

(3)

Question 7 continued

(Total for Question 7 is 11 marks)

8 Make x the subject of $t = a(b + dx)$

(Total for Question 8 is 3 marks)

9

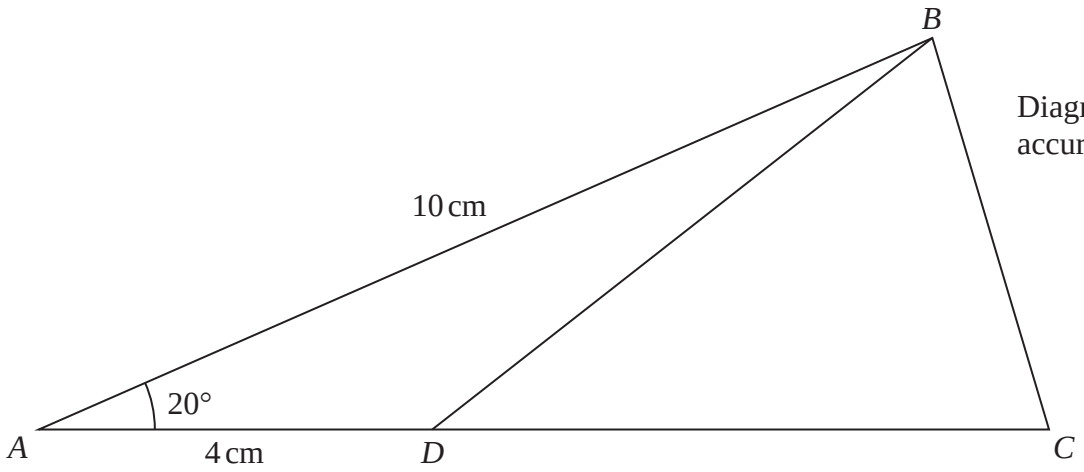


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Figure 3

Figure 3 shows ΔABC in which $AB = 10\,\text{cm}$ and $\angle BAC = 20°$

The point D lies on the line AC so that $AD = 4\,\text{cm}$ and $\angle BDA$ is obtuse.

Calculate, to 3 significant figures,

(a) the length, in cm, of BD,

(3)

(b) the size, in degrees, of $\angle BDC$.

(4)

Given that the area of ΔABC is $18\,\text{cm}^2$

(c) calculate the length, in cm to 3 significant figures, of CD.

(3)

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

Question 9 continued

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Question 9 continued

(Total for Question 9 is 10 marks)

10

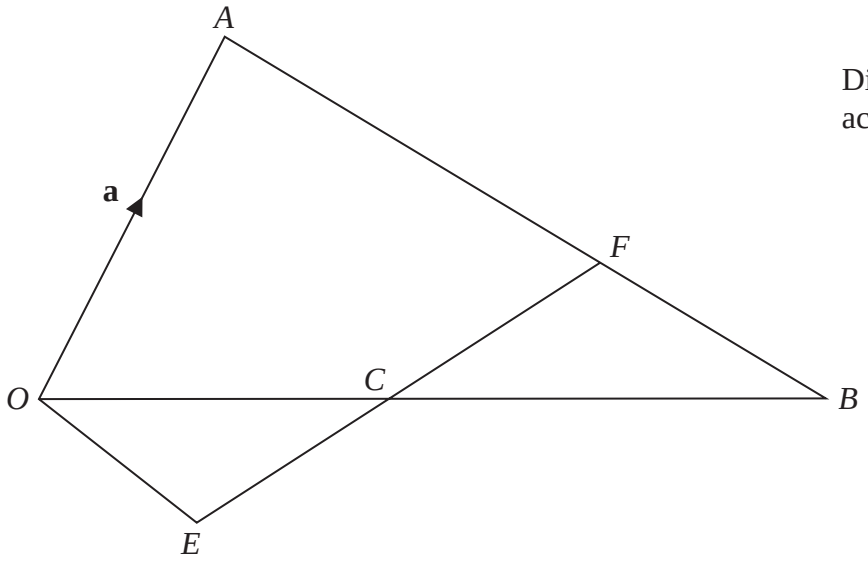

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Figure 4

In Figure 4, OAB is a triangle.
The point C is the midpoint of OB.
The point F is on AB such that $AF : FB = 2 : 1$

Given that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = 2\mathbf{b}$

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

(i) $\overrightarrow{AB}$ (ii) $\overrightarrow{BC}$ (iii) $\overrightarrow{AF}$ (iv) $\overrightarrow{FC}$

(5)

The point E is such that FCE is a straight line so that $\overrightarrow{FE} = \lambda\overrightarrow{FC}$, where λ is a scalar.

(b) Write down an expression in terms of **a**, **b** and λ for $\overrightarrow{FE}$.

(1)

(c) Find and simplify an expression in terms of **a**, **b** and λ for $\overrightarrow{OE}$.

(2)

The point E is such that $\overrightarrow{OE} = \mu\overrightarrow{AB}$, where μ is a scalar.

(d) Find the value of λ and the value of μ.

(6)

(e) State what can be deduced about triangles OCE and CFB.

(1)

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Question 10 continued

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Question 10 continued

(Total for Question 10 is 15 marks)

11 The equation of a curve is given by $y = -2x^3 + 3x^2 + 2x$

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

Give your values of y to two decimal places where necessary.

x	–1	–0.5	–0.25	0	0.25	0.5	0.75	1	1.25	1.5	2
y	3	0		0	0.66	1.5	2.34	3		3	0

(2)

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

(3)

(c) Using your curve, write down the values, to one decimal place, of the x coordinates of the stationary points on $y = -2x^3 + 3x^2 + 2x$

(2)

(d) Use your curve to estimate the range of values for x, to one decimal place, for which

$$-2x^3 + 3x^2 + 2x - 1 > 0$$

(3)

(e) By drawing a suitable straight line on the grid, find estimates, to one decimal place, of the 3 values of x which satisfy $-2x^3 + 3x^2 + \frac{3}{2}x - 2 = 0$

(6)

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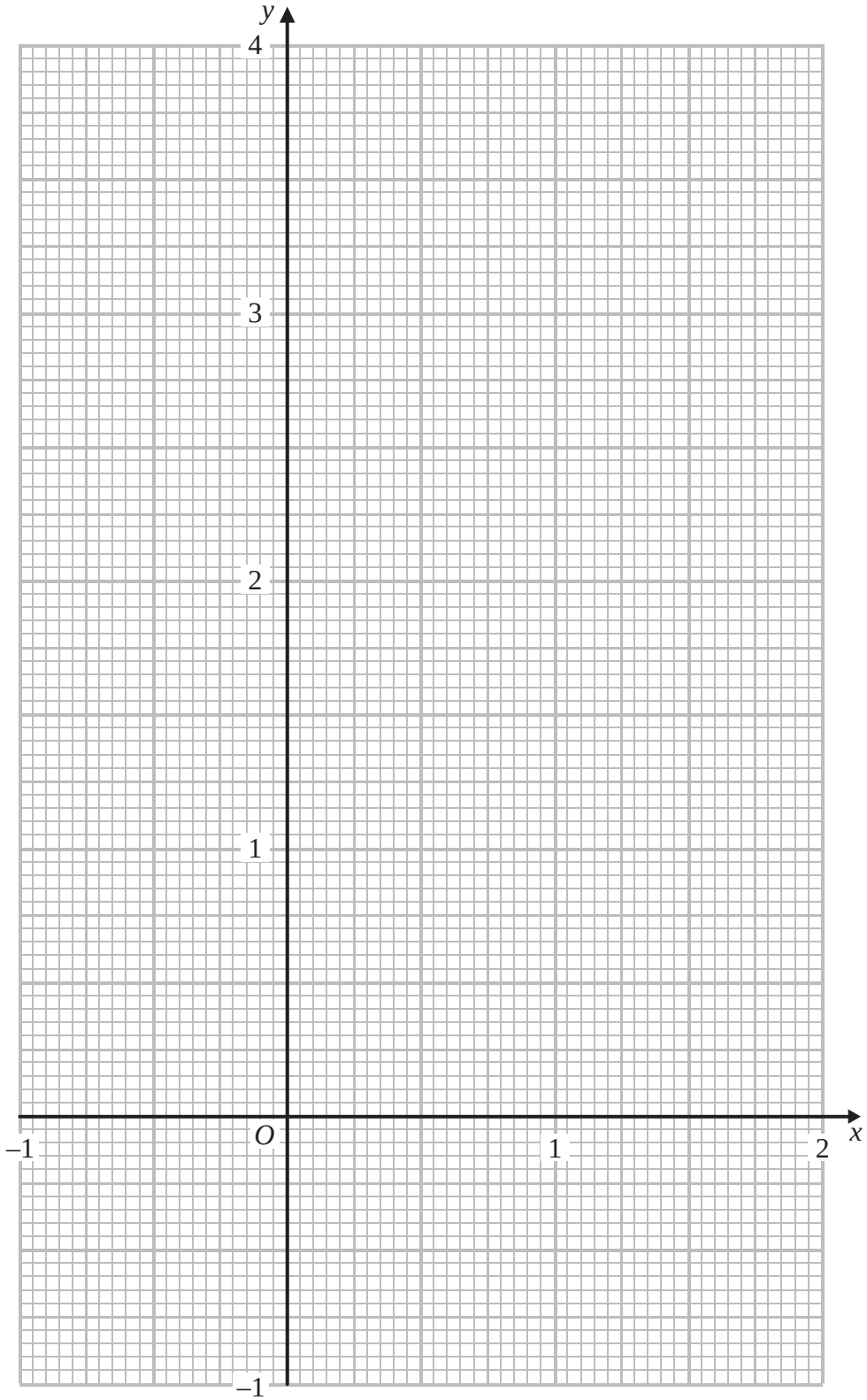
Question 11 continued



Use the grid on page 31 if you need to redraw your graph.

Question 11 continued

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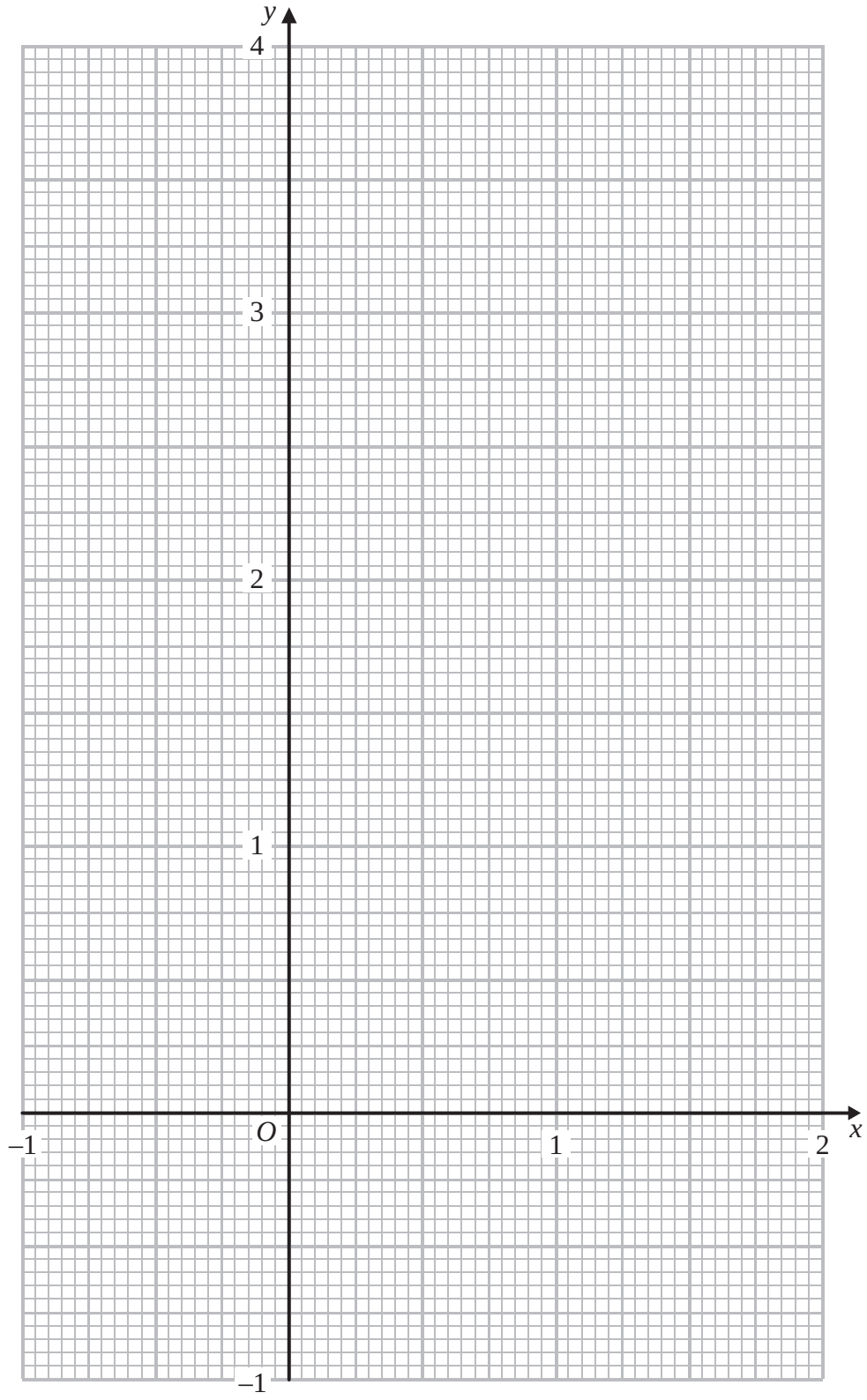
Question 11 continued

Use this grid if you need to redraw your graph.



Question 11 continued

(Total for Question 11 is 16 marks)

TOTAL FOR PAPER IS 100 MARKS