

Write your name here

Surname

Other names

Centre Number

Candidate Number

**Pearson Edexcel
International GCSE**

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Mathematics B

Paper 2R



Tuesday 17 January 2017 – 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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Answer ALL ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1
$$\begin{pmatrix} 3+y & -3 \\ 2 & 1 \end{pmatrix} \begin{pmatrix} -2 \\ x \end{pmatrix} = \begin{pmatrix} -16 \\ 4 \end{pmatrix}$$

Find the value of x and the value of y .

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(Total for Question 1 is 4 marks)



2 A square based pyramid has a perpendicular height of 150 cm.

The length of a diagonal of the square base is $400\sqrt{2}$ cm.

Calculate the volume, in m^3 , of the pyramid.

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

(Total for Question 2 is 4 marks)



Question 3 continued

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(Total for Question 3 is 7 marks)



- 4 A particle P is moving along a straight line through the fixed point O .
The displacement, s metres, of P from O at time t seconds is given by

$$s = t^3 - 27t + 55 \quad t \geq 0$$

- (a) Write down the distance, in metres, of P from O when $t = 0$ (1)
- (b) Find an expression, in terms of t , for the velocity, v m/s, of P at time t seconds. (2)
- (c) Find the value of t when P is closest to O . (2)
- (d) Find the distance, in metres, of P from O when P is closest to O . (1)
- (e) Find the distance, in metres, travelled by P in the interval $0 \leq t \leq 5$ (3)

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Question 4 continued

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(Total for Question 4 is 9 marks)



- 5 All 50 students at *Holborn College* have to study at least one of Physics (P), Chemistry (C) and Biology (B).

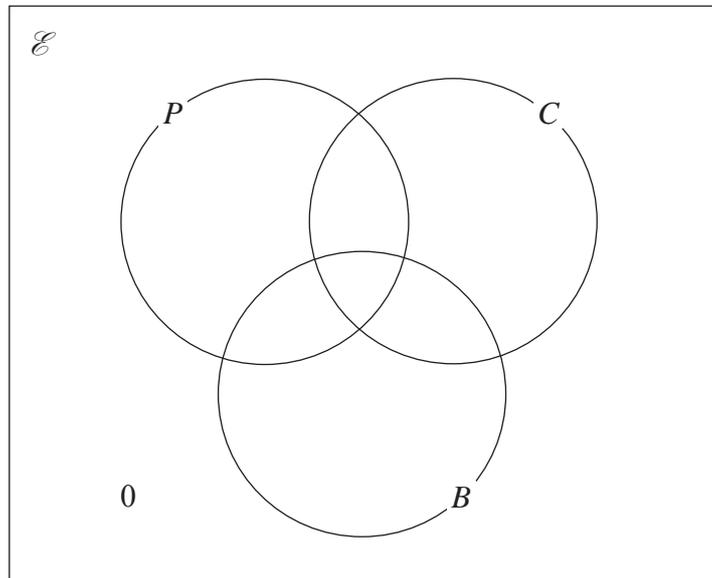
Of these 50 students

- 5 study all three subjects
- 12 study Physics and Biology
- 7 study Physics and Chemistry
- 13 study Chemistry and Biology
- 4 study Chemistry only

The number of students at *Holborn College* who study Biology only is three times the number of students at *Holborn College* who study Physics only.

Let x be the number of students at *Holborn College* who study Physics only.

- (a) Complete the Venn diagram with all of this information.



(4)

- (b) Find the value of x .

(2)

- (c) Write down

(i) $n(B \cup P')$

(ii) $n([B \cup P] \cap C)$

(2)

A student at *Holborn College* is to be chosen at random.

Given that this student studies Physics,

- (d) find the probability that this student does **not** study either Chemistry or Biology.

(2)

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Question 5 continued

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Question 5 continued

Area with horizontal dotted lines for writing answers.

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(Total for Question 5 is 10 marks)



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6

$$-5 < 5(x + 4) < 13$$

where x is an integer.

Find all the possible values of x .

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(Total for Question 6 is 4 marks)



7 The functions f , g and h are defined by

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

$$g: x \mapsto 2x^2$$

$$h: x \mapsto \frac{1}{x+1} \quad x \neq -1$$

(a) Find (i) $g(\sqrt{6})$

(ii) $h\left(-\frac{1}{3}\right)$

(2)

(b) Express $hf(x)$ in terms of x , simplifying your answer.

(1)

(c) Solve the equation

(i) $g(x) = \frac{25}{8}$

(ii) $gf(x) = x$

(7)

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Question 7 continued

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Question 7 continued

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Question 7 continued

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(Total for Question 7 is 10 marks)



8

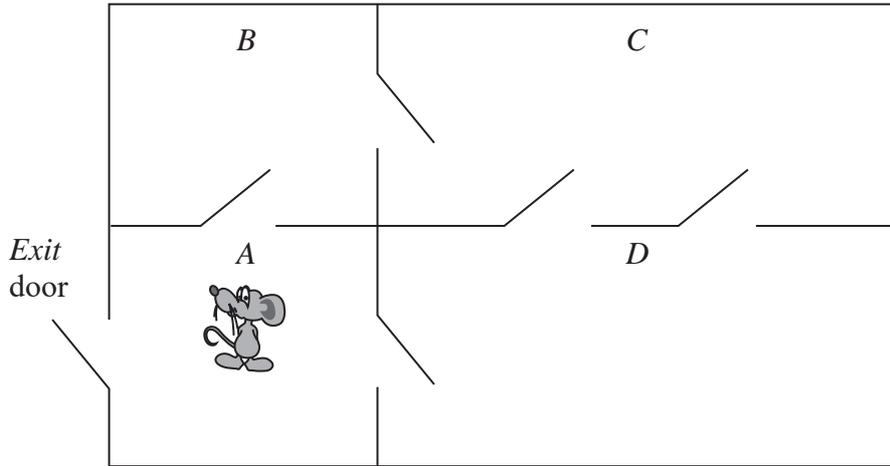


Figure 1

Sigmund is investigating the behaviour of his pet mouse, Morty, in a maze. Figure 1 shows the maze with 4 rooms A , B , C and D . When Morty is in the maze, he can move around the maze leaving and entering rooms through two-way doors, shown in the diagram as



When in a room, Morty leaves the room and enters the next room by choosing a door at random. He is equally likely to choose any door in the room, including the door through which he entered the room.

Sigmund records a change of room as a move. So, A to B is one move, A to B to C is two moves. The investigation ends when Morty leaves room A by the *Exit* door.

- (a) Morty is placed in room A , as shown in Figure 1.
- Write down the probability that the investigation will end after **one** move. (1)
 - Find the probability that Morty will be back in room A after **two** moves. (3)
 - Show that Morty is more likely to be in room C than to be in room A after **two** moves. (3)

In a second investigation, Morty is placed in room C .

- (b) Show that the probability that this investigation will end after **three** moves is 0.13 to 2 significant figures. (3)



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 10 marks)



9

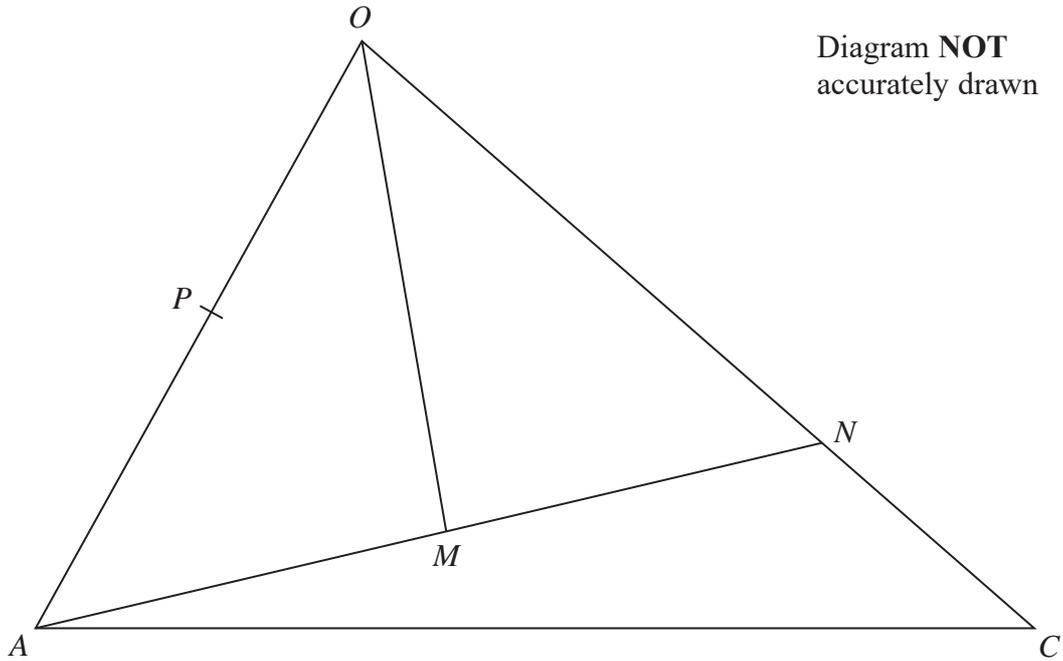


Figure 2

Figure 2 shows the triangle OAC .

The point N on OC is such that $ON:OC = 5:6$
 M is the midpoint of AN , and P is the midpoint of OA .

$$\vec{OA} = 2\mathbf{a} \text{ and } \vec{OC} = 6\mathbf{c}$$

(a) Find, in terms of \mathbf{a} and \mathbf{c} or \mathbf{a} or \mathbf{c} , simplifying your answer where possible,

(i) \vec{AC} (ii) \vec{ON} (iii) \vec{OM} (5)

(b) Use a vector method to show that PM is parallel to OC . (2)

The area of triangle OAC is 30 square units.

(c) Find the area of triangle APM . (3)

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Question 9 continued

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Question 9 continued

Handwriting practice area consisting of 20 horizontal dotted lines for writing.

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Question 9 continued

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(Total for Question 9 is 10 marks)



10

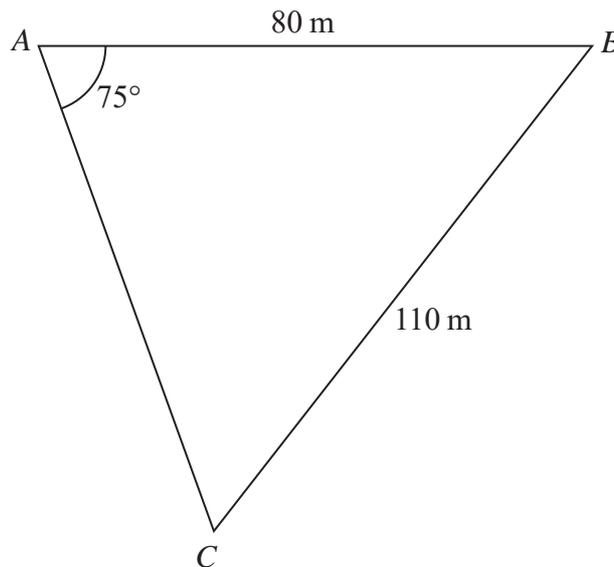
Diagram **NOT**
accurately drawn

Figure 3

Figure 3 shows a triangular field ABC on horizontal ground with $AB = 80$ metres, $BC = 110$ metres and $\angle BAC = 75^\circ$

In this question, give **all** your answers to 3 significant figures.

Find

(a) the size, in degrees, of $\angle ACB$, (3)

(b) the length, in metres, of AC . (4)

M is the midpoint of BC .

(c) Find the length, in metres, of AM . (3)

A vertical mast, PA is positioned at A . The angle of elevation of the top of the mast, P , from the point B is 41°

(d) Find the height, in metres, of the mast AP . (2)

Q is the midpoint of AP and a straight cable joins Q to M .

(e) Find the length, in metres, of QM . (2)

(f) Find the size, in degrees, of the angle of depression of the point M from the point Q . (2)

$$\left[\begin{array}{l} \text{Sine Rule: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \\ \text{Cosine Rule: } a^2 = b^2 + c^2 - 2bc \cos A \end{array} \right]$$

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Question 10 continued

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Question 10 continued

Handwriting practice area consisting of 25 horizontal dotted lines for writing.

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Question 10 continued

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(Total for Question 10 is 16 marks)



11 $(x + 3)$ is a factor of $3x^3 + kx^2 - 27x + 36$
where k is a constant.

(a) Show that $k = -4$

(2)

(b) Show that $3x^3 - 4x^2 - 27x + 36 = 0$ can be written in the form

$$\frac{27}{x} - \frac{36}{x^2} = px + q$$

where p and q are integers, giving the value of p and the value of q .

(3)

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Question 11 continued

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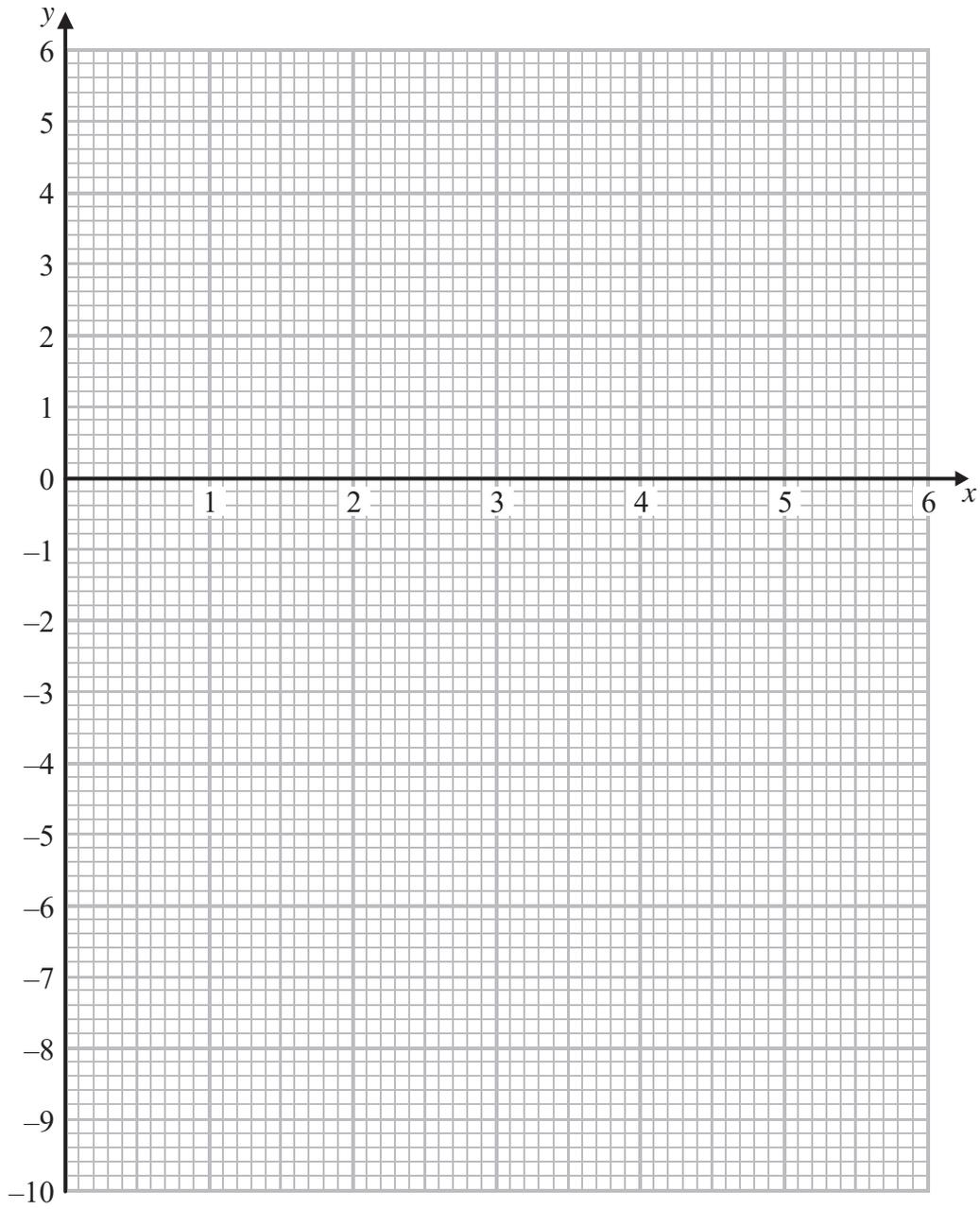
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Question 11 continues on the next page



Question 11 continued



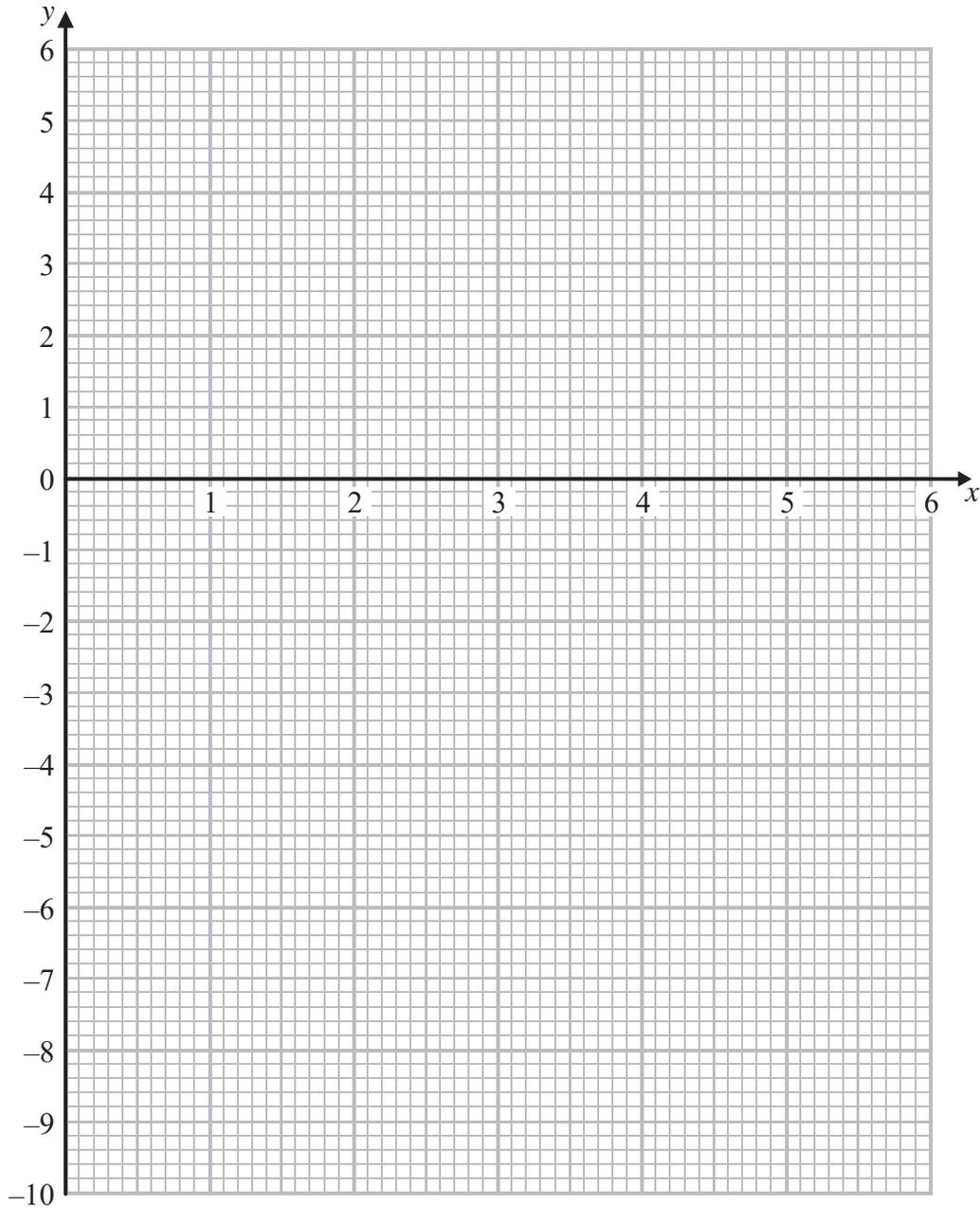
Turn over for a spare grid if you need to redraw your graph.

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Question 11 continued**Only use this grid if you need to redraw your graph.**

(Total for Question 11 is 16 marks)

TOTAL FOR PAPER IS 100 MARKS

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