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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE

Monday 10 June 2024

Morning (Time: 2 hours 30 minutes)

Paper reference **4MB1/02**

Mathematics B
PAPER 2



You must have: Ruler graduated in centimetres and millimetres, protractor, pair of 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 (a) Write 0.000 015 96 in standard form.

(1)

The star, Sirius, is approximately 81 460 000 000 000 km from Earth.
Light from Sirius takes approximately 3142.7 days to reach Earth.

(b) Calculate the speed, in km/s to one significant figure, that light travels from Sirius to Earth.
Give your answer in standard form.
Show your working clearly.

(4)

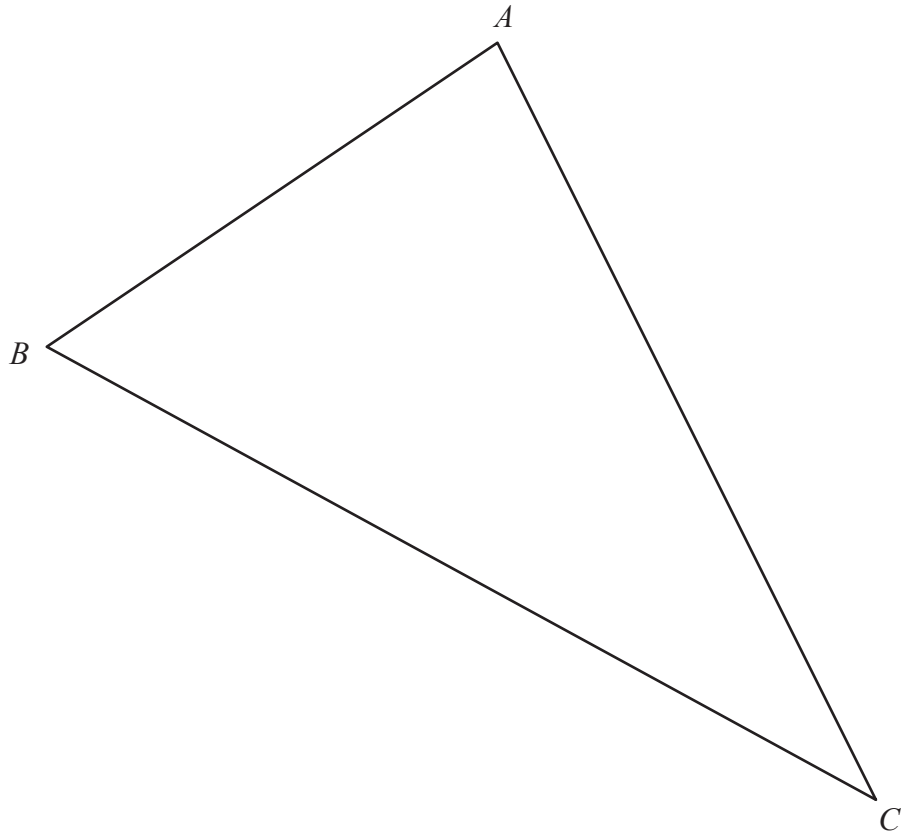
(Total for Question 1 is 5 marks)

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2



The diagram shows triangle ABC

Using ruler and compasses only and **showing all your construction lines**, construct

(a) the locus of the points that are 3 cm from B

(1)

(b) the perpendicular bisector of AC

(2)

(c) the bisector of $\angle ACB$

(2)

The region R consists of all the points inside the triangle that are closer to A than to C, closer to BC than to AC and more than 3 cm from B

(d) Show, by shading, the region R
Label the region R

(1)

(Total for Question 2 is 6 marks)

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3 A college offers courses in Astronomy (A), Biology (B), Chemistry (C) and Physics (D)

A group of 220 students are asked which of these courses they study.

Here is some information about the numbers of students who study these subjects.

$$n(A) = 58 \qquad n(B \cap C \cap D) = x \qquad n(B \cap D) = 48$$

$$n(B \cap C \cap D') = 35 \qquad n\left([B \cup C]' \cap D\right) = 20$$

The incomplete Venn diagram on the opposite page shows some other information about the numbers of students who study these subjects.

(a) Using all the information given, complete the Venn diagram giving the number of elements in each appropriate subset, in terms of x where necessary.

(3)

Given that $n(C') = 105$

(b) find the value of x

(2)

One of the 220 students is chosen at random.

(c) Write down the probability that this student studies Biology only.

(1)

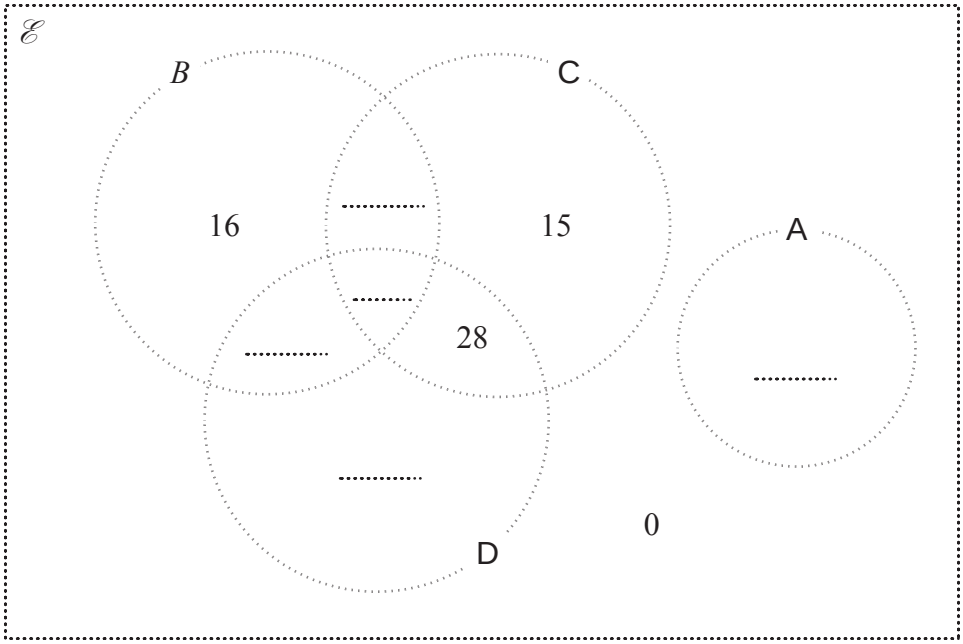
(d) Write down the probability that this student studies Chemistry but not Biology.

(1)

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Question 3 continued



(Total for Question 3 is 7 marks)

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4 Triangle A and triangle D are drawn on the grid opposite.

Triangle A is reflected in the x-axis to give triangle B

(a) On the grid, draw and label triangle B

(2)

Triangle A is transformed to triangle C by a rotation of 90° clockwise about the point (0, 0)

(b) On the grid, draw and label triangle C

(2)

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

(c) Describe fully this transformation.

(3)

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

$$\mathbf{M} = \begin{pmatrix} -1 & -1 \\ 0 & -2 \end{pmatrix}$$

(d) On the grid, draw and label triangle E

(3)

Triangle E is transformed to triangle B under the transformation with matrix $\mathbf{N}$

(e) Using a combination of transformation matrices or otherwise, find the matrix $\mathbf{N}$

(3)

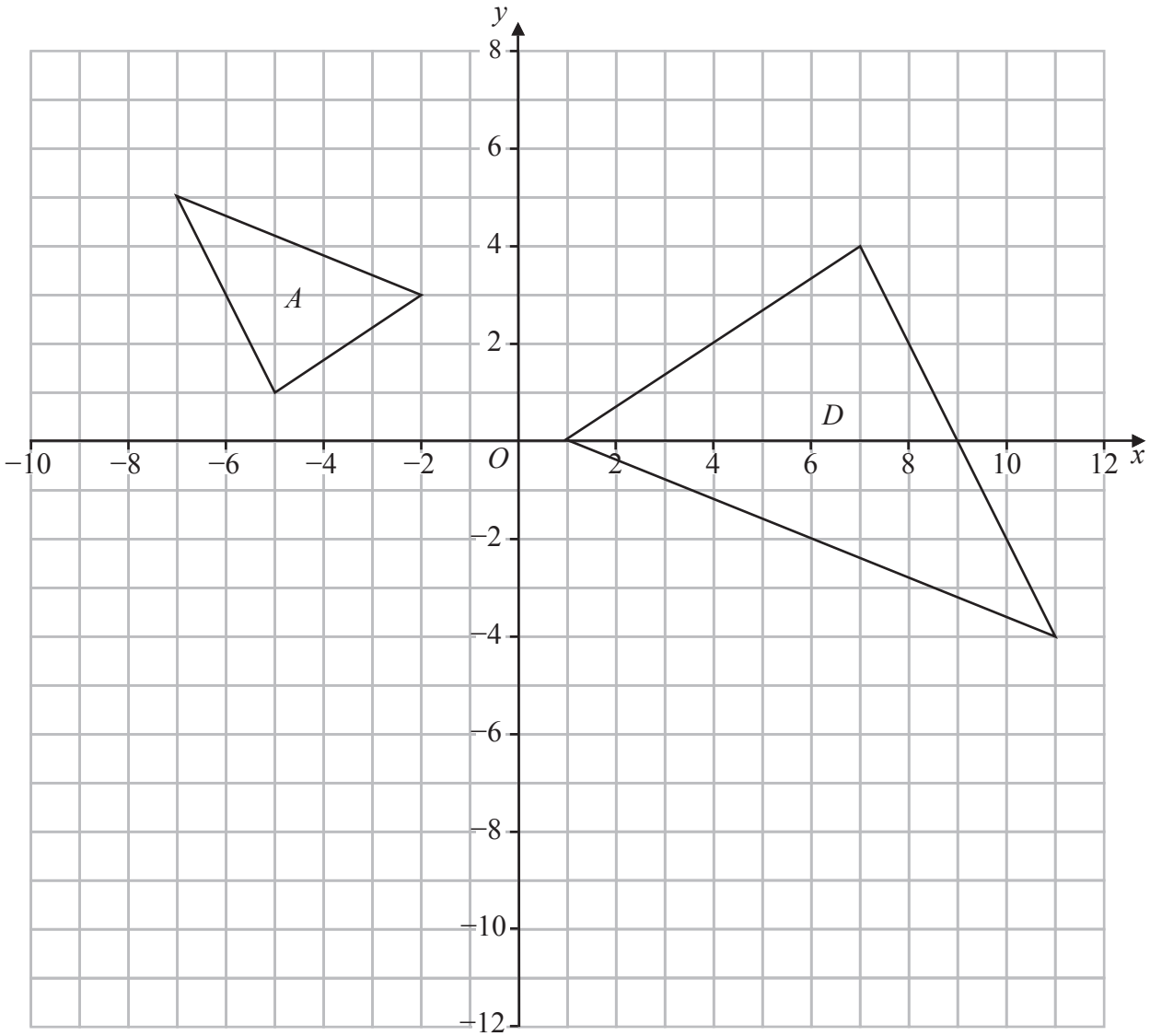
$$\left[\text{The inverse of matrix } \begin{pmatrix} a & b \\ c & d \end{pmatrix} \text{ is } \frac{1}{ad-bc}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}\right]$$

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Question 4 continued



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Question 4 continued

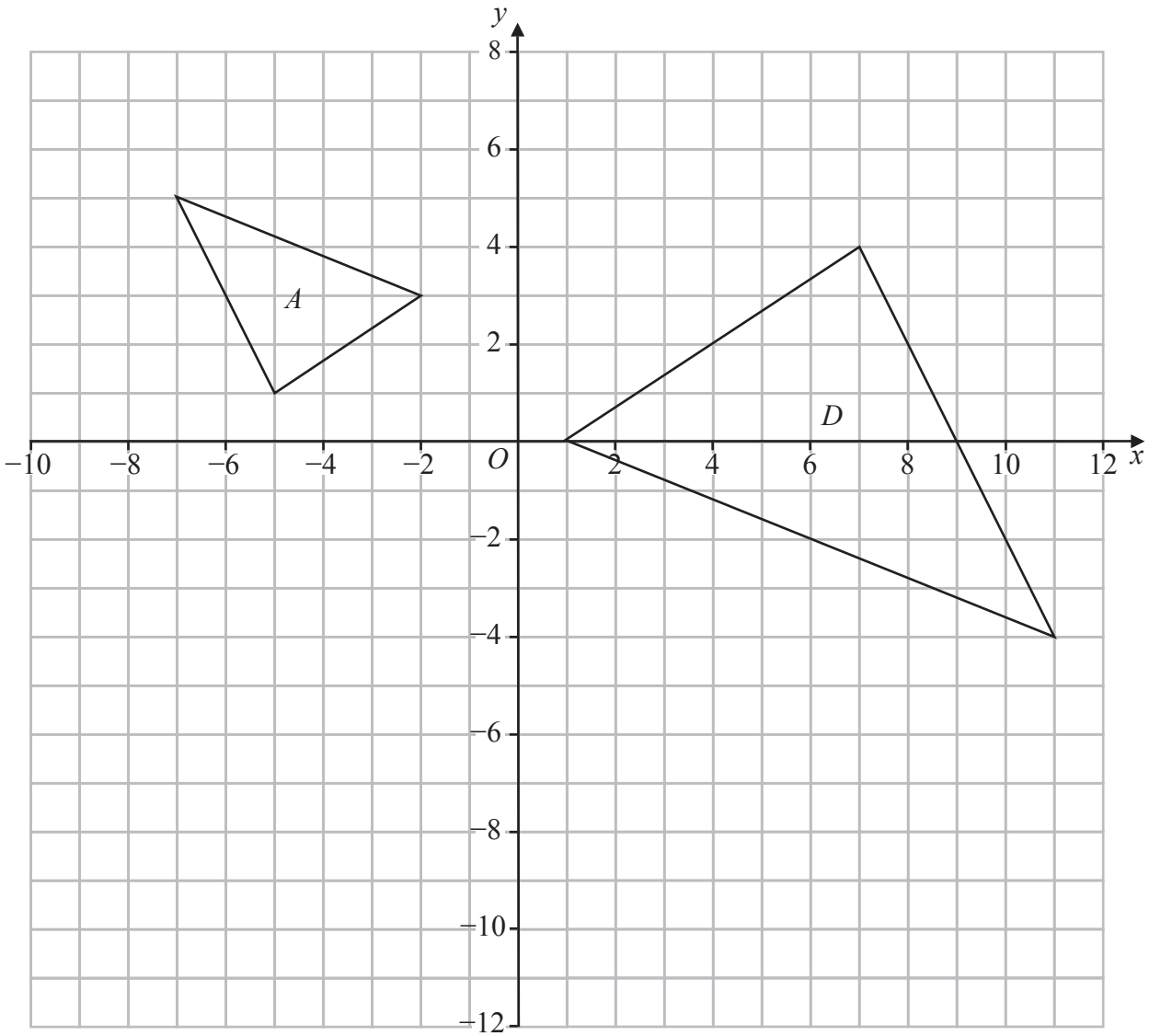
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Question 4 continued

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(Total for Question 4 is 13 marks)

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5 A particle P is moving along a straight line.
At time t seconds, the displacement, x metres, of P from a fixed point O on the line is given by

$$x = kt^2 - t^3$$

When $t = 2$ the velocity of particle P is 24 m/s

Particle P comes to instantaneous rest at the point A

Find the distance, in metres, between O and A

(5)

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Question 5 continued

(Total for Question 5 is 5 marks)

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6 The probability of a spinner landing on red is 0.6

This spinner is spun once.

(a) Write down the probability that the spinner does not land on red.

(1)

This spinner is spun twice.

(b) Calculate the probability that the spinner does not land on red either time.

(2)

This spinner is spun 140 times.

(c) Calculate the expected number of times the spinner will land on red.

(1)

A bag contains n counters.

The counters are red or blue or green such that

number of red counters : number of blue counters : number of green counters $= 2 : 1 : 1$

A sample of 3 counters is taken at random from the bag without replacement.

The probability of getting 2 red counters followed by a blue counter is $\frac{5}{78}$

(d) Calculate the probability of getting 3 green counters.
Give your answer as a fraction.

(6)

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

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Question 6 continued

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Question 6 continued

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Question 6 continued

(Total for Question 6 is 10 marks)

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7

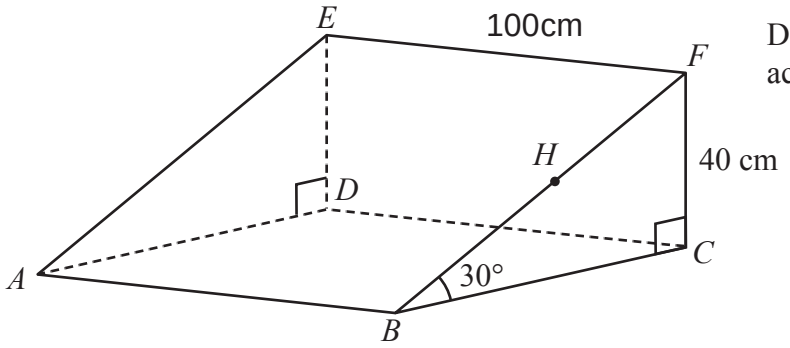


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a right triangular prism *ABCDEF*

The base *ABCD* is on a horizontal plane.

$CF = DE = 40\,\text{cm}$ $EF = DC = AB = 100\,\text{cm}$ $\angle FBC = 30°$

The point *H* lies on the line *BF* such that $BH = 57.5\,\text{cm}$

(a) Show that $EH = 102.5\,\text{cm}$

(3)

(b) Calculate, in degrees to 3 significant figures, $\angle EHD$

(5)

[Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$]

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Question 7 continued

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Question 7 continued

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Question 7 continued

(Total for Question 7 is 8 marks)

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8 A Swiss company makes three different types of watches, diver, calendar and automatic.

The numbers of each type of watch made in January is such that

diver : calendar : automatic = 4 : 6 : 5

The number of calendar watches the company makes in January is 54

(a) Calculate the number of diver watches the company makes in January.

(2)

Mel works for the company. She earns 32 Swiss francs for each hour worked plus 6% of the value of the watches she sells.

In January Mel works 120 hours and sells watches to the value of 13 000 Swiss francs.

(b) Calculate the total amount Mel earns in January.

(2)

In February Mel works 150 hours and earns a total amount of 8040 Swiss francs.

(c) Calculate the value of the watches Mel sells in February.

(3)

In March the company makes 250 automatic watches.

The cost to make each automatic watch is 80 Swiss francs.
64% of these automatic watches are sold for 140 Swiss francs each.
The remaining automatic watches are sold in America for $216 each.

Using an exchange rate of 1 Swiss franc = $1.08

(d) calculate the total profit, in Swiss francs, the company makes on these 250 automatic watches.

(5)

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Question 8 continued

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Question 8 continued

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Question 8 continued

(Total for Question 8 is 12 marks)

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9 A graph has equation

$$y = \frac{1}{4}x^2 - 3 - \frac{1}{x} \qquad x \neq 0$$

(a) Complete the table of values for the graph.

x	– 4	–3	–2	–1	– 0.5	0.5	1	2	3	4
y	1.25	– 0.42			– 0.94	– 4.94		– 2.5	–1.08	0.75

(2)

(b) On the grid opposite, plot the points from your completed table and draw the graph

$$y = \frac{1}{4}x^2 - 3 - \frac{1}{x}$$

(3)

(c) Using your graph, find estimates, to one decimal place, of the solutions of the equation

$$\frac{1}{4}x^2 - 3 - \frac{1}{x} = 0$$

(1)

(d) By drawing a suitable line on the grid, find the range of values, to one decimal place, of x in $-4 \leqslant x \leqslant 4$ for which

$$\frac{1}{4}x^2 - 2 - \frac{1}{x} \leqslant 0$$

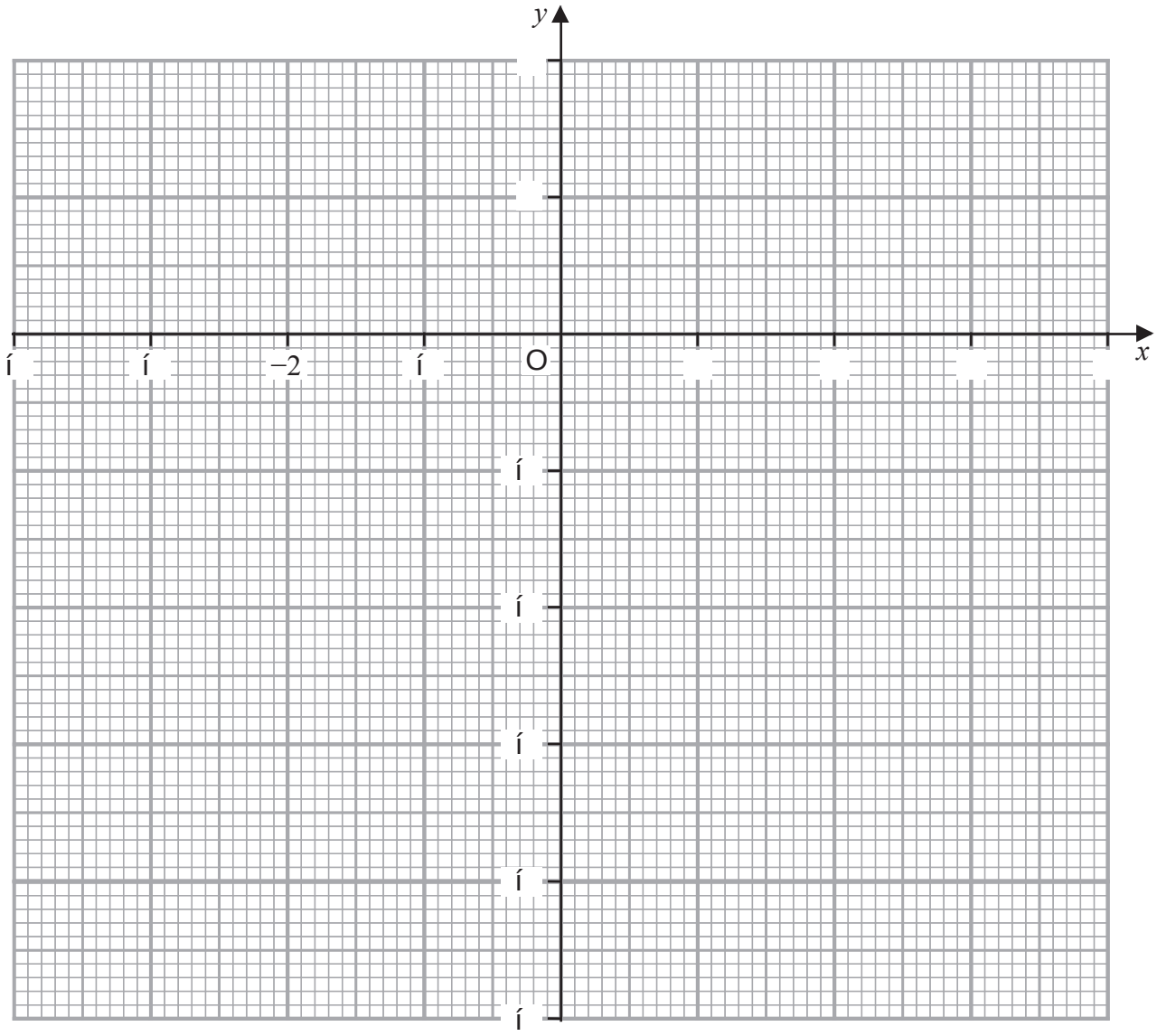
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Question 9 continued



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

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Question 9 continued

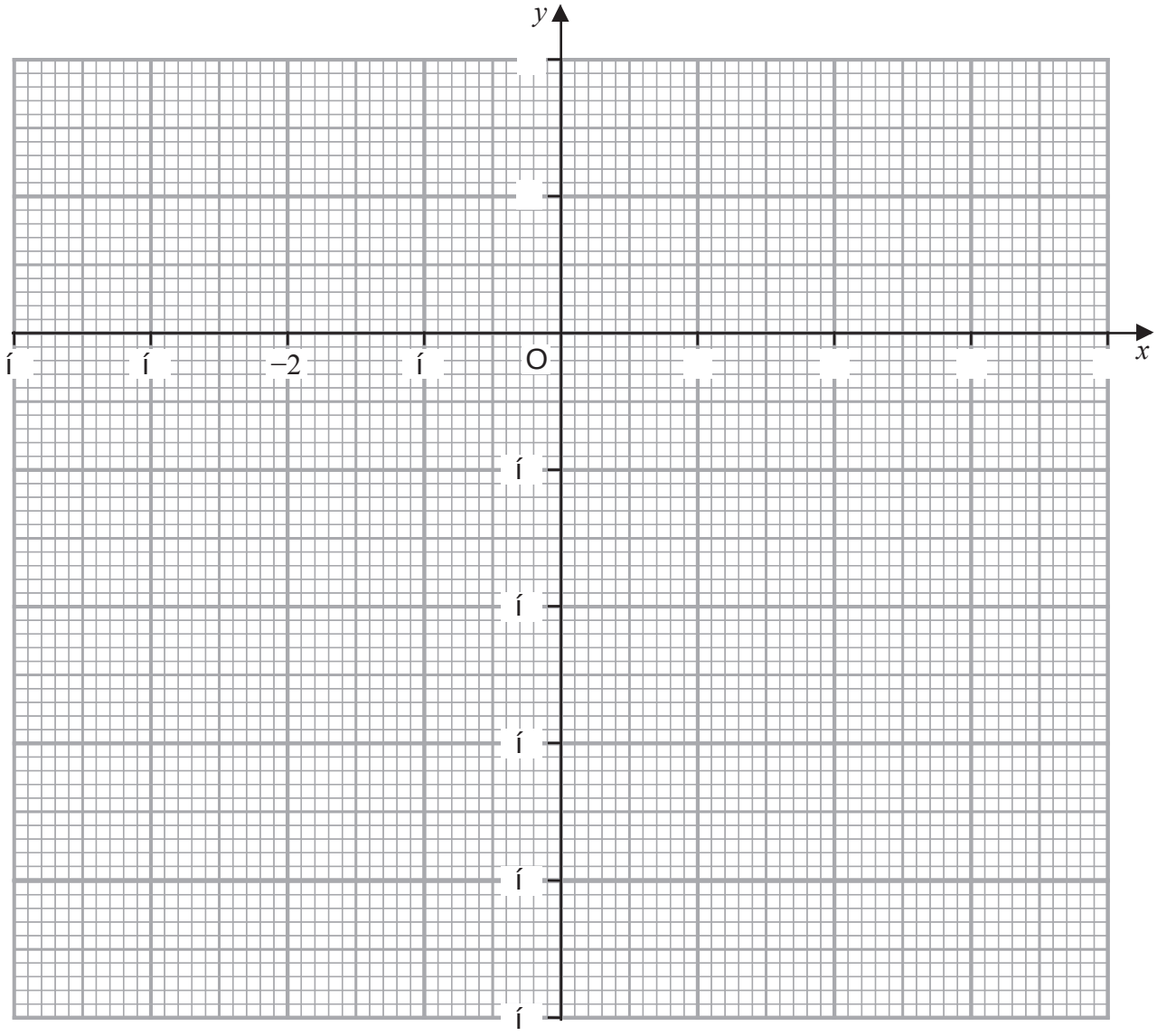
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Question 9 continued

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



(Total for Question 9 is 10 marks)

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10 $f(x) = 6x^3 - (6p - 1)x^2 - (5p + q)x + 2$ where p and q are integers.

Given that $(2x + 1)$ is a factor of $f(x)$

(a) show that $2p + q = -3$

(2)

Given that $(x - p)$ is also a factor of $f(x)$

(b) find the value of p and the value of q
Show clear algebraic working.

(7)

(c) Factorise fully $f(x)$

(2)

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

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Question 10 continued

(Total for Question 10 is 11 marks)

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11 f is the function such that

$$f : x \mapsto 2x - 5 \qquad x > 1$$

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

(2)

g is the function such that

$$g : x \mapsto \frac{7 - 8x}{2x + 1}$$

(b) Find g(–1)

(1)

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

(1)

(d) Find the value for x, to 3 significant figures, for which $f(x) = g(x)$

Show your working clearly.

(4)

h is the function such that

$$h : x \mapsto 2x^2 + 4x - 5 \qquad x > -1$$

(e) Express $h(x)$ in the form $a(x + b)^2 - c$ where a, b and c are integers.

(3)

(f) Hence find the inverse function h^{-1} in the form $h^{-1} : x \mapsto ...$

(2)

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Question 11 continued

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Question 11 continued

(Total for Question 11 is 13 marks)

TOTAL FOR PAPER IS 100 MARKS

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