

Please check the examination details below before entering your candidate information

Candidates surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International GCSE

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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Pearson

You must write down all the stages in your working.

$$\frac{2.5 \times 10^{60} - 1.3 \times 10^{59}}{1.5 \times 10^{-48}} \quad (3)$$


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- 2** The ages, in years, of 7 friends are

9 8 7 6 10 a 7

The mean age of the 7 friends is 8 years.

- (a) Work out the value of a (2)
- (b) Find the median age of the 7 friends. (2)

There are 34 passengers on a bus.
The mean age of these passengers is 49 years.

11 of these passengers are pensioners.
The mean age of these pensioners is 72 years.

- (c) Calculate the mean age, in years, of the passengers on the bus who are not pensioners. (3)

(Total for Question 2 is 7 marks)



3 Triangles A and D are drawn on the grid below.

Triangle B is the image of triangle A under a reflection in the line with equation $y = -x$

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

(2)

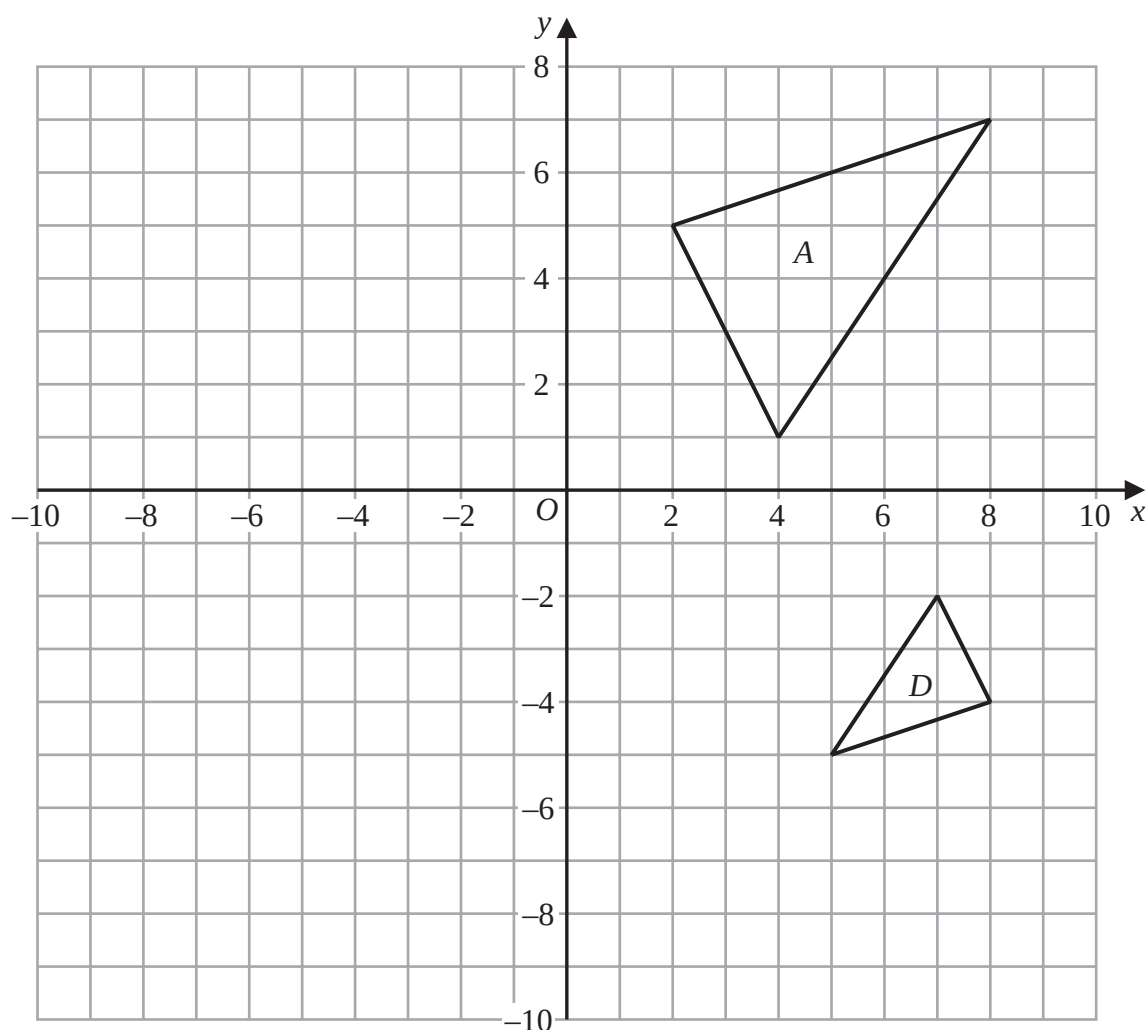
Triangle A is transformed to triangle C under the translation $\begin{pmatrix} -9 \\ -2 \end{pmatrix}$

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

(2)

(c) Describe fully the **single** transformation that maps triangle A onto triangle D .

(3)



A spare grid is on the next page if you need to redraw your triangles.



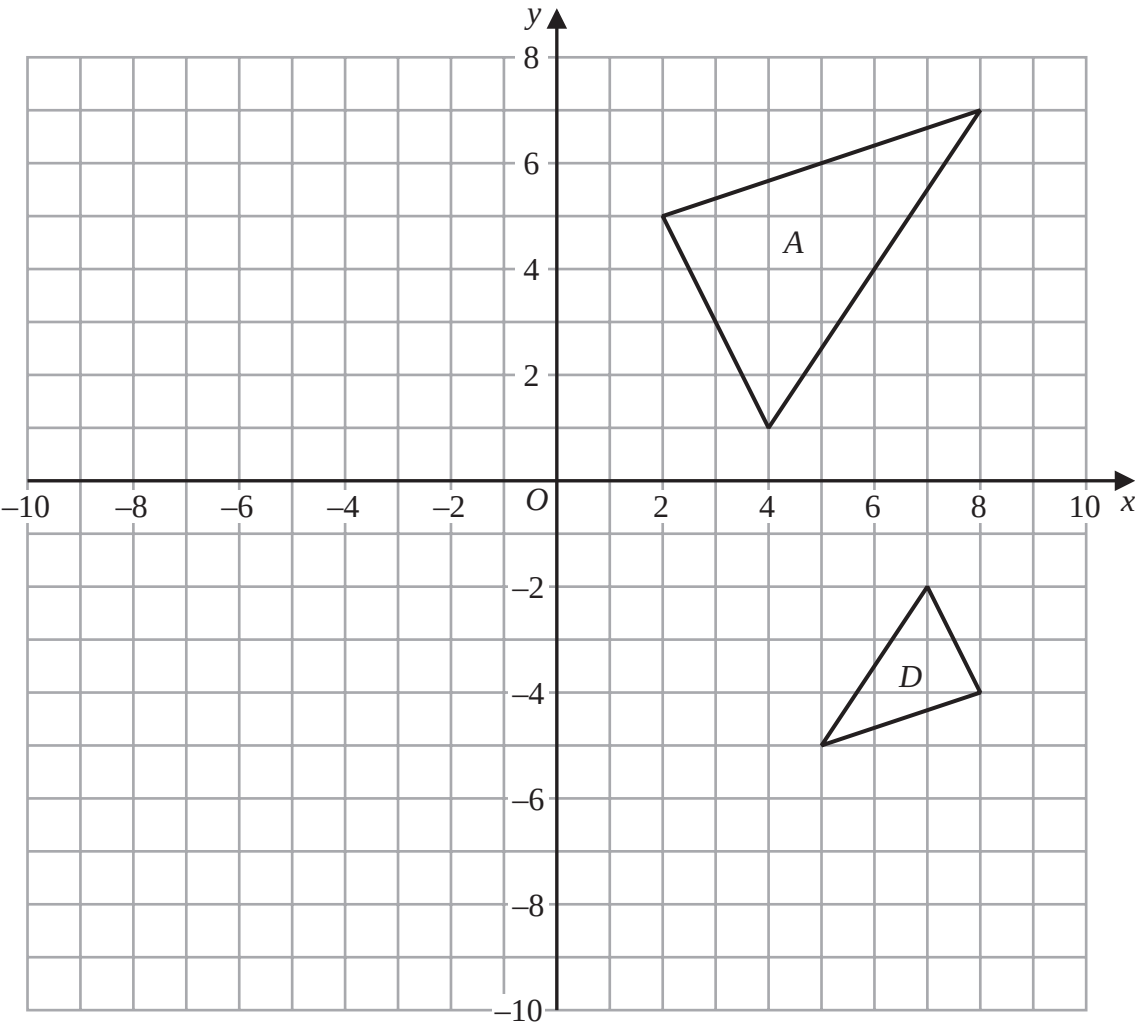
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Question 3 continued

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



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(Total for Question 3 is 7 marks)



- 4 A curve C has equation $x^2 + y^2 = 64$
A straight line l has equation $4y + 3x = 40$

Show that the line l intersects the curve C only once.
Show clear algebraic working.

(6)

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Question 4 continued

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(Total for Question 4 is 6 marks)



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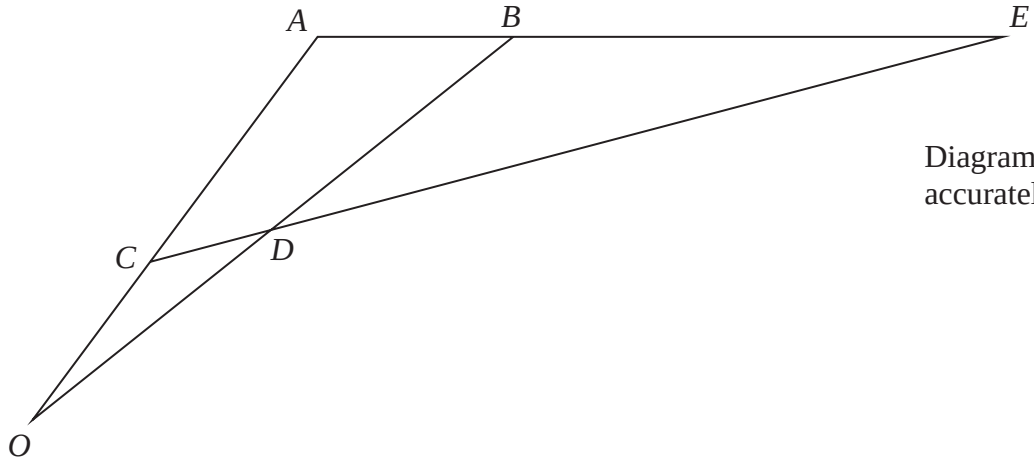
Diagram NOT
accurately drawn

Figure 1

Figure 1 shows triangle OAB

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

(a) find $\overrightarrow{AB}$ in terms of $\mathbf{a}$ and $\mathbf{b}$

(1)

The point C lies on OA such that $OC:OA = 1:3$

The point D lies on OB such that $\overrightarrow{OD} = \frac{2}{5} \overrightarrow{OB}$

Given that the point E is such that ABE and CDE are straight lines,

(b) find and simplify an expression, in terms of $\mathbf{a}$ and $\mathbf{b}$, for $\overrightarrow{AE}$

(6)

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Question 5 continued

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(Total for Question 5 is 7 marks)



6

$$\mathbf{A} = \begin{pmatrix} -2 & -3 \\ 2 & 4 \end{pmatrix} \quad \mathbf{BA} = \begin{pmatrix} 4x & -14 \\ x & -1 \end{pmatrix}$$

Given that the determinant of $\mathbf{B}$ is 10

find $\mathbf{B}$

Show your working clearly.

(7)

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$$\left[\begin{array}{l} \text{Determinant of matrix } \begin{pmatrix} a & b \\ c & d \end{pmatrix} = ad - bc \\ \text{Inverse of matrix } \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \frac{1}{ad - bc} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix} \end{array} \right]$$



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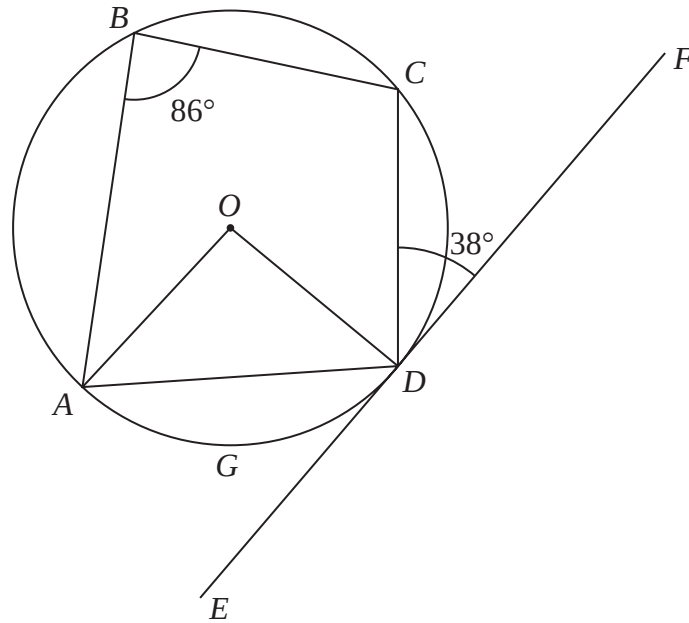
Question 6 continued

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(Total for Question 6 is 7 marks)



7

Diagram **NOT**
accurately drawn**Figure 2**

In Figure 2, $ABCDG$ is a circle, centre O

EDF is the tangent to the circle at the point D

$$\angle ABC = 86^\circ \qquad \angle CDF = 38^\circ$$

The length of the arc AGD is 0.8π cm.

(a) Giving reasons, show that the radius of the circle is 1.5 cm.

(6)

(b) Calculate the area, in cm^2 to 2 decimal places, of the circle $ABCDG$

(2)

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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 8 marks)



- 8 All 66 students in a drama group take part in at least one of the four activities given below.

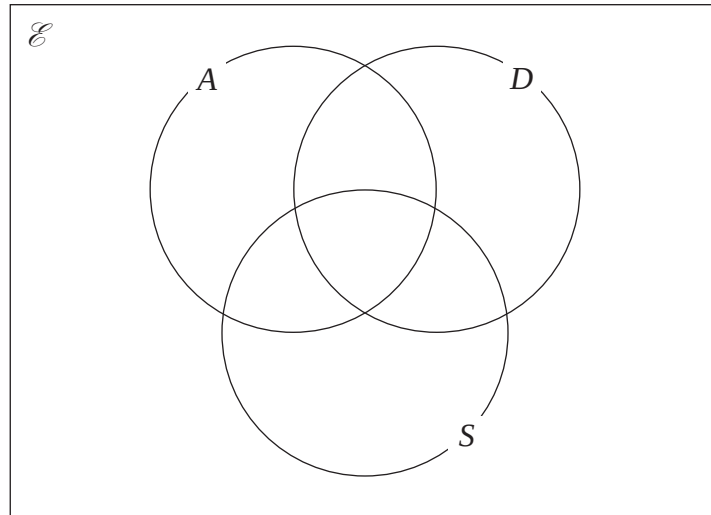
acting (A) dancing (D) singing (S) stage management (M)

Of these 66 students

- 11 take part in acting, dancing and singing
- 17 take part in acting and singing
- 14 take part in dancing and singing
- 16 take part in acting and dancing
- 33 take part in singing
- 37 take part in acting
- 29 take part in dancing

Any student who takes part in stage management does **not** take part in acting, dancing or singing.

- (a) Show all this information on the Venn diagram, giving the number of students in each subset.



(3)

- (b) Find (i) $n(M)$

(ii) $n([A \cap D'] \cup S)$

(iii) $n([A \cap D \cap S']')$

(3)

One of the students in the drama group is selected at random.

Given that this student takes part in dancing,

- (c) find the probability that this student also takes part in

- (i) stage management,

(1)

- (ii) singing.

(2)



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Question 8 continued

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(Total for Question 8 is 9 marks)



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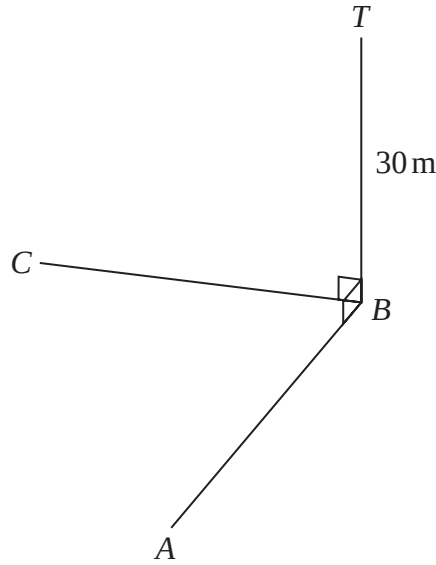
Diagram **NOT**
accurately drawn**Figure 3**

Figure 3 shows three points A , B and C on horizontal ground.
A vertical mast BT of height 30m is at point B .

The angle of elevation of T from A is 32°

The angle of elevation of T from C is 25°

The bearing of A from B is 195°

The bearing of C from B is 280°

Calculate the bearing, in degrees to the nearest degree, of C from A .

(8)

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



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Question 9 continued

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 8 marks)



10 The production costs of building a *Kimo* boat are

\$ L for labour
 \$ M for materials
 \$ H for overheads

In 2020, the total of the production costs for a *Kimo* boat was \$120 000 where

$$L:M:H = 5:3:2$$

(a) Calculate the value of H in 2020

(2)

The production costs were different in 2021 from what they were in 2020

The labour costs had increased by 10%

The cost of materials had increased by 5%

The overheads had decreased by 4%

(b) Calculate the percentage increase, from 2020 to 2021, in the total of the production costs of building a *Kimo* boat.

(3)

Gordon bought a *Kimo* boat and sold it a year later for \$360 000, making a loss of 25% on the price for which he bought the boat.

(c) Calculate the price for which Gordon bought the boat.

(2)

Gordon sold the boat to a friend living in Hungary. Gordon's friend paid Gordon the \$360 000 in Hungarian forints.

Using exchange rates of

$$£1 = \$1.35 \quad £1 = 388.50 \text{ Hungarian forints}$$

(d) change \$360 000 to Hungarian forints.

(3)

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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 10 marks)



11 (a) On the grid on the opposite page, draw the straight line with equation

(i) $4y - 3x = 6$ $-3 \leq x \leq 4$

(ii) $3y + 2x = 15$ $-3 \leq x \leq 4$

(4)

(b) Using your straight lines, find an estimate, to one decimal place, of the solution of the simultaneous equations

$$\begin{aligned} 4y - 3x &= 6 \\ 3y + 2x &= 15 \end{aligned}$$

(1)

(c) Hence, or otherwise, solve the inequality $\frac{6 + 3x}{4} < \frac{15 - 2x}{3}$

(1)

(d) Complete the table of values for $y = x^2 - 2x - 1$

x	-2	-1	0	1	2	3	4
y			-1			2	7

(2)

(e) On the same grid on the opposite page, plot the points from your completed table and join them to form a smooth curve.

(2)

(f) Using part (a) and part (e), find an estimate, to one decimal place, for the range of values of x for which

$$x^2 - \frac{11}{4}x - \frac{5}{2} < 0$$

Show your working clearly.

(3)

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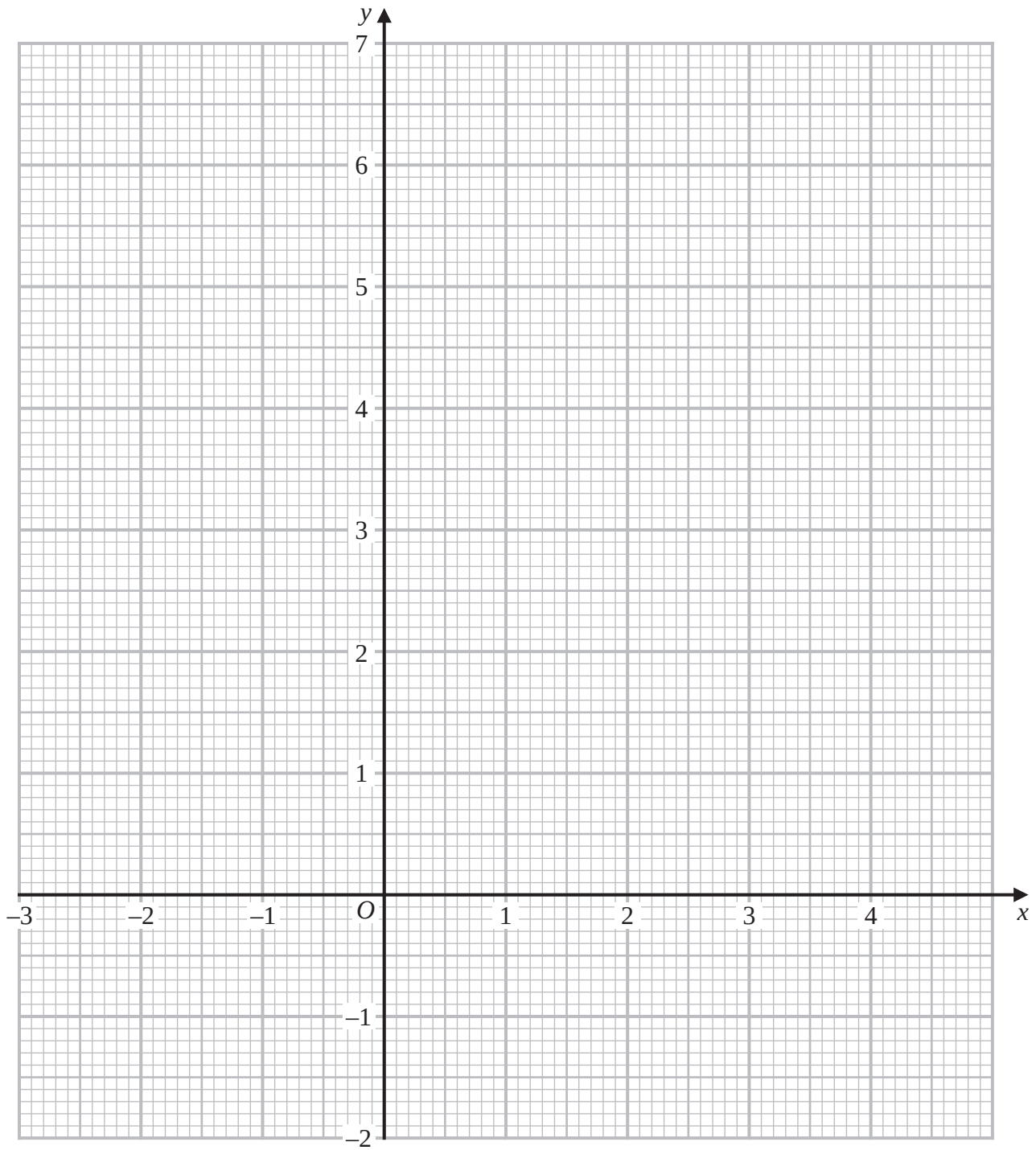
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Question 11 continued



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Question 11 continued

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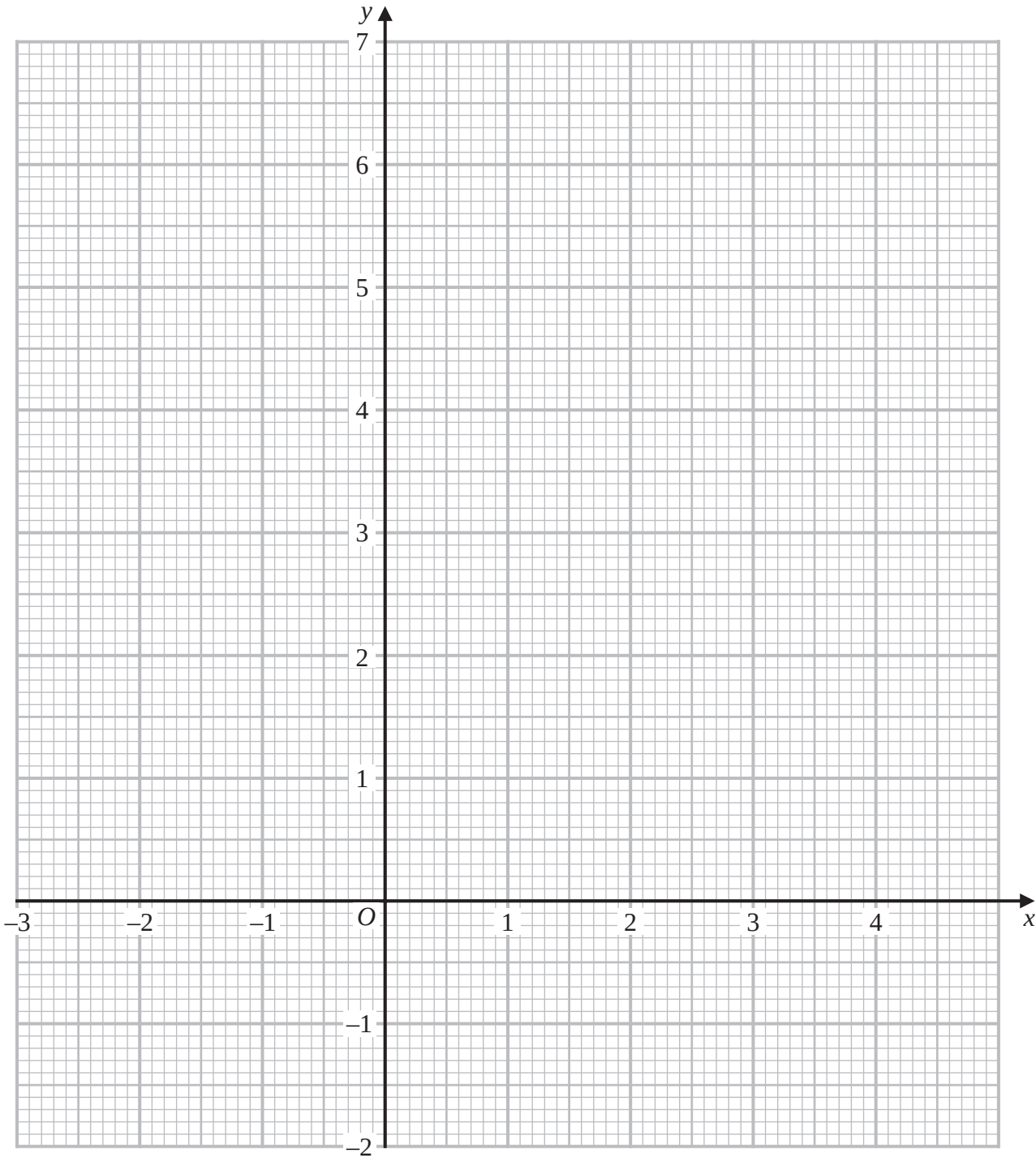
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Question 11 continued

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(Total for Question 11 is 13 marks)



12 The function g is defined for all values of x by

$$g:x \mapsto 5 - x^2$$

(a) Find $g(-4)$ (1)

(b) Write down the range of the function g (1)

The function f is defined as

$$f:x \mapsto \frac{4}{2x-11} \quad x \neq \frac{11}{2}$$

(c) Find $fg(2)$ (2)

(d) Express the inverse function f^{-1} in the form $f^{-1}:x \mapsto \dots$ (3)

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

(f) Express $ff(x)$ in terms of x giving your answer as a single fraction in its simplest form. (3)

The function h is defined for all values of x by

$$h:x \mapsto x(x+1)$$

The function m is defined for all values of x by

$$m:x \mapsto ax + b$$

where a and b are constants such that $a > 0$ and $b > 0$

Given that $hm(x) = 3(x+1)(3x+2)$ for all values of x

(g) find the value of a and the value of b (2)

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Question 12 continued

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Question 12 continued

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(Total for Question 12 is 13 marks)

TOTAL FOR PAPER IS 100 MARKS

