Please check the examination details below before entering your candidate information

Candidate 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

Answer all TWELVE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Write 248 000 000 in standard form.

(1)

(b) Write 2.56×10^{-4} as an ordinary number.

(1)

(c) Calculate, giving your answer in standard form

$$\frac{2.5 \times 10^{60} - 1.3 \times 10^{59}}{1.5 \times 10^{-48}}$$

(3)

(Total for Question 1 is 5 marks)

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)

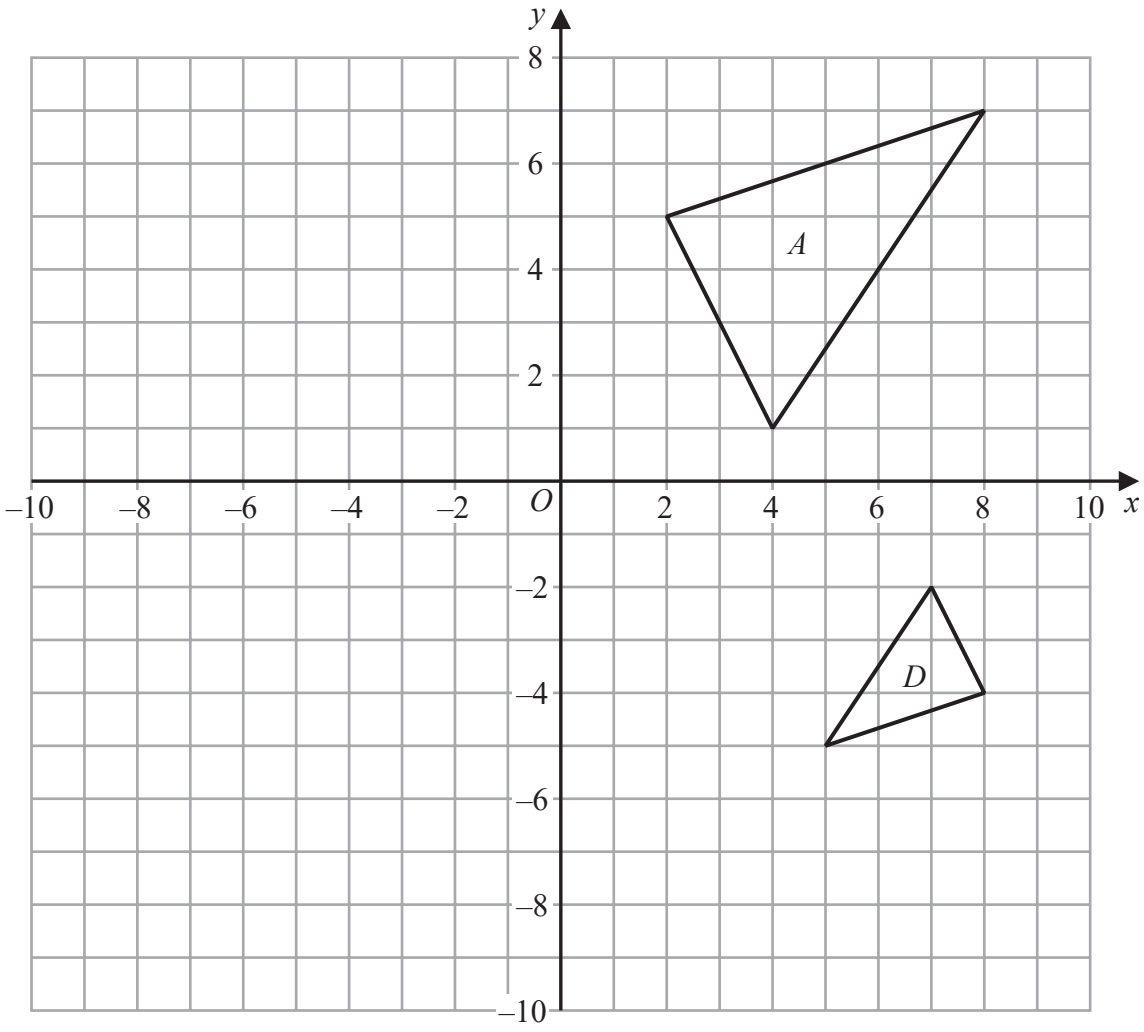
Triangle A is transformed to triangle C under the translation $\begin{pmatrix} -9 \\ -2 \end{pmatrix}$

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

(2)

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

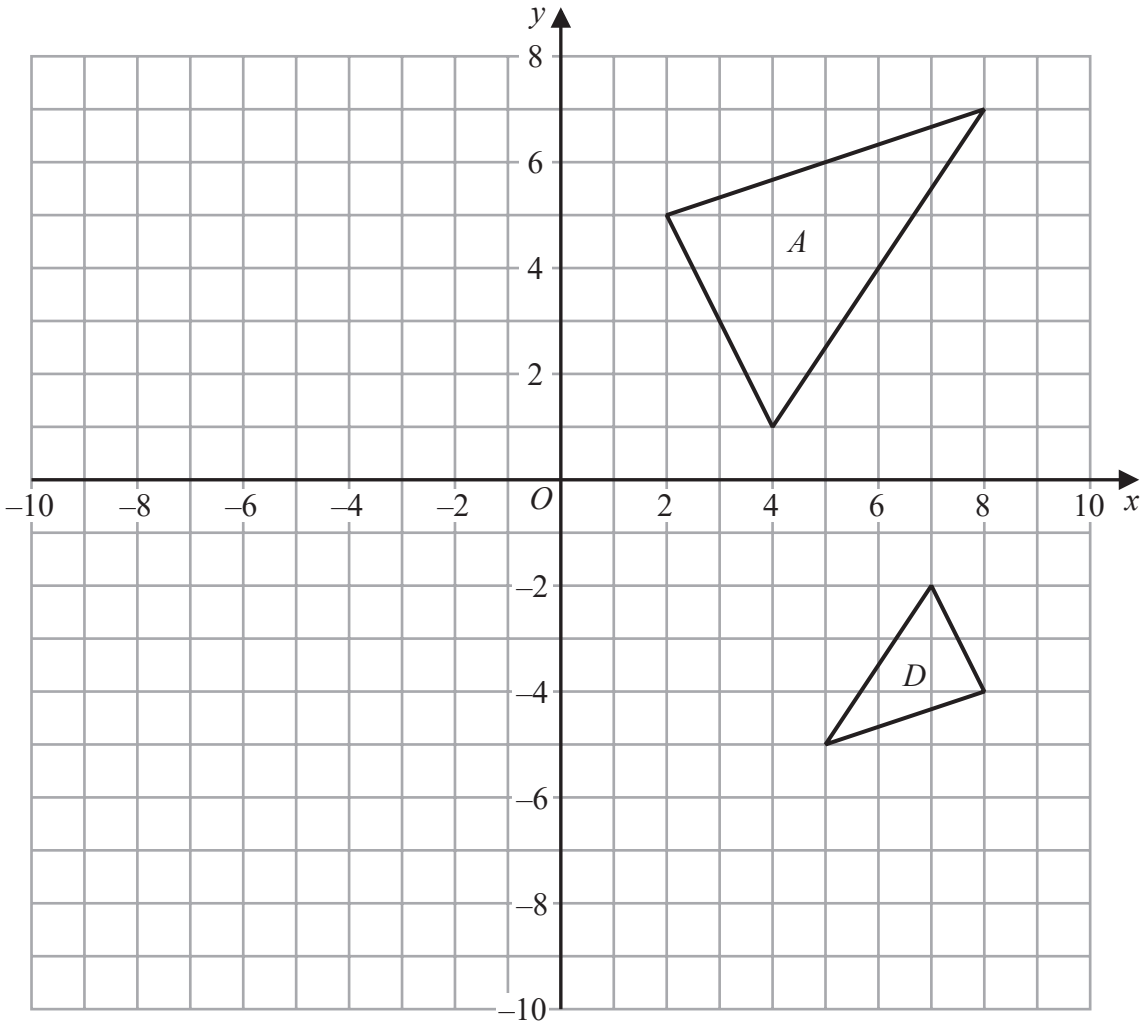
(3)



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

Question 3 continued

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



(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)

Question 4 continued

(Total for Question 4 is 6 marks)

5

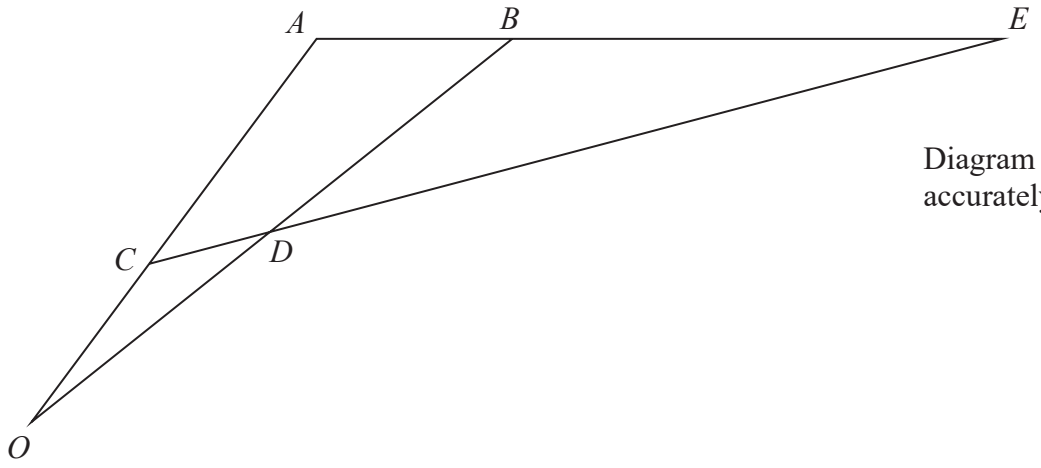


Diagram **NOT** accurately drawn

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 **a** and **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 **a** and **b**, for $\overrightarrow{AE}$

(6)

Question 5 continued

(Total for Question 5 is 7 marks)

6

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

Given that the determinant of **B** is 10

find **B**
Show your working clearly.

(7)

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

Question 6 continued

(Total for Question 6 is 7 marks)

7

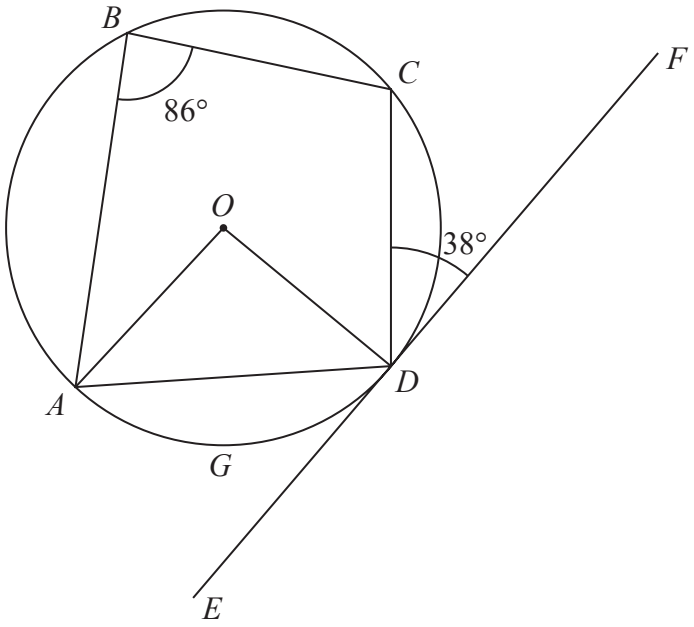


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Figure 2

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

EDF is the tangent to the circle at the point D

$\angle ABC = 86°$ $\angle CDF = 38°$

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)

Question 7 continued

Question 7 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 7 continued

(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.

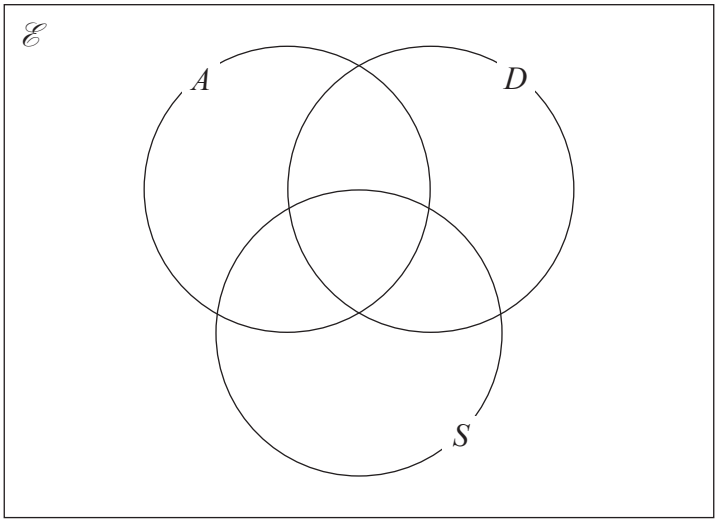
acting (A) dancing (D) singing (S) stage management (M)

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)

Question 8 continued

(Total for Question 8 is 9 marks)

9

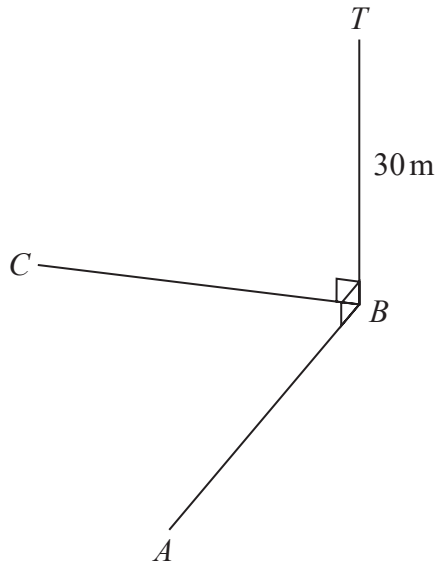


Diagram **NOT** accurately drawn

Figure 3

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

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

Question 9 continued

Question 9 continued

Question 9 continued

(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 £1 = 388.50 Hungarian forints

(d) change $360 000 to Hungarian forints.

(3)

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 10 marks)

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

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

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

(4)

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

$$4y - 3x = 6$$
$$3y + 2x = 15$$

(1)

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

(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)

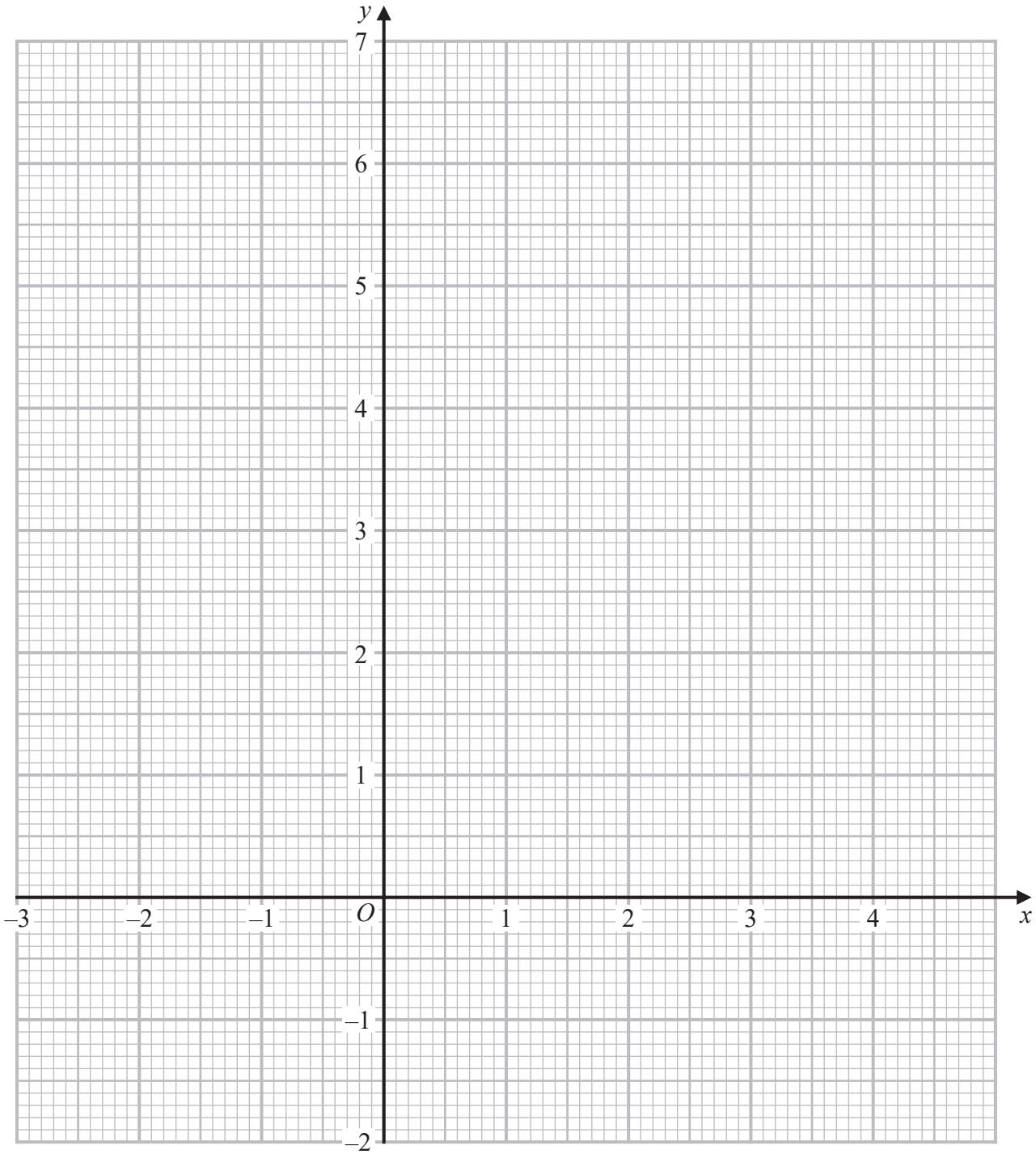
(f) Using part (a) and part (e), find an estimate, to one decimal place, for the range of values of x for which

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

Show your working clearly.

(3)

Question 11 continued

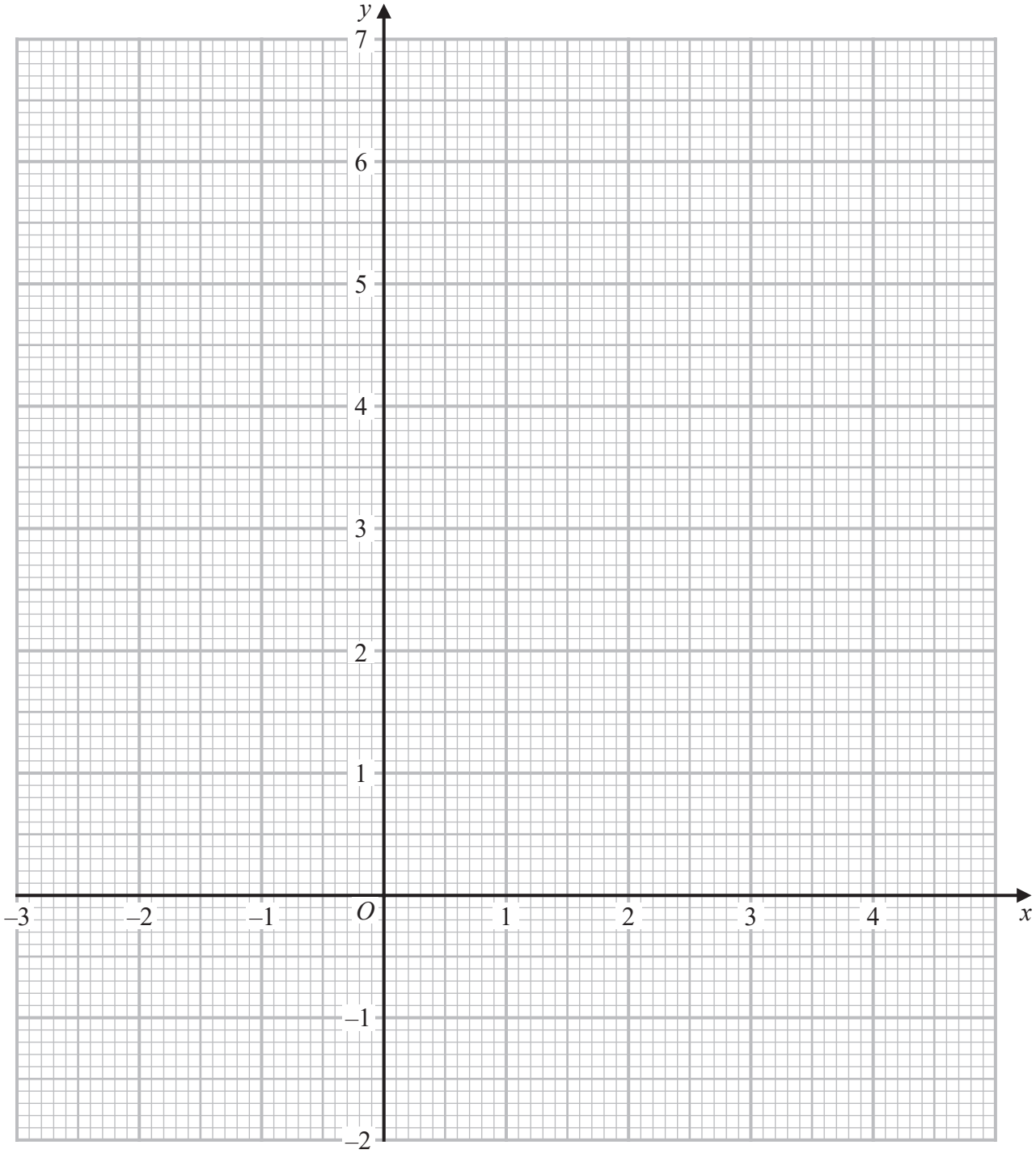


Turn over for a spare grid if you need to redraw your graph.

Question 11 continued

Question 11 continued

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



(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

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

(c) Find fg(2)

(2)

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

(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)

Question 12 continued

Question 12 continued

(Total for Question 12 is 13 marks)

TOTAL FOR PAPER IS 100 MARKS