

Write your name here

Surname

Other names

Centre Number

Candidate Number

**Pearson Edexcel  
International GCSE**

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# Mathematics B

## Paper 2R



Tuesday 19 January 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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**PEARSON**





3 Given that  $a > 0$  and  $b > 0$  and that

$$\begin{pmatrix} 2a & a \\ b & b \end{pmatrix} \begin{pmatrix} b & 2a \\ b & a \end{pmatrix} = \begin{pmatrix} c & 80 \\ 18 & c \end{pmatrix}$$

find the value of  $a$ , the value of  $b$  and the value of  $c$ .

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**Question 3 continued**

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**(Total for Question 3 is 6 marks)**



4 (a) Simplify fully  $\frac{2x^2 - x - 10}{3} \times \frac{x}{x + 2}$  (3)

(b) Given that  $y = \frac{2x^2 - x - 10}{3} \times \frac{x}{x + 2}$

solve  $\frac{dy}{dx} = 0$  (3)

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**Question 4 continued**

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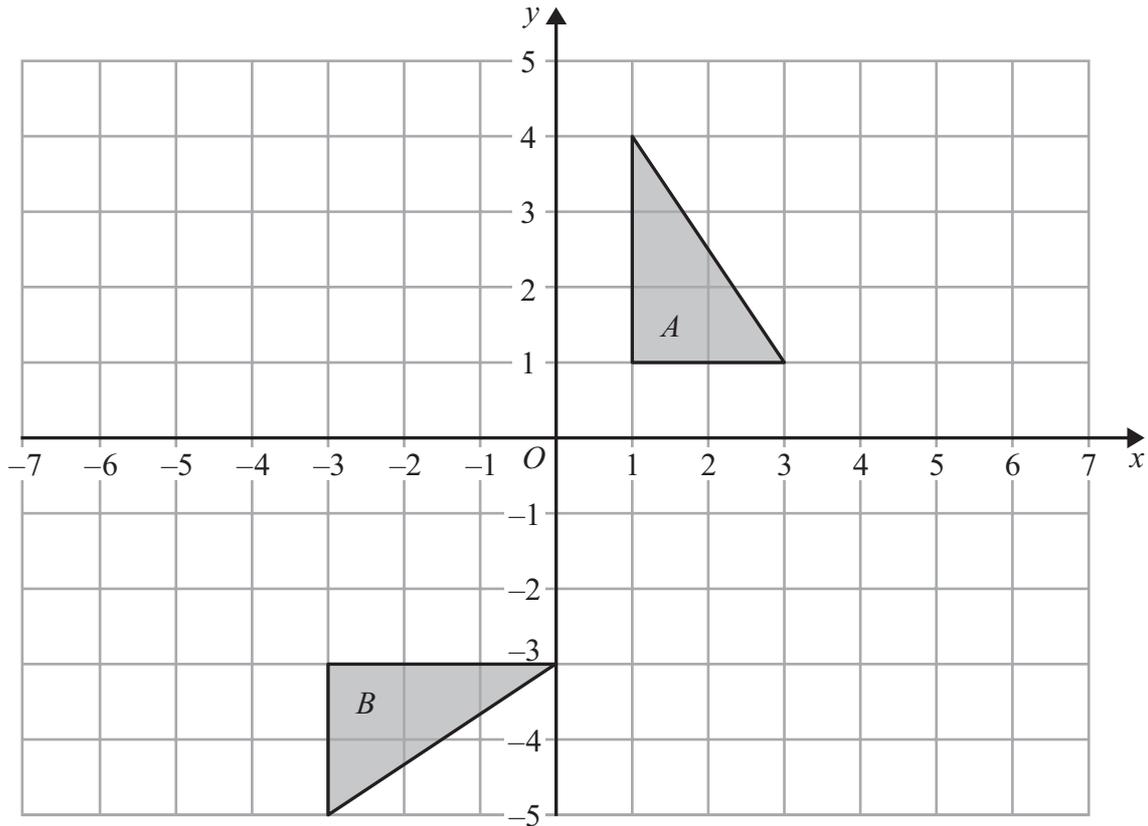
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**(Total for Question 4 is 6 marks)**



5



On the grid, triangle  $B$  is the image of triangle  $A$  under a single transformation.

(a) Describe fully this single transformation.

(3)

Triangle  $B$  is transformed to triangle  $C$  under the transformation with matrix  $N$  where

$$N = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$$

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

(3)

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**Question 5 continued**

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**(Total for Question 5 is 6 marks)**



6 The two functions,  $f$  and  $g$ , are defined as

$$f : x \mapsto \frac{4}{x-1}$$

$$g : x \mapsto 3x + 1$$

(a) Write down the value of  $x$  that must be excluded from any domain of  $f$ . (1)

(b) Express the inverse function  $f^{-1}$  in the form  $f^{-1} : x \mapsto \dots$  (2)

(c) Find the values of  $x$  that satisfy  $f(x) = g(x)$ . (5)

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**Question 6 continued**

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**(Total for Question 6 is 8 marks)**



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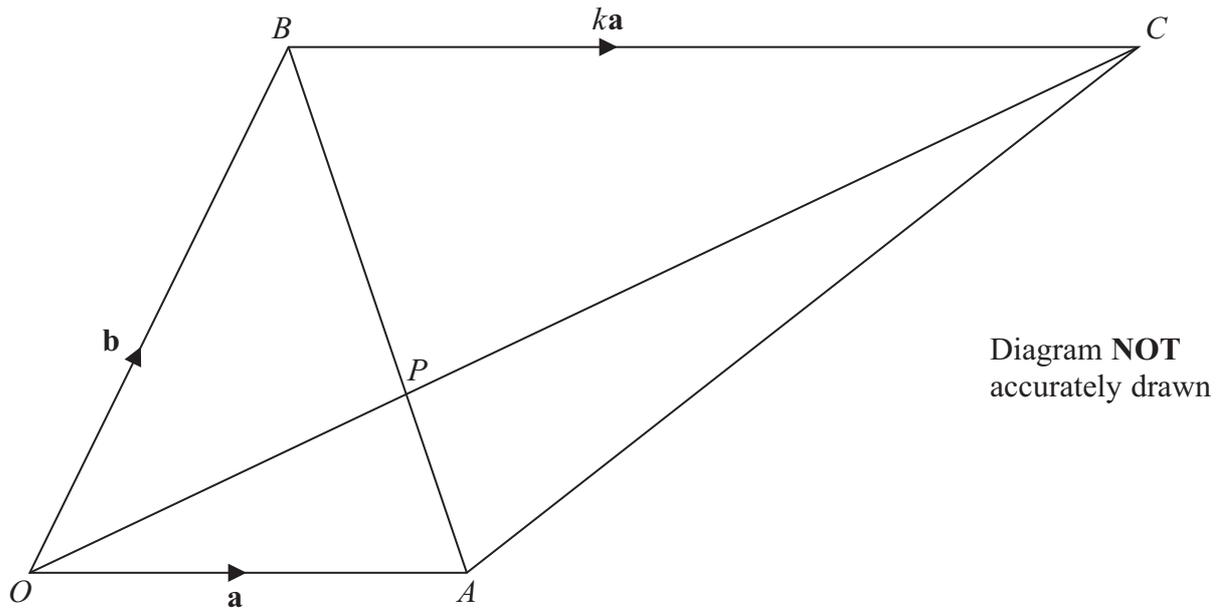


Figure 1

Figure 1 shows trapezium  $OBCA$  in which  $\vec{OA} = \mathbf{a}$ ,  $\vec{OB} = \mathbf{b}$  and  $\vec{BC} = k\mathbf{a}$  where  $k$  is a constant.

$OC$  and  $AB$  intersect at  $P$ .

(a) Write down in terms of  $\mathbf{a}$  and  $\mathbf{b}$  and where necessary  $k$ ,

- (i)  $\vec{AB}$       (ii)  $\vec{AC}$       (iii)  $\vec{OC}$  (3)

Given that  $OP : OC = 1 : m$ ,

(b) write down an expression for  $\vec{OP}$  in terms of  $\mathbf{a}$ ,  $\mathbf{b}$ ,  $k$  and  $m$ . (1)

Given that  $AP : AB = 1 : n$ ,

(c) write down and simplify an expression for  $\vec{OP}$  in terms of  $\mathbf{a}$ ,  $\mathbf{b}$ , and  $n$ . (2)

(d) Show that  $m = n$ . (2)

(e) Hence, find  $k$  in terms of  $n$ . (2)

Given that  $OBCA$  is a parallelogram,

(f) write down the value of  $n$ . (1)

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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 11 marks)**



- 8 (a) Expand and simplify  $(2x - 27)(x - 45)$  (2)

One day Francine drives a total of 21 km to work. Her journey consists of two parts.

For the first part of her journey to work, she drives 15 km at an average speed of  $x$  km/h.

- (b) Write down an expression, in terms of  $x$ , for the time taken, in hours, for the first 15 km. (1)

For the second part of her journey to work, she drives at an average speed of  $(x - 27)$  km/h.

- (c) Write down an expression, in terms of  $x$ , for the time taken, in hours, for the second part of the journey. (1)

The total of the times taken by Francine for the two parts of her journey to work is 40 minutes.

- (d) Change 40 minutes into hours. (1)

- (e) Using your answers to parts (b), (c) and (d) write down an equation in  $x$ . (1)

- (f) Show that this equation simplifies to  $2x^2 - 117x + 1215 = 0$  (3)

- (g) Hence show that the times taken by Francine for the two parts of her journey to work are the same. (2)

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**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 11 marks)**







**Question 9 continued**

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**Question 9 continued**

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**(Total for Question 9 is 13 marks)**



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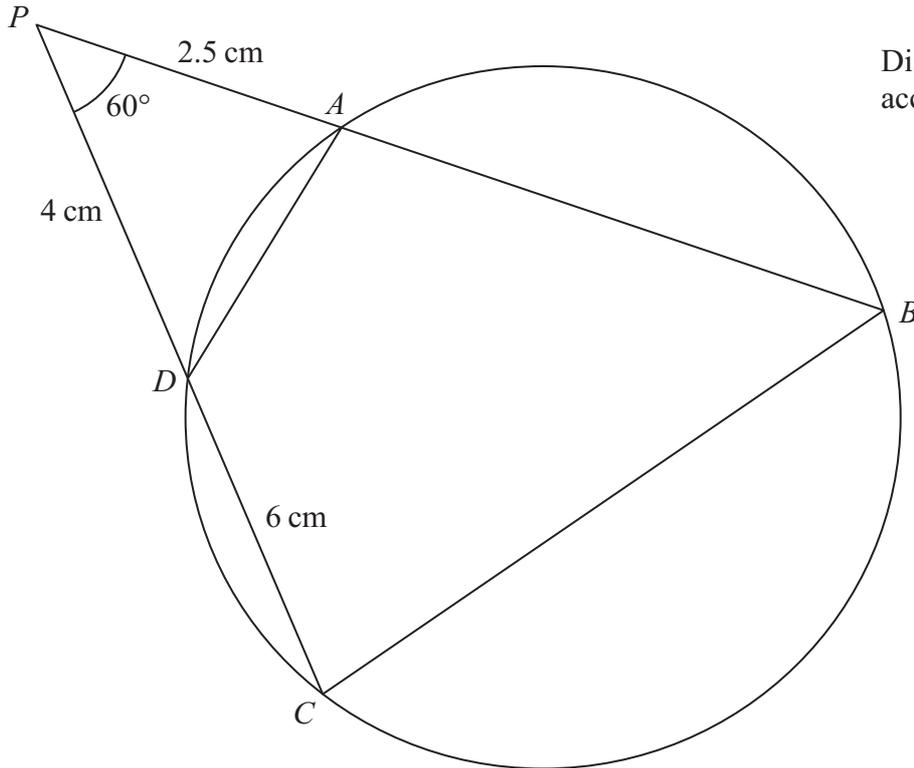


Figure 2

In Figure 2,  $ABCD$  is a circle. The point  $P$ , outside the circle, is such that  $PAB$  and  $PDC$  are straight lines so that  $PA = 2.5$  cm,  $PD = 4$  cm,  $DC = 6$  cm and  $\angle BPC = 60^\circ$

- (a) Show that  $AB = 13.5$  cm. (3)
- (b) Find the length, in cm, of  $BC$ . (3)
- (c) Find the size, in degrees to 3 significant figures, of  $\angle ABC$ . (3)
- (d) Giving reasons, find the size, in degrees to 3 significant figures, of  $\angle PAD$ . (3)
- (e) Find the area, in  $\text{cm}^2$  to 3 significant figures, of  $ABCD$ . (4)

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

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

$$\text{Area of triangle} = \frac{1}{2} bc \sin A]$$

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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 16 marks)**



11

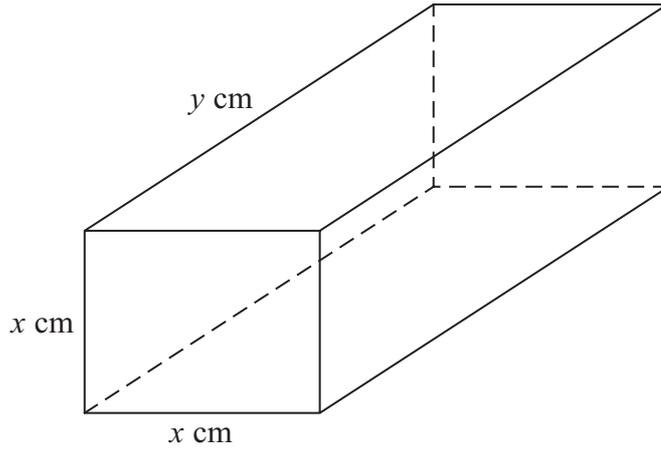


Figure 3

Figure 3 shows a solid cuboid with dimensions,  $x$  cm,  $x$  cm and  $y$  cm.

The total surface area of the cuboid is  $A$  cm<sup>2</sup>

(a) Write down and simplify an expression, in terms of  $x$  and  $y$ , for  $A$ .

(2)

The volume of the cuboid is 36 cm<sup>3</sup>

(b) Find an expression for  $y$  in terms of  $x$ .

(1)

(c) Hence show that

$$A = 2x^2 + \frac{144}{x}$$

(2)

(d) Using calculus, find, to 1 decimal place, the value of  $x$  for which  $A$  is a minimum.

(4)

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**Question 11 continued**

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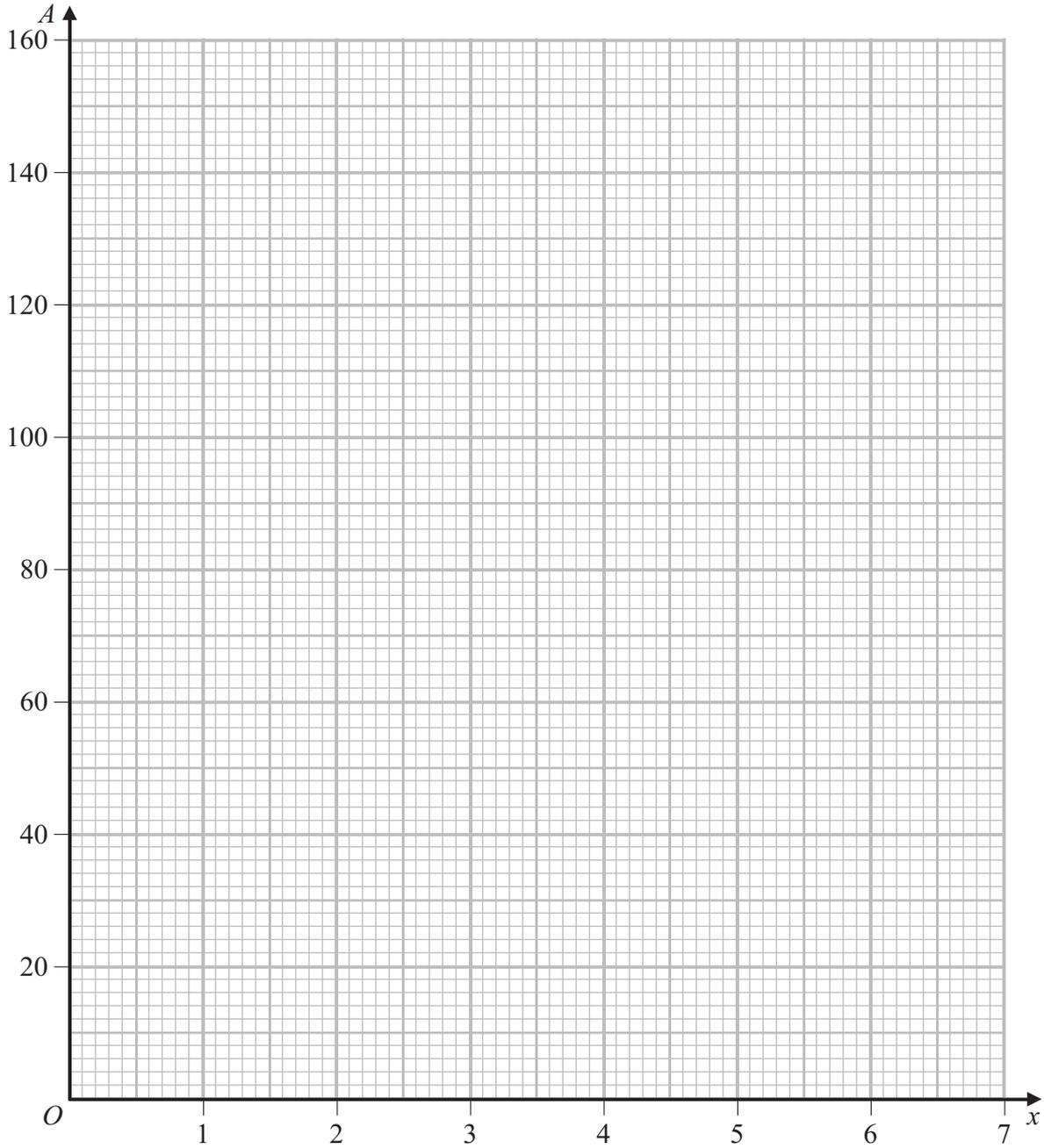
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**Question 11 continues on the next page.**





**Question 11 continued**



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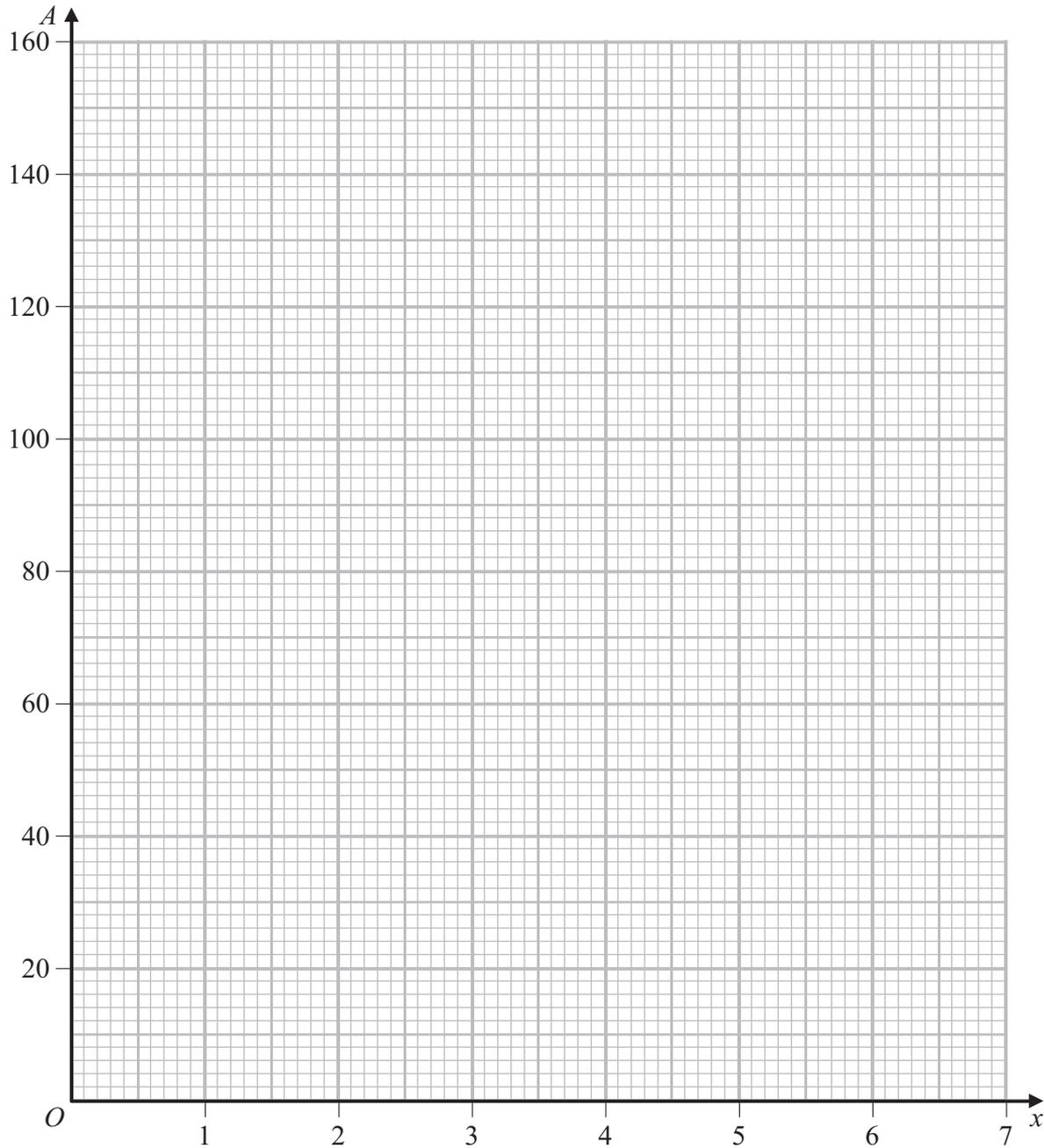
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**Turn over for a spare grid if you need to redraw your graph.**



**Question 11 continued**

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



(Total for Question 11 is 15 marks)

**TOTAL FOR PAPER IS 100 MARKS**

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