Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

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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P 4 6 9 1 9 A 0 1 3 2

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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 The time in Singapore is eight hours ahead of London so when it is 8 pm in Singapore, it is noon on the same day in London.

(a) When it is 10 am in London, write down the time in Singapore.

(1)

(b) When it is 3 am in Singapore, write down the time in London.

(1)

A plane leaves London at 2:35 pm (London time). It arrives in Singapore at 9:52 am the next day (Singapore time).

(c) Calculate the time, in hours and minutes, for the journey.

(2)

(Total for Question 1 is 4 marks)

2 $\mathscr{E} = \{x : x \text{ is an integer and } 1 \leqslant x \leqslant 24\}$
$A = \{\text{multiples of } 3\}$
$B = \{\text{factors of } 24\}$

(a) Find n(A).

(1)

(b) List the elements of B.

(1)

(c) Find $A \cap B$.

(2)

(Total for Question 2 is 4 marks)

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.

Question 3 continued

(Total for Question 3 is 6 marks)

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

(3)

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

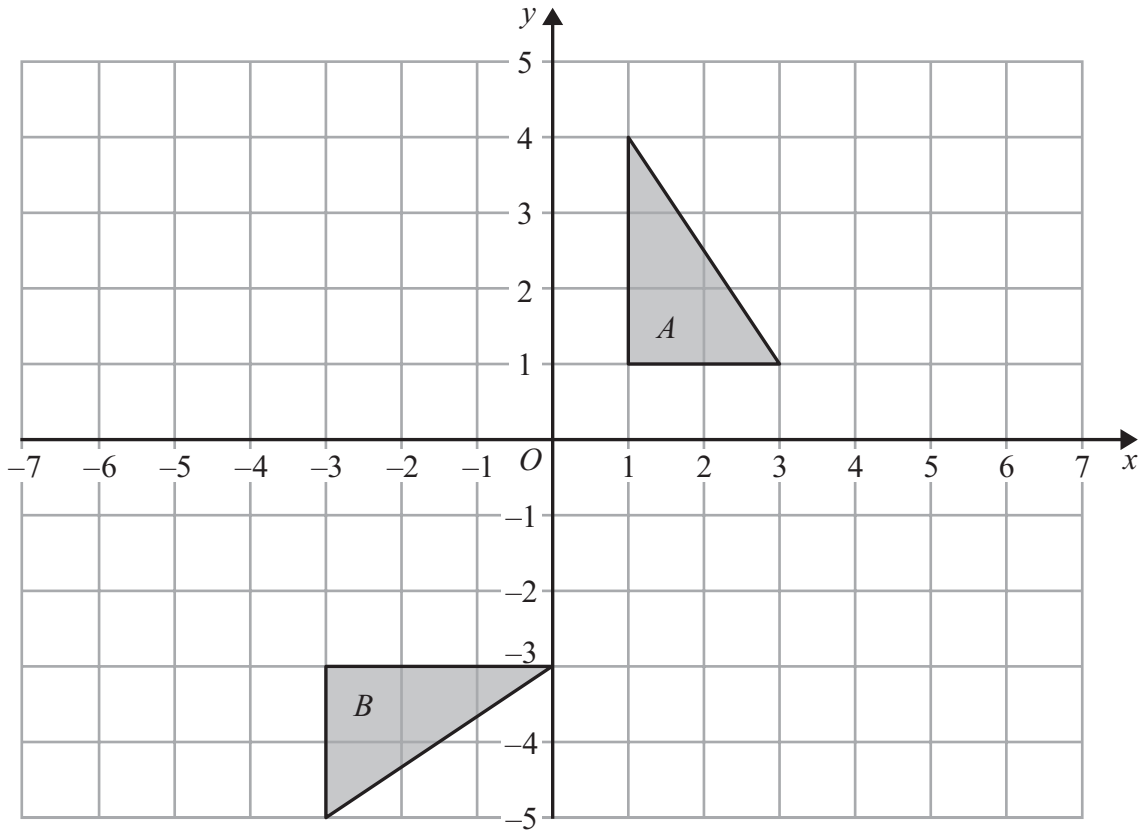
solve $\dfrac{\mathrm{d}y}{\mathrm{d}x} = 0$

(3)

Question 4 continued

(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 $\mathbf{N}$ where

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

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

(3)

Question 5 continued

(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 $f^{-1} : x \mapsto ...$

(2)

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

(5)

Question 6 continued

(Total for Question 6 is 8 marks)

7

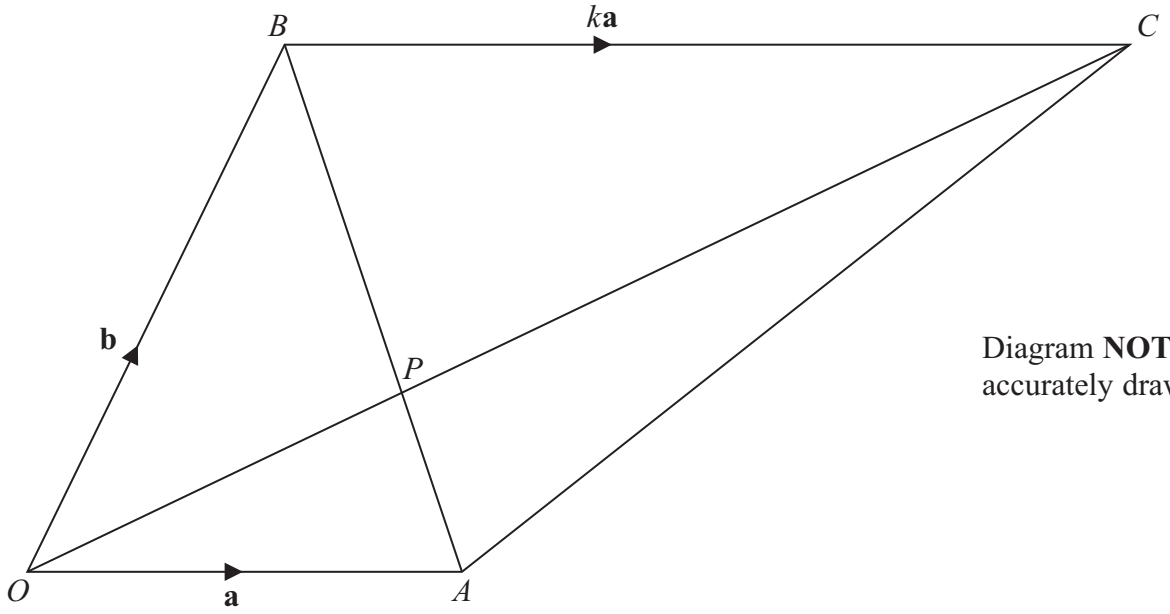


Diagram **NOT** accurately drawn

Figure 1

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

OC and AB intersect at P.

(a) Write down in terms of **a** and **b** and where necessary k,

(i) $\overrightarrow{AB}$ (ii) $\overrightarrow{AC}$ (iii) $\overrightarrow{OC}$

(3)

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

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

(1)

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

(c) write down and simplify an expression for $\overrightarrow{OP}$ in terms of **a**, **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)

.....

.....

Question 7 continued

Question 7 continued

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Question 7 continued

(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

Question 8 continued

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Question 8 continued

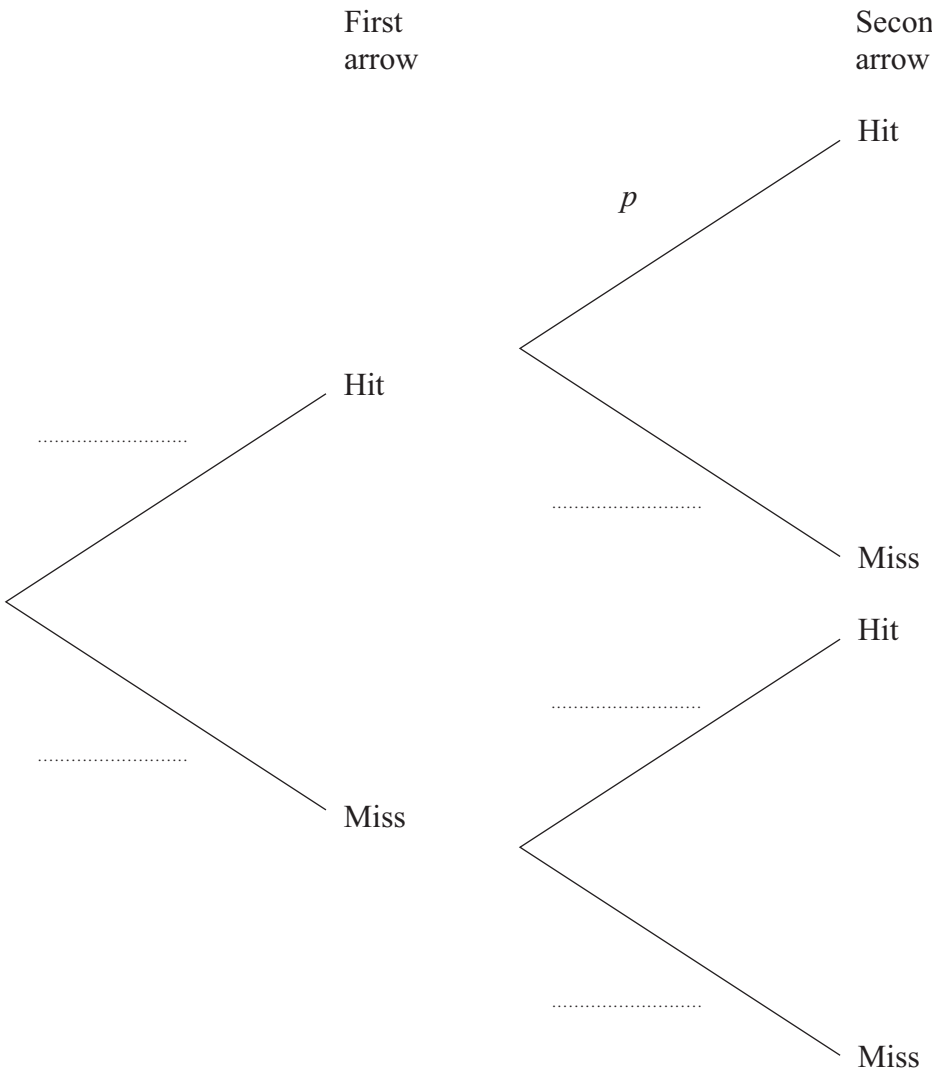
(Total for Question 8 is 11 marks)

9 Wilhelm shoots two arrows at a target.

The probability that the first arrow hits the target is $\frac{4}{5}$

When the first arrow hits the target, the probability that the second arrow hits the target is p.
When the first arrow misses the target, the probability that the second arrow hits the target is q.

(a) Use this information to complete the probability tree diagram.



(3)

Wilhelm shoots two arrows at the target.

Given that the probability that both arrows miss the target is $\frac{3}{20}$

(b) (i) write down an equation in q,

(ii) solve your equation to find the value of q.

(3)

Question 9 continued

Given also that the probability that exactly one arrow hits the target is $\frac{7}{12}$

(c) (i) write down an equation in p,

(ii) solve your equation to find the value of p.

(4)

When Robin shoots one arrow at the target, the probability that the arrow hits the target is $\frac{9}{10}$

Wilhelm shoots two arrows at the target and then Robin shoots one arrow at the target.

(d) Find the probability that exactly one of these arrows hits the target.

(3)

Question 9 continued

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Question 9 continued

(Total for Question 9 is 13 marks)

10

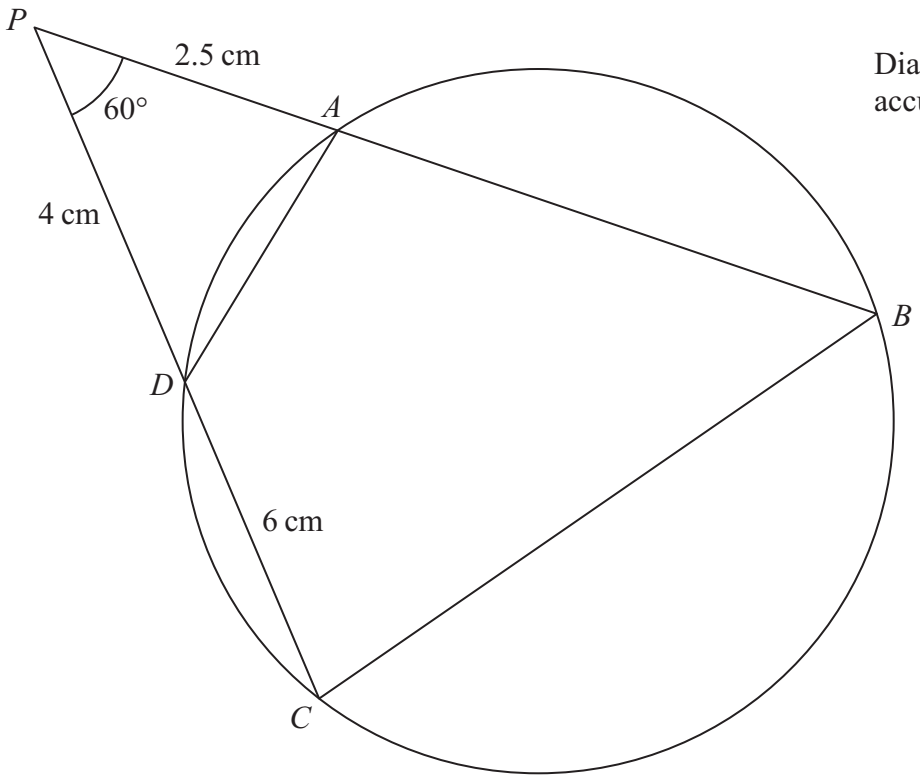

Diagram **NOT** accurately drawn

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 $\angle BPC = 60°$

(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 cm^2 to 3 significant figures, of $ABCD$.

(4)

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

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

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

Question 10 continued

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Question 10 continued

(Total for Question 10 is 16 marks)

11

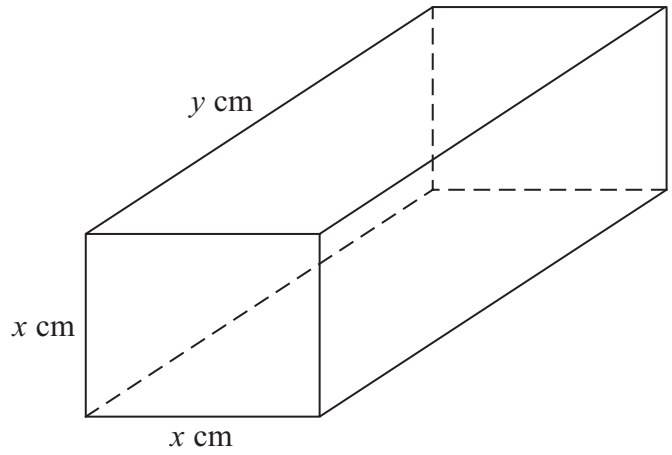

Figure 3

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^2

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

(2)

The volume of the cuboid is 36 cm^3

(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)

Question 11 continued

Question 11 continues on the next page.

Question 11 continued

(e) Complete the following table of values for $A = 2x^2 + \frac{144}{x}$

Give your values of A to one decimal place where necessary.

x	1	2	3	4	5	6	7
$2x^2$	2			32		72	98
$\frac{144}{x}$	144			36		24	20.6
A	146			68		96	118.6

(3)

(f) On the grid, plot the points from your completed table and, using your answer to part (d), join them to form a smooth curve.

(3)

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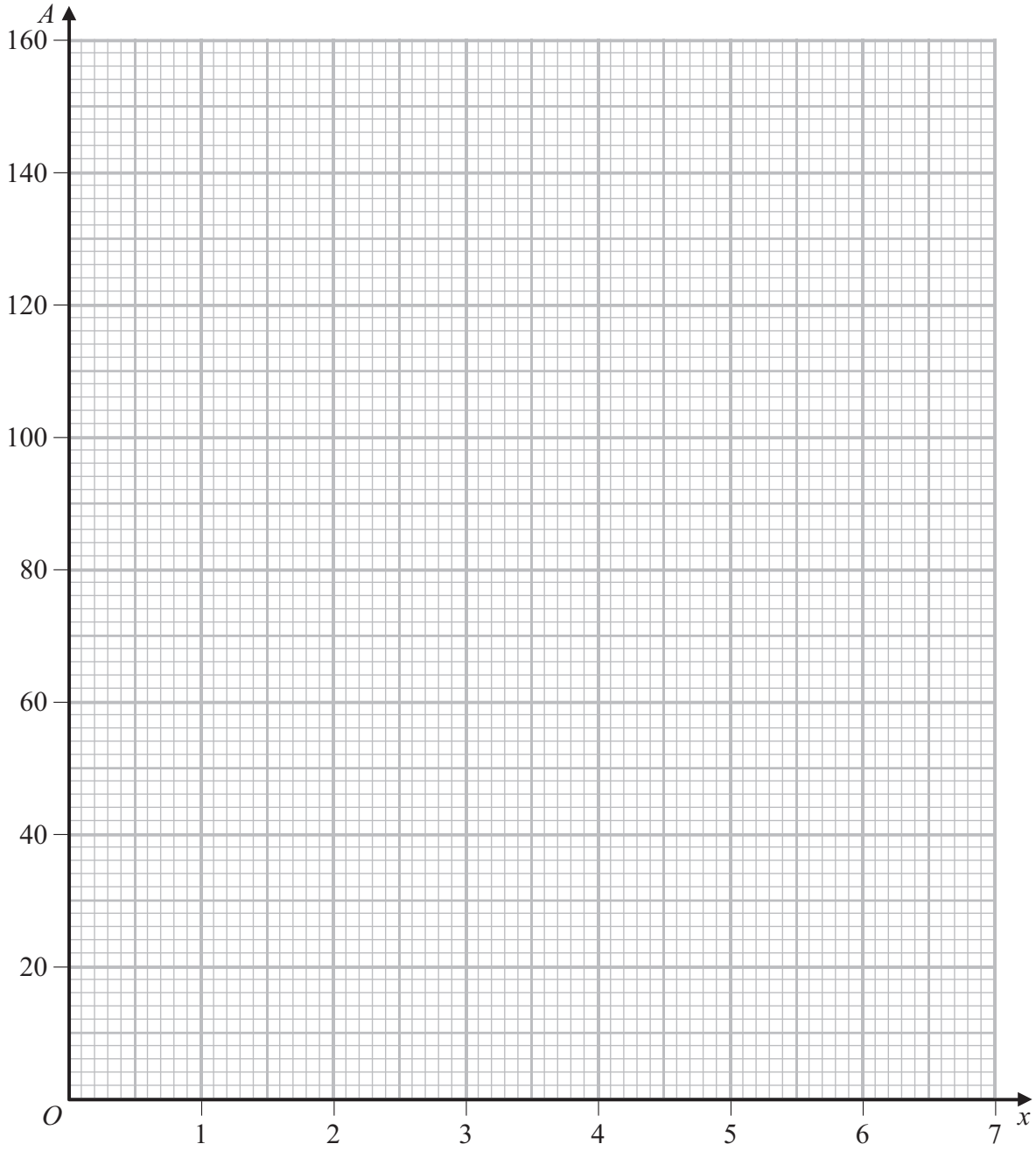
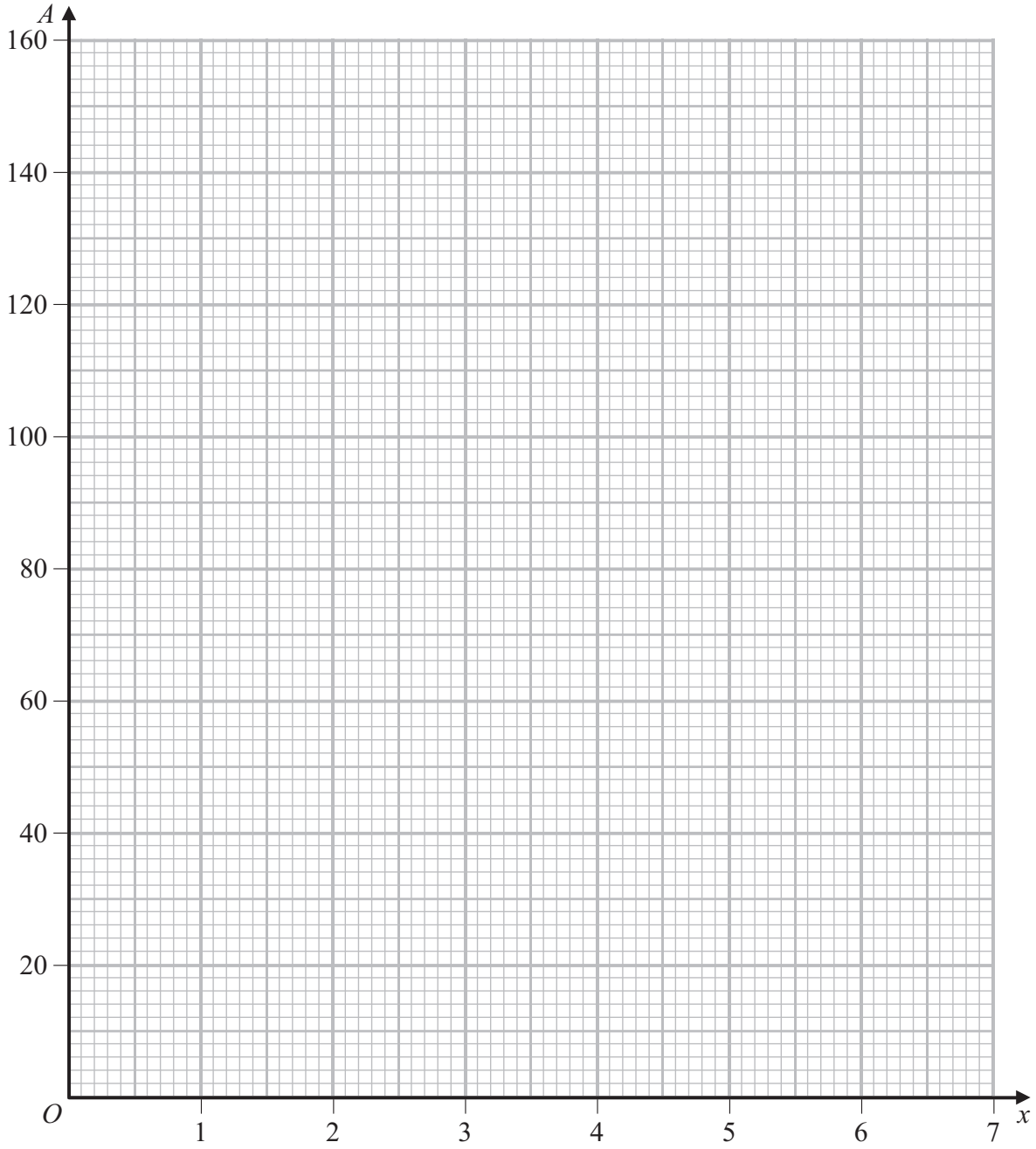
Question 11 continued



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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