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Surname

Other names

Pearson Edexcel
International GCSE

Centre Number

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Candidate Number

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Mathematics B

Paper 2



Thursday 7 June 2018 – Morning
Time: 2 hours 30 minutes

Paper Reference

4MB0/02

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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Question 1 continued

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(Total for Question 1 is 5 marks)



- 2 All the people at a musical party did at least one activity chosen from singing (S), playing the guitar (G) and playing the piano (P).

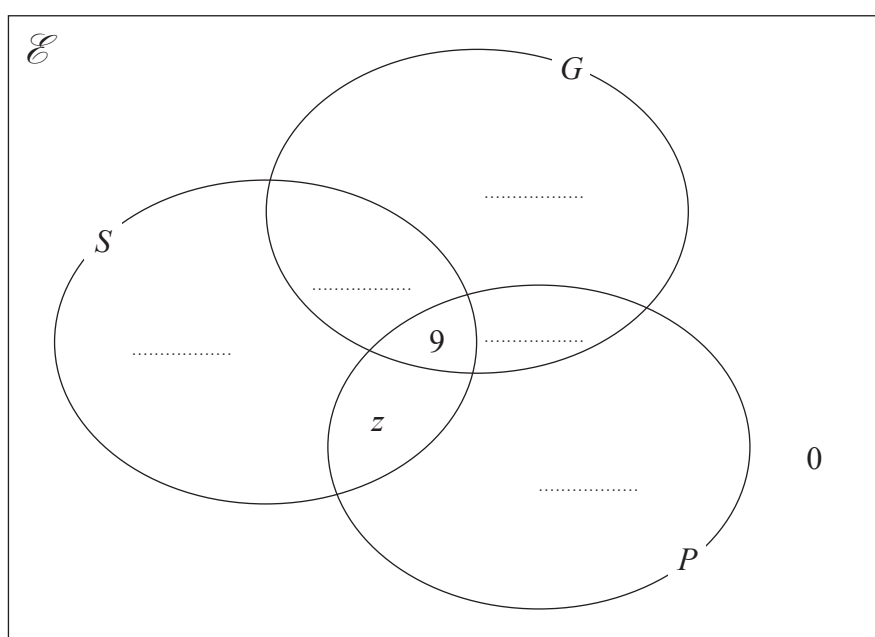
Of these people

- 21 sang
- 15 played a guitar
- 20 played the piano
- 9 did all three activities

Letting $n(S \cap G \cap P') = x$
 $n(S' \cap G \cap P) = y$
 $n(S \cap G' \cap P) = z$

- (a) complete the Venn diagram with all this information.

(2)



Of the people at the party, 11 did exactly two of the three activities.

- (b) Find the number of people at the party.

(3)

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Question 2 continued

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(Total for Question 2 is 5 marks)



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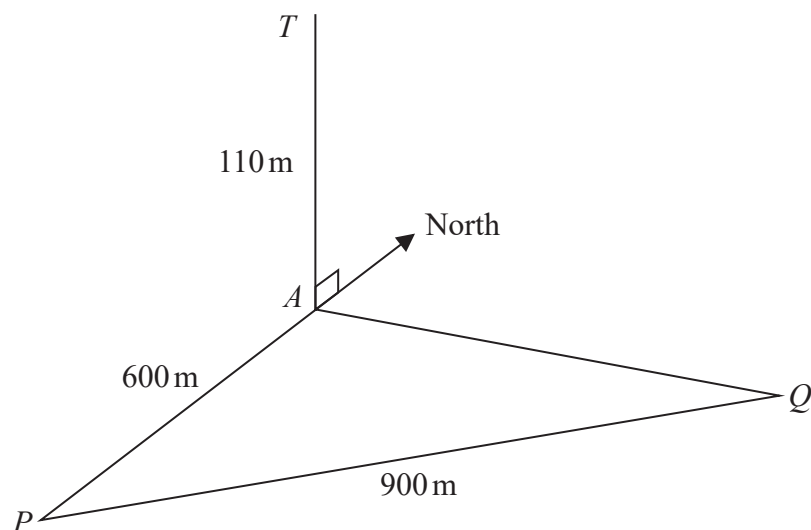


Figure 2

Figure 2 shows a vertical tower AT of height 110 m and a horizontal triangle PAQ . The base A of the tower is 600 m due north of a point P .

- (a) Calculate the size, in degrees to one decimal place, of the angle of elevation of T from P .

(2)

The point Q is 900 m on a bearing of 065° from P .

- (b) Calculate the distance, in metres to 3 significant figures, of A from Q .

(3)

- (c) Calculate the bearing, in degrees to the nearest degree, of A from Q .

(3)

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

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Question 3 continued

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Question 3 continued

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Question 3 continued

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(Total for Question 3 is 8 marks)



4 Given that y is proportional to the square of T such that $y = 1600$ when $T = 2.5$

(a) find the value of y when $T = 4.5$

(3)

Given also that y is proportional to the cube of r such that $y = 12.5$ when $r = \frac{1}{2}$

(b) find the value of r when $T = 5000$

(4)

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Question 4 continued

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(Total for Question 4 is 7 marks)



- 5 The points with coordinates (3, 1), (4, 3), (6, 3) and (6, 1) are the vertices of a quadrilateral Q .

(a) On the grid, draw and label quadrilateral Q .

(1)

Quadrilateral R is the image of quadrilateral Q under a reflection in the line with equation $y = x$

(b) On the grid, draw and label quadrilateral R .

(3)

Quadrilateral S is the image of quadrilateral R under the transformation given by the matrix $\mathbf{L}$ where

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

(c) On the grid, draw and label quadrilateral S .

(3)

(d) Find the matrix that represents the transformation that maps quadrilateral S onto quadrilateral Q .

(2)

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A blank Cartesian coordinate system with x and y axes ranging from -7 to 7. The grid lines are spaced at intervals of 1 unit. The origin is labeled O.

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Question 5 continued

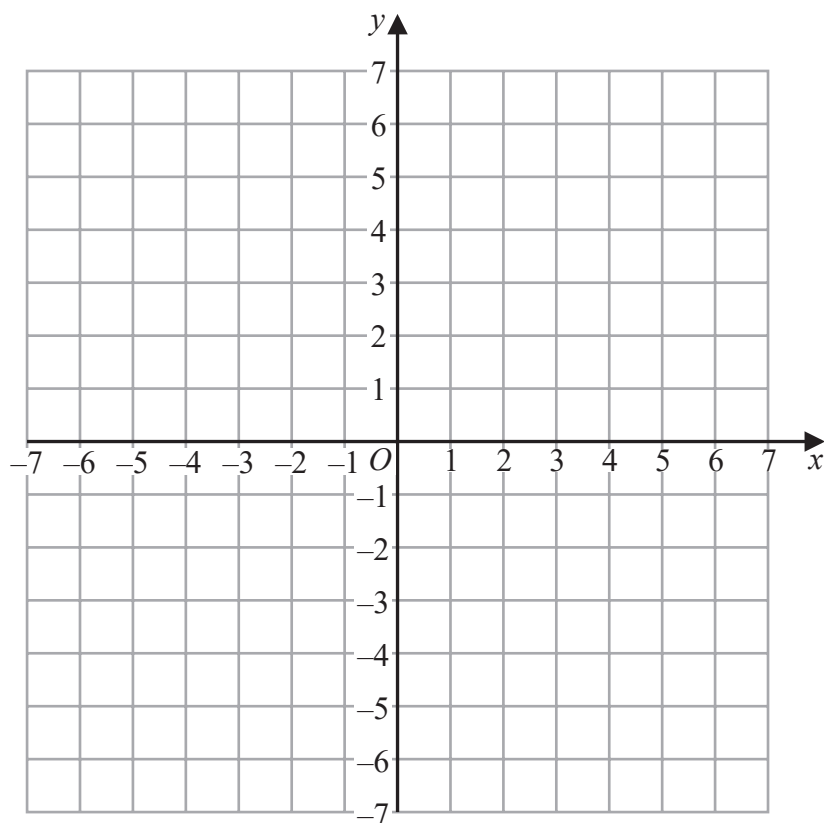
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Only use this grid if you need to redraw your quadrilaterals.



P 5 3 3 4 8 A 0 1 5 4 0

6 Chen buys watches in America to sell in England.

Chen borrowed \$800 000 for two years from a bank in America.
He used all this money to buy watches at \$200 each.

In the first year, Chen sold 62% of the watches in England for £270 each.

(a) Calculate how many watches Chen sold in the first year.

(2)

In the second year, Chen sold in England 70% of the watches that he had left at £220 each.
He then sold in England all the remaining watches by the end of the second year at £150 each.

At the end of the second year, Chen paid back to the bank in America \$800 000 plus
interest of 8% of this money.

At the end of the two years the exchange rate was £1 = \$1.30

(b) Calculate the total profit in dollars (\$) that Chen made.

(6)

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Question 6 continued

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(Total for Question 6 is 8 marks)



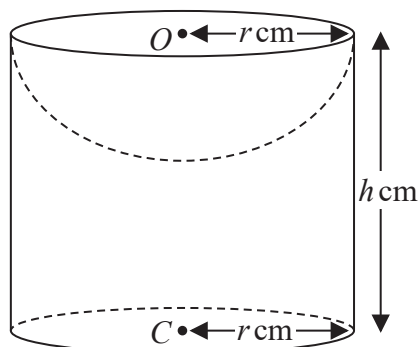


Diagram **NOT**
accurately drawn

Figure 3

Figure 3 shows a solid S formed by removing a hemisphere of radius r cm from a right circular cylinder of radius r cm and height h cm.

The centre O of the hemisphere and the centre C of the lower circular face of the cylinder are such that OC is the axis of symmetry of S and $OC = h$ cm.

The volume of S is V cm³ and the total surface area of S is A cm²

- (a) Show that $A = 3\pi r^2 + 2\pi rh$ (1)

Given that $A = 1300\pi$

- (b) show that $V = 650\pi r - \frac{13}{6}\pi r^3$ (4)

- (c) Using calculus, find the value of r for which V has a stationary value. (2)

- (d) Find the stationary value of V , giving your answer in terms of π . (2)

$$\left[\begin{array}{l} \text{Area of circle} = \pi r^2 \\ \text{Curved surface area of a right circular cylinder} = 2\pi rh \\ \text{Surface area of sphere} = 4\pi r^2 \\ \text{Volume of sphere} = \frac{4}{3}\pi r^3 \end{array} \right]$$



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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 9 marks)



8 The functions f and g are defined as

$$f(x) = 2x - 5 \text{ for all values of } x$$

$$g(x) = x^2 \text{ for all } x \geq 0$$

(a) Find $f(2)$

(1)

(b) Find the positive value of x for which $gf(x) = 36$

(3)

(c) (i) Solve for x , the equation $f^{-1}(x) = \lambda f(x)$ giving your answer in terms of λ .

(ii) State any values of λ for which the equation $f^{-1}(x) = \lambda f(x)$ has no solution.

(5)

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Question 8 continued

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(Total for Question 8 is 9 marks)



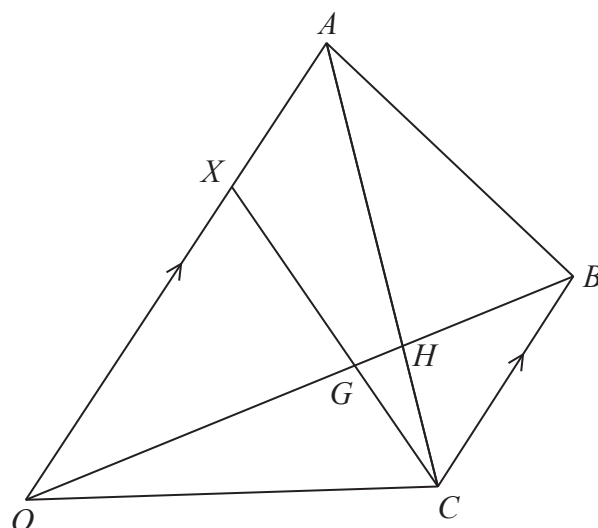


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Figure 4

Figure 4 shows quadrilateral $OABC$ with CB parallel to OA .

$$\vec{OA} = 12\mathbf{a} \quad \vec{OB} = 6\mathbf{b} \quad \text{and} \quad CB = \frac{1}{2}OA$$

(a) Write down in terms of $\mathbf{a}$ or $\mathbf{b}$ or $\mathbf{a}$ and $\mathbf{b}$

(i) $\vec{BC}$ (ii) $\vec{OC}$

(2)

The point X on OA is such that $OX:OA = 3:4$

CX and OB intersect at G .

CA and OB intersect at H .

Given that $\vec{XG} = k\vec{XC}$ where k is a scalar,

(b) show that $\vec{OG} = 6k\mathbf{b} + (9 - 15k)\mathbf{a}$.

(2)

(c) Hence find $\vec{OG}$ in terms of $\mathbf{b}$ only.

(2)

Given that $OG:GH:HB = m:1:n$ where m and n are integers,

(d) find the value of m and the value of n .

(4)

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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 10 marks)



Time taken (T seconds)	Frequency
$20 < T \leq 30$	70
$30 < T \leq 40$	130
$40 < T \leq 50$	210
$50 < T \leq 60$	160
$60 < T \leq 70$	130
$70 < T \leq 80$	100

The table gives information about the times, in seconds, taken by 800 women to do a puzzle.

- (a) Calculate an estimate for the mean time taken by the 800 women.

(4)

The table below gives information about the times, in seconds, taken by some children to do the same puzzle.

Time taken (T seconds)	Frequency
$20 < T \leq 30$	30
$30 < T \leq 50$	64
$50 < T \leq 55$	24
$55 < T \leq 60$	35
$60 < T \leq 70$	30
$70 < T \leq 100$	15

- (b) On the grid opposite, draw a histogram to show this information.

(3)

One of the children is to be chosen at random.

- (c) Calculate an estimate for the probability that this child took 35 seconds or less to do the puzzle.

(2)

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Frequency
density

Question 10 continued

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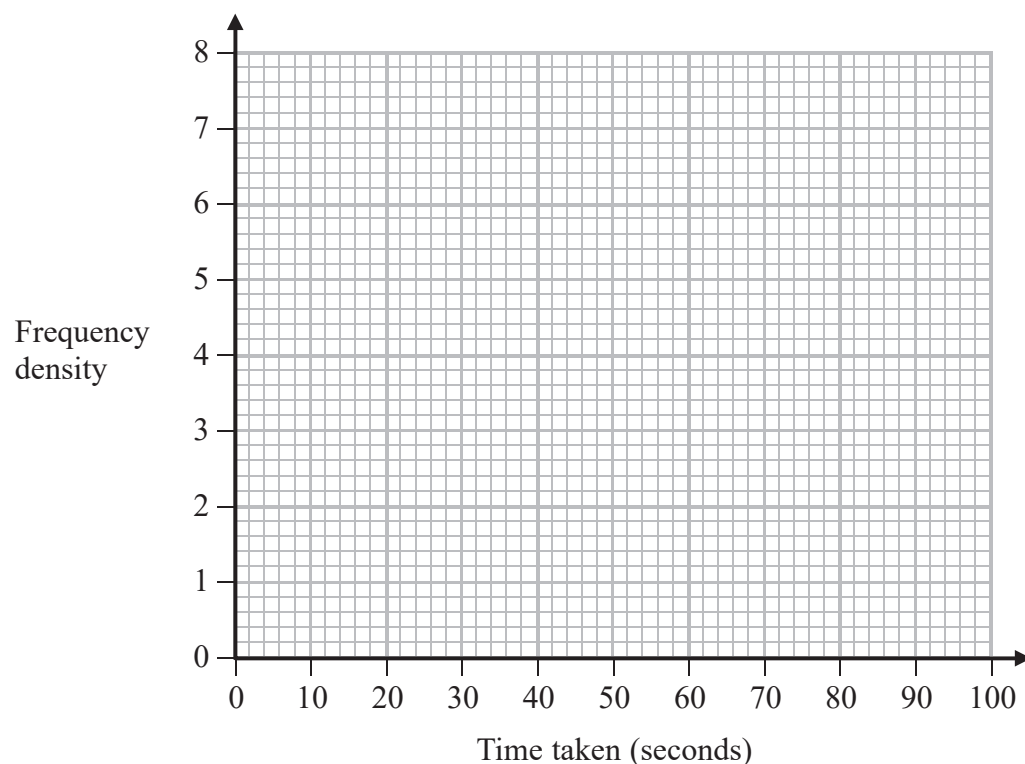
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Question 10 continued

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



(Total for Question 10 is 9 marks)



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- (3)

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Question 11 continued

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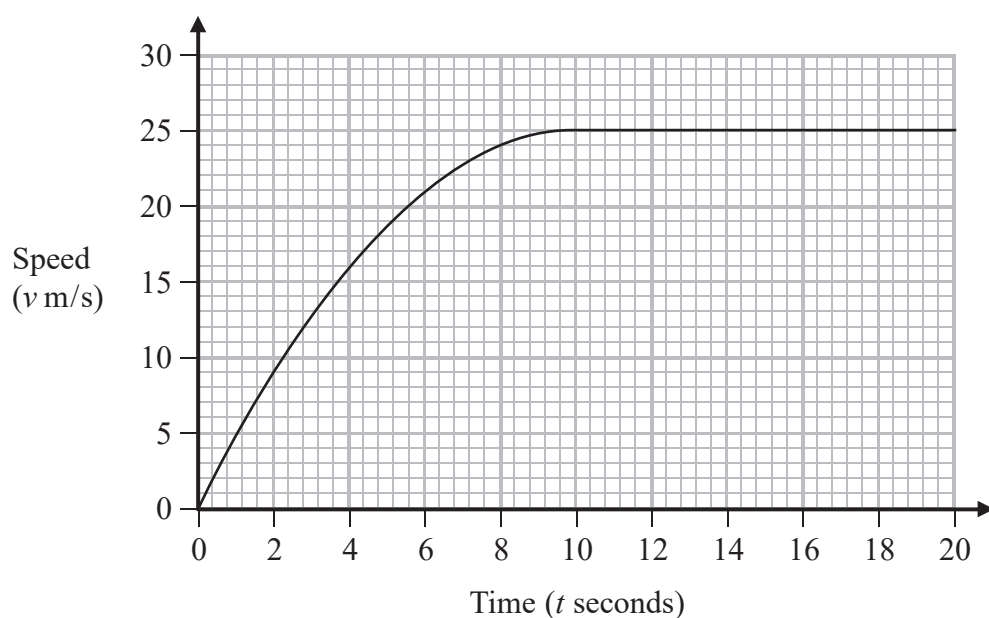


Question 11 continued

A van travelled along the same road in the same direction as the car. The van passed the point P at time $t = 2$

From the point P the van travelled at a constant speed of 10 m/s for 4 seconds and then travelled with constant acceleration to reach a speed of 20 m/s in 14 seconds.

(c) On the grid below, draw a speed-time graph for the van's journey from P .



(2)

The car travelled a distance of $416\frac{2}{3} \text{ m}$ during the 20 seconds.

(d) Calculate how far the car was ahead of the van at time $t = 20$

(3)

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Question 11 continued

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(Total for Question 11 is 10 marks)



12 The equation of a curve is $y = x^2 - 8 + \frac{5}{x}$

(a) Complete the table of values for $y = x^2 - 8 + \frac{5}{x}$

Give your values of y correct to one decimal place where necessary.

x	0.5	1	1.5	2	2.5	3	3.5	4
y	2.3		-2.4		0.3	2.7		9.3

(3)

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

(3)

(c) Using your curve, find an estimate of the minimum value, to one decimal place, of $x^2 - 8 + \frac{5}{x}$ in the interval $0.5 \leq x \leq 4$

(1)

(d) By drawing a suitable straight line on the grid, find estimates, to one decimal place, of the two solutions of the equation $x^3 - 2x^2 - 6x + 5 = 0$ in the interval $0.5 \leq x \leq 4$

(4)

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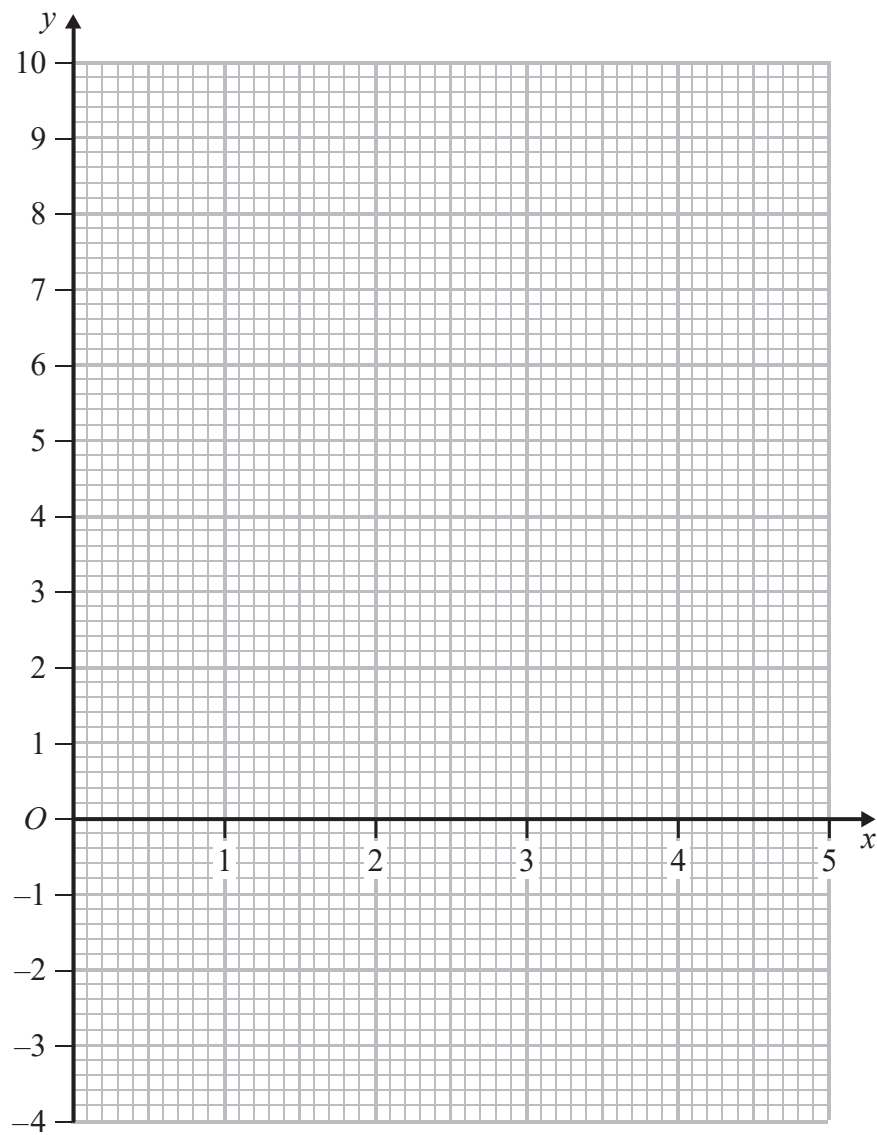


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Question 12 continued



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



Question 12 continued

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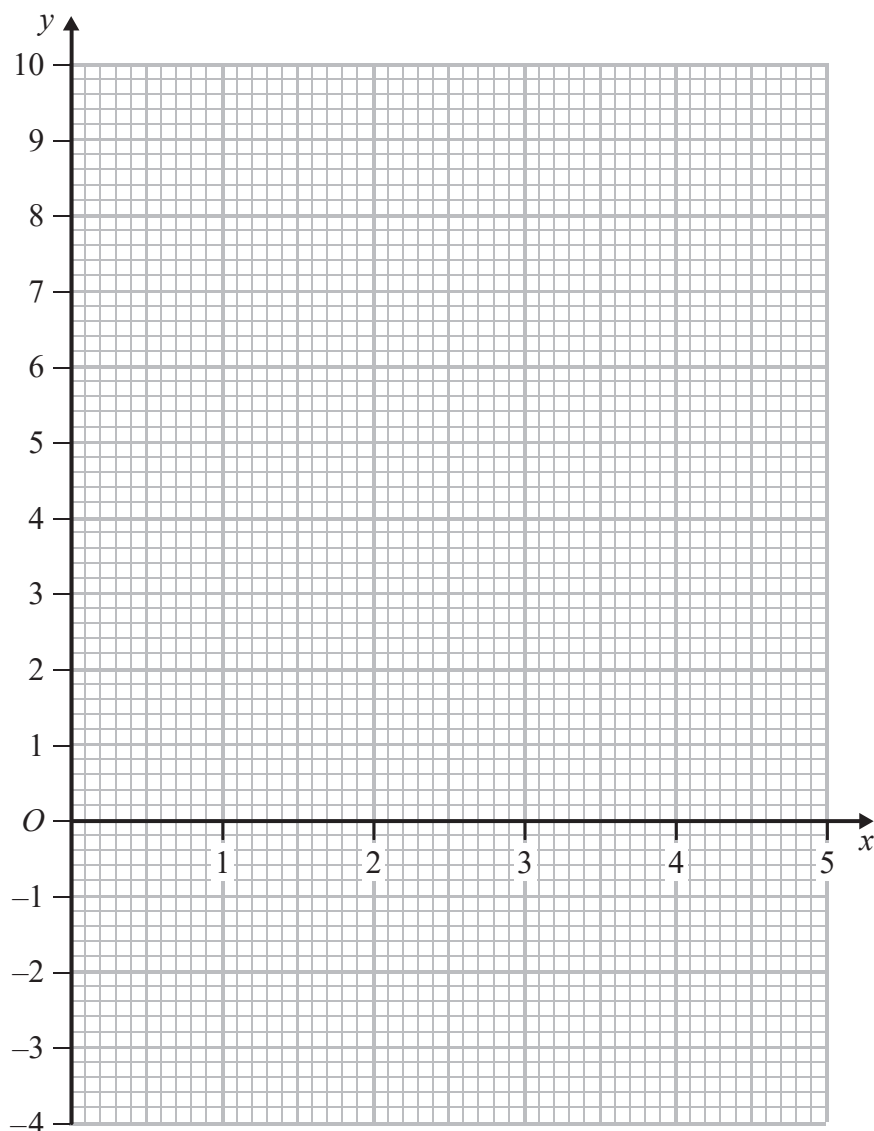
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Question 12 continued

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TOTAL FOR PAPER IS 100 MARKS



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