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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Wednesday 15 January 2020

Morning (Time: 2 hours 30 minutes) | Paper Reference **4MB1/02R**

Mathematics B

Paper 2R



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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Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 James bought a car on 1st March 2016

On 1st March 2017, the value of the car was 20% less than the amount that James paid for the car on 1st March 2016

On 1st March 2018, the value of the car was 10% less than the value of the car on 1st March 2017

On 1st March 2018, the value of the car was £20 340

(a) Calculate the amount, in £, that James paid for the car on 1st March 2016

(3)

On 1st March 2019, the value of the car was £19 323

(b) Calculate the percentage decrease in the value of the car from 1st March 2018 to 1st March 2019

(2)

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Question 1 continued

(Total for Question 1 is 5 marks)

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2 A mixture for concrete is made up of 105 kg of cement, 252 kg of sand and 273 kg of gravel.

Given that

the mass of cement : the mass of sand : the mass of gravel = $1 : (2x + y) : (x + 2y)$

(a) write down two different equations in x and y.

Simplify your equations.

(2)

(b) Hence solve these two equations for the value of x and for the value of y.

Give each value as a simplified fraction.

(3)

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Question 2 continued

(Total for Question 2 is 5 marks)

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3 (a) Find the inverse of the matrix $\begin{pmatrix} 2 & 2 \\ 5 & 4 \end{pmatrix}$

(2)

(b) Use your answer to part (a) to find the value of x and the values of y that satisfy

$$\begin{pmatrix} 2 & 2 \\ 5 & 4 \end{pmatrix}\begin{pmatrix} y^2 - 9x \\ x \end{pmatrix} = \begin{pmatrix} 0 \\ -2 \end{pmatrix}$$

(6)

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

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Question 3 continued

(Total for Question 3 is 8 marks)

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4 Bag B_1 and bag B_2 each contain soil.

The weight of soil in B_1 is 7.5 kg to the nearest 100 g.
The weight of soil in B_2 is 5 kg to the nearest 10 g.

(a) Find

(i) the lower bound for the total weight of soil in the two bags,

(1)

(ii) the upper bound for the difference in the weights of soil in the two bags,

(2)

(iii) the lower bound, to the nearest 50 g, for the difference in the weights of soil in the two bags.

(2)

A large jar is to be filled with sweets.

The jar will be filled using bags of sweets.
The weight of the sweets in each bag of sweets is 220 g to the nearest 5 g.
When the jar is full of sweets, the weight of sweets in the jar is 10 kg to the nearest 0.2 kg.

Bertie has 45 bags of sweets.

(b) Giving your reasons, determine whether Bertie has a sufficient number of bags of sweets to be sure that he can fill the jar with sweets.

(4)

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Question 4 continued

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Question 4 continued

(Total for Question 4 is 9 marks)

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5 Solve $\dfrac{3^{4x} \times 5^{3x+1} \times 45^{1-2x}}{9} = 5^4$

Show clear algebraic working.

(4)

(Total for Question 5 is 4 marks)

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6 The functions f, g and h are defined as

$$f: x \mapsto x + 3$$
$$g: x \mapsto x^2 - 2x + 3$$
$$h: x \mapsto \frac{6}{x} \qquad x \neq 0$$

(a) Find (i) g(–3) (ii) $fh\left(-\frac{1}{4}\right)$

(2)

(b) (i) Express the inverse of the composite function hf in the form $(hf)^{-1}: x \mapsto \ldots$ and simplify your answer.

(ii) State the value of x that must be excluded from any domain of $(hf)^{-1}$

(4)

(c) Find the two values of x for which $hgf(x) = 2$

(5)

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Question 6 continued

(Total for Question 6 is 11 marks)

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7 (a) Write down all the multiples of **3** lying between 1 and 20

(1)

Ahmed and Hani play a game with 20 numbered balls.
The 20 balls are numbered from 1 to 20



The balls are put in a bag.

Ahmed takes at random a ball from the bag, makes a note of its number and puts the ball back into the bag.
If the number of the ball is a multiple of **5**, Ahmed wins the game.

If Ahmed does not win the game, Hani takes at random a ball from the bag, makes a note of its number and puts the ball back into the bag.
If the number of the ball is a multiple of **3**, Hani wins the game.

If Hani does not win the game, Ahmed takes at random a ball from the bag, makes a note of its number and puts the ball back into the bag.
If the number of the ball is a multiple of **6**, Ahmed wins the game.

If Ahmed does not win the game, Hani takes at random a ball from the bag, makes a note of its number and puts the ball back into the bag.
If the number of the ball is a multiple of **4**, Hani wins the game.

If Hani does not win the game, the game stops and the result is a draw.

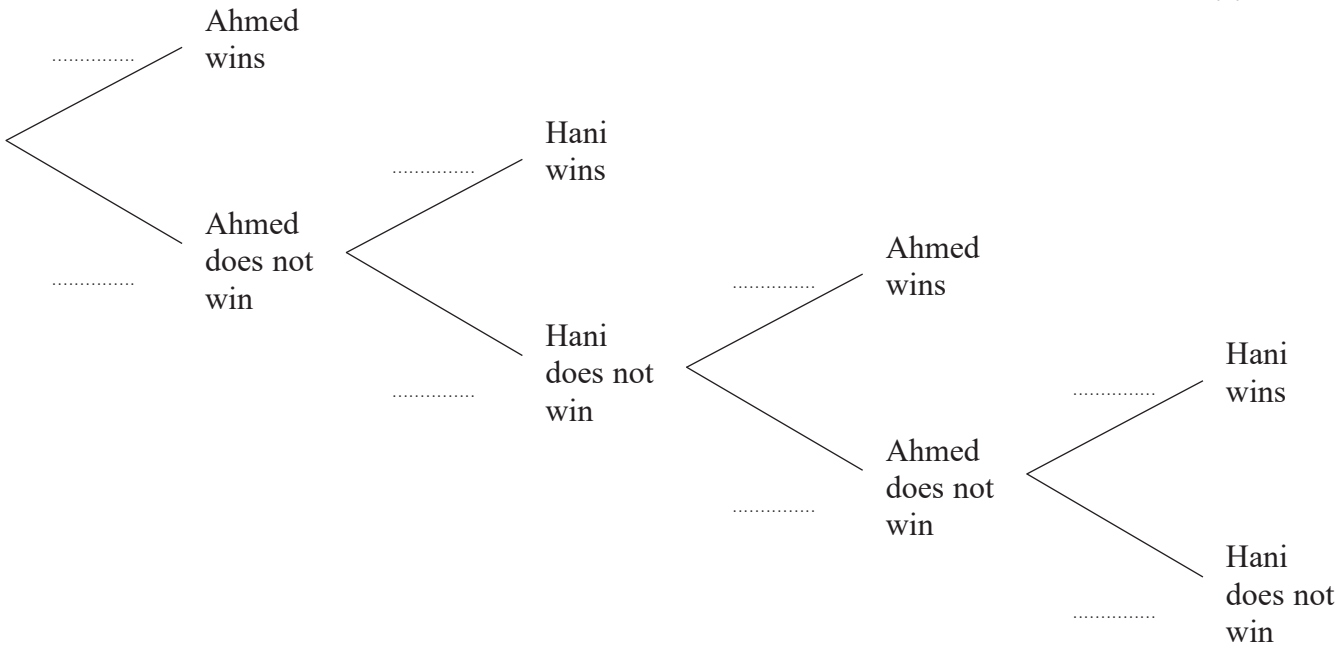
The incomplete probability tree diagram for the game is shown below.

(b) Complete the probability tree diagram for Ahmed and Hani's game.

(4)

(c) Determine which player, Ahmed or Hani, is more likely to win the game.
Give a reason for your answer.

(5)



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Question 7 continued

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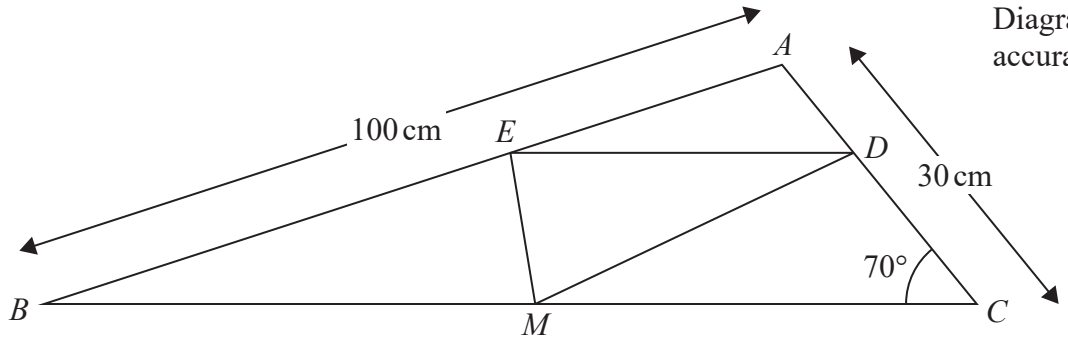

Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows triangle ABC in which $AB = 100\,\text{cm}$, $AC = 30\,\text{cm}$ and $\angle ACB = 70°$

Calculate, to 3 significant figures,

(a) the size, in degrees, of $\angle ABC$,

(3)

(b) the length, in cm, of BC.

(3)

As shown in Figure 1, the point E lies on AB and the point D lies on AC such that ED and BC are parallel and $AD : DC = 1 : 2$

(c) Write down the length, in cm, of DC.

(1)

The midpoint of BC is the point M.

(d) Calculate the area, in cm^2 to 3 significant figures, of triangle DCM.

(2)

Given that $\dfrac{\text{area } \triangle ABC}{\text{area } \triangle DCM} = k$,

(e) find the value of k without working out the area of triangle ABC.

(1)

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$$\left[\begin{array}{c} \textbf{Sine rule } \dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C} \\ \textbf{Cosine rule } a^2 = b^2 + c^2 - 2bc\cos A \\ \textbf{Area of triangle} = \dfrac{1}{2}ab\sin C \end{array}\right]$$

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Question 8 continued

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Question 8 continued

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9 The triangle A has vertices with coordinates (–5, 2), (–11, 0) and (–7, 6).

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

(1)

Triangle B is the image of triangle A under the enlargement with centre (1, 4) and scale factor $-\frac{1}{2}$

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

(3)

Triangle C is the image of triangle B under a rotation of 180° about the point (3, 1).

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

(3)

(d) Describe fully the **single** transformation that maps triangle C onto triangle A.

(3)

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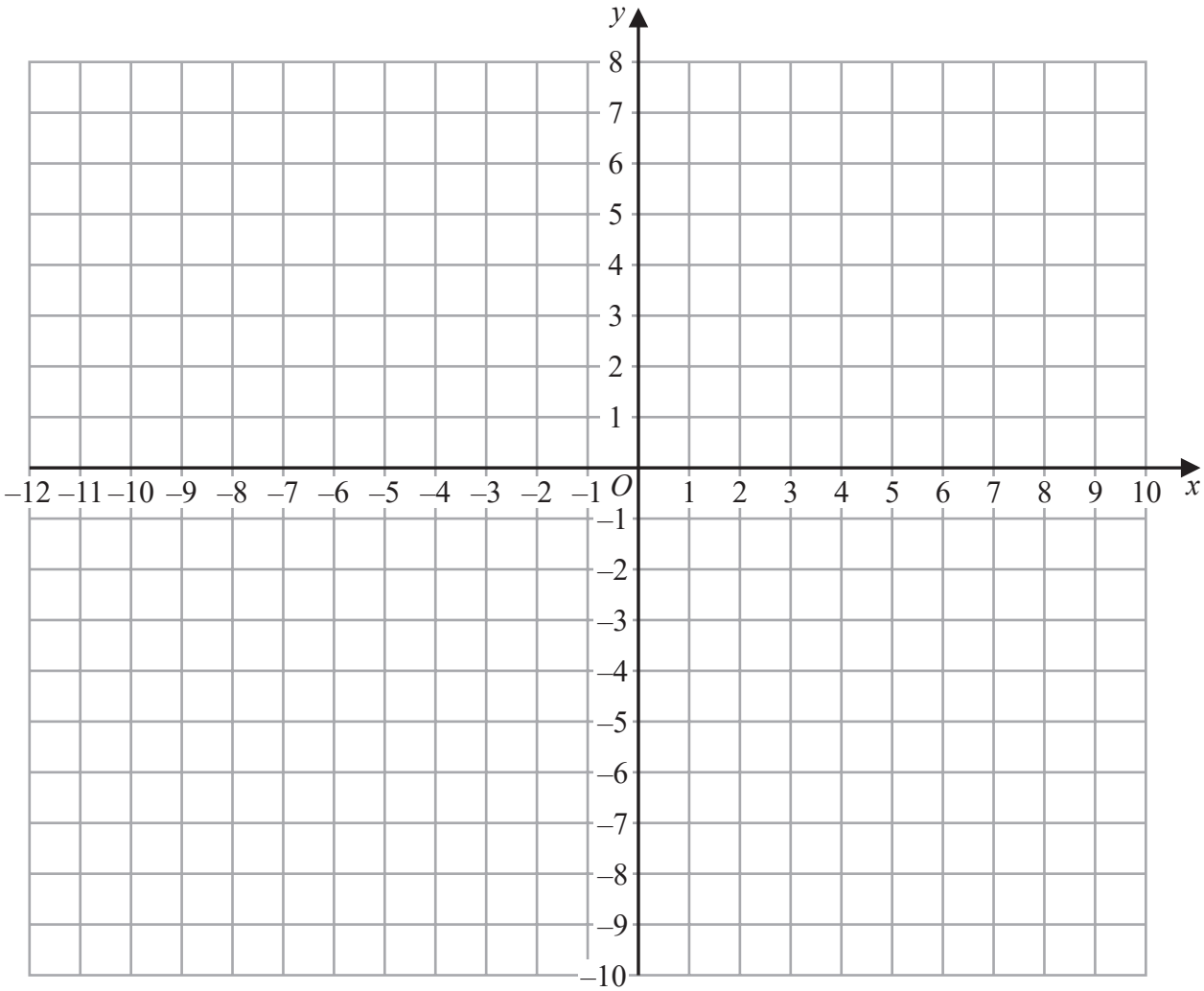
Question 9 continued



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

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Question 9 continued

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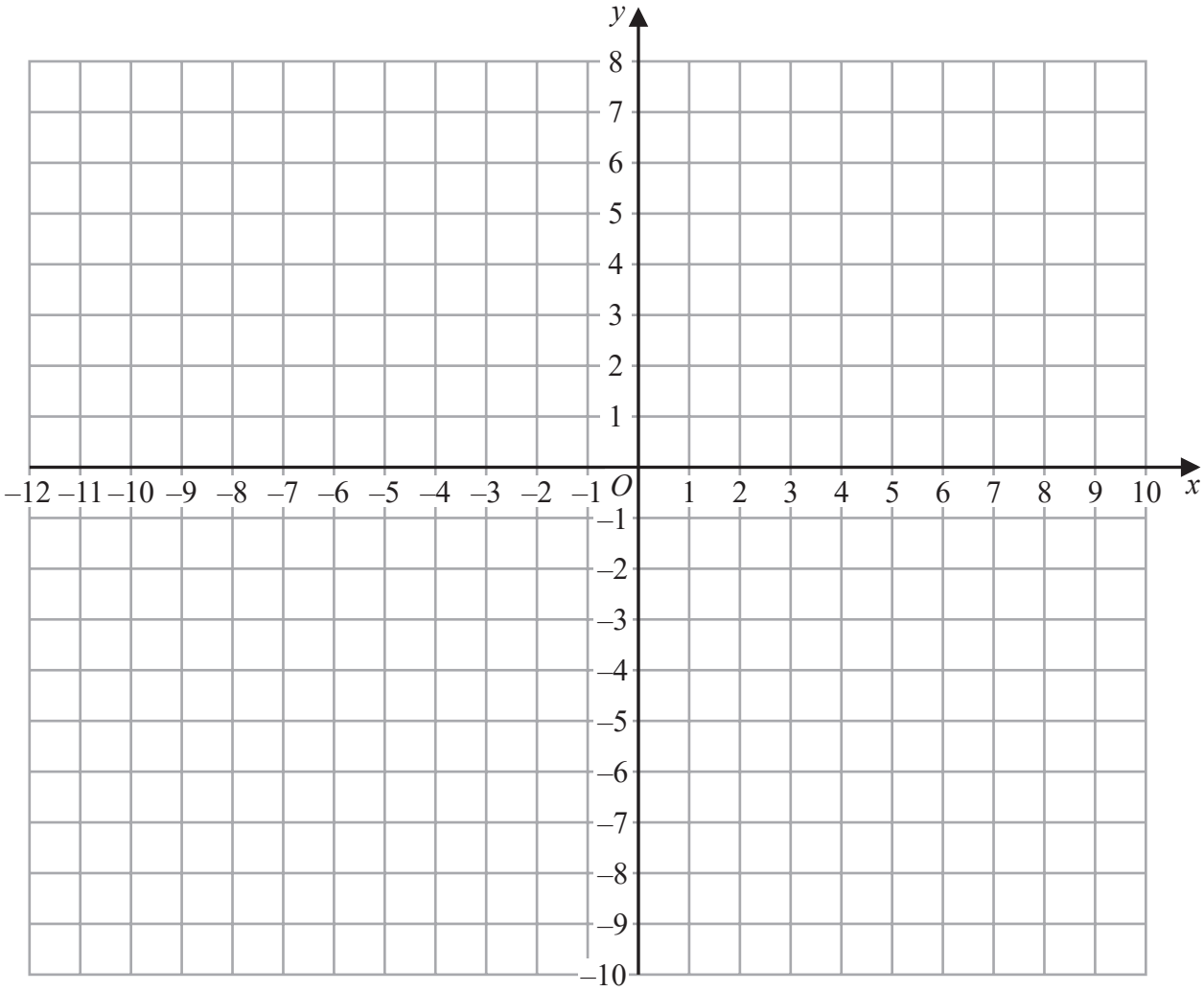

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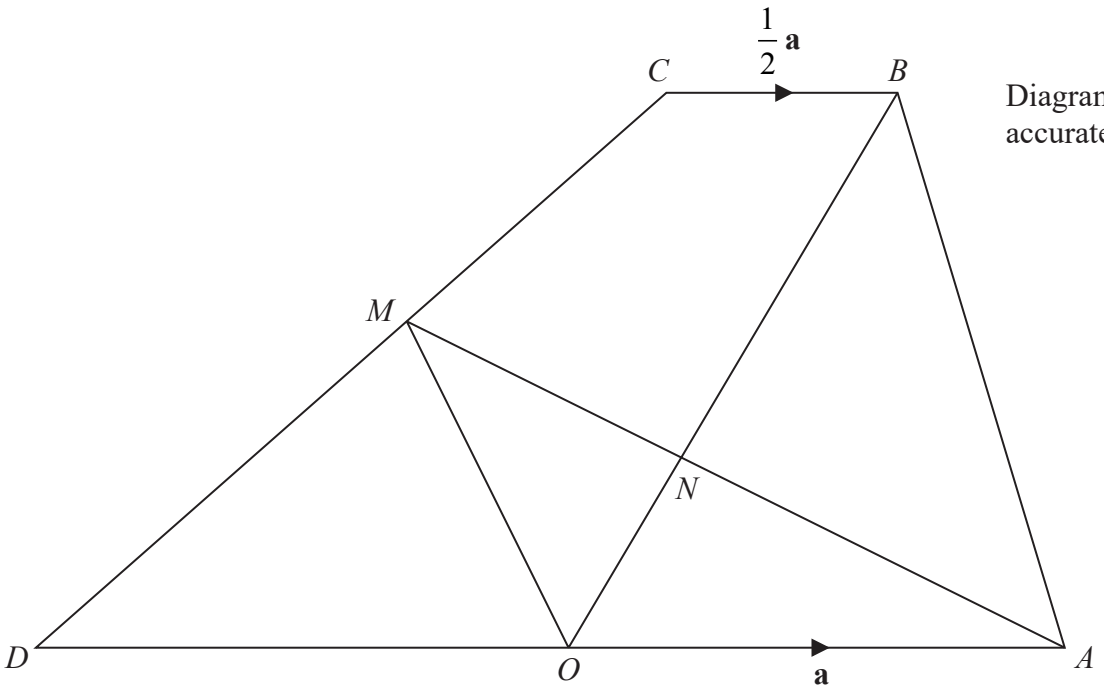

Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows trapezium $ABCD$ in which the point O is the midpoint of AD and the point M is the midpoint of CD.

Given that $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{CB} = \frac{1}{2}\mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$,

(a) find, in terms of **a** and **b**, simplifying your answers where possible,

(i) $\overrightarrow{AB}$ (ii) $\overrightarrow{AC}$ (iii) $\overrightarrow{CD}$ (iv) $\overrightarrow{AM}$

(7)

The lines OB and AM intersect at N so that $\overrightarrow{AN} = \lambda\overrightarrow{AM}$ and $\overrightarrow{ON} = \mu\overrightarrow{OB}$, where λ and μ are positive constants.

(b) (i) Find and simplify an expression in terms of **a**, **b** and λ for $\overrightarrow{ON}$

(2)

(ii) Hence find the value of λ and the value of μ

(4)

The area of triangle OAB is 14 square units.

(c) Find the area of triangle BNA.

(1)

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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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11 Part of the curve with equation $y = x^2 - 5x + 3$ is drawn on the grid.

The equation of another curve is $y = -\frac{x^3}{6} + \frac{6x^2}{5} - \frac{3x}{2}$

(a) Complete the table of values for $y = -\frac{x^3}{6} + \frac{6x^2}{5} - \frac{3x}{2}$

Give your values of y to 2 decimal places.

x	0	0.5	1	2	3	4	4.5	5
y	0	–0.47			1.8			1.67

(3)

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

(3)

(c) Use the two curves on the grid to find an estimate, to 2 decimal places, of the range of positive values of x for which $\frac{x^3}{6} - \frac{x^2}{5} - \frac{7x}{2} + 3 < 0$

Show your working clearly.

(4)

For positive values of x, the two curves on the grid intersect at the points P and Q.

(d) Find an estimate, to 1 decimal place, of the gradient of the straight line through P and Q.

(2)

The equation of the straight line through P and Q has the form $y = ax + b$

(e) Find, to 1 decimal place, the value of b.

(2)

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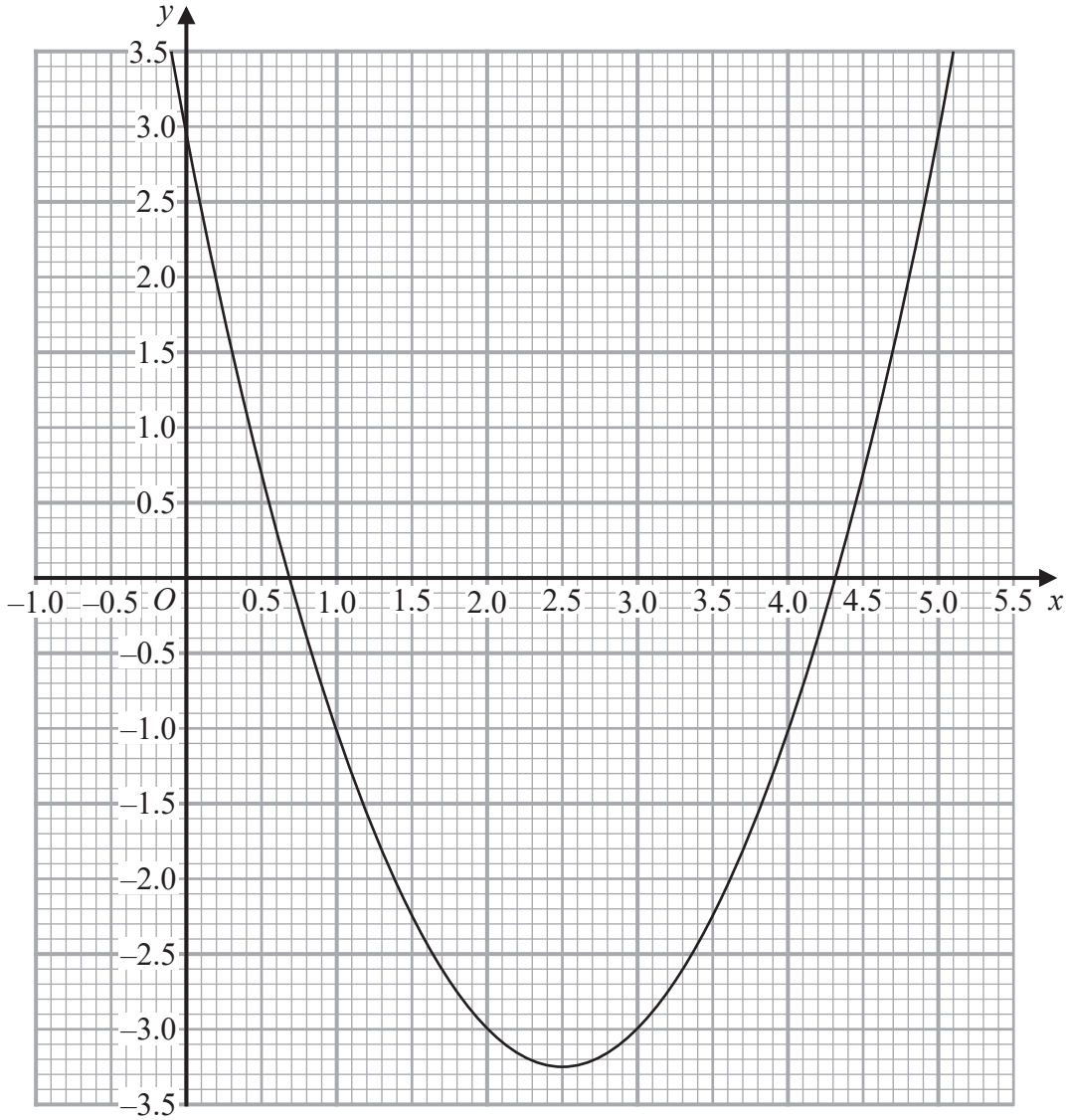
Question 11 continued



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

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Question 11 continued

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Question 11 continued

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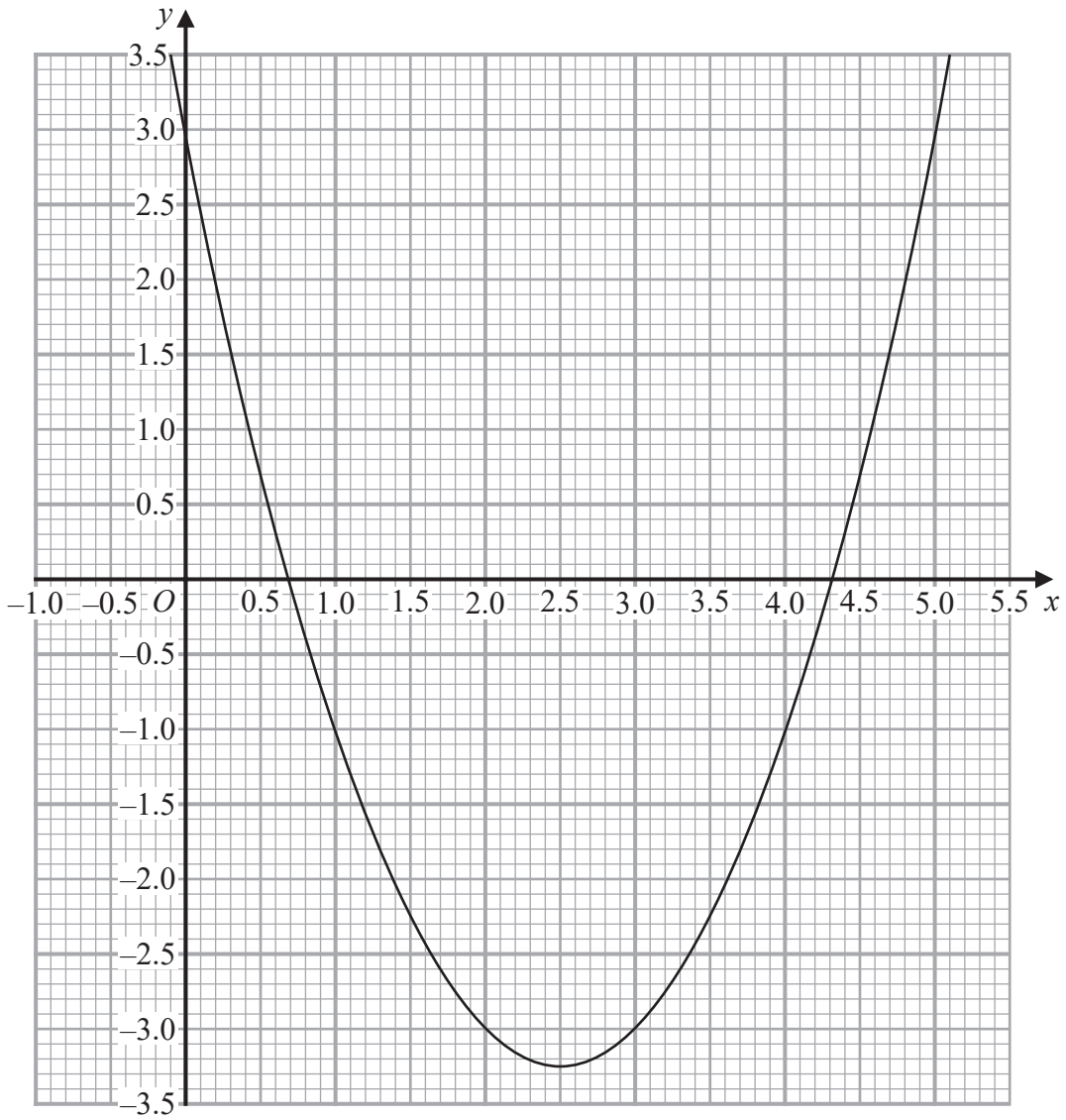

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Question 11 continued

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