

4MB1 | 2023 | May/June | Paper 2 | GradeMax

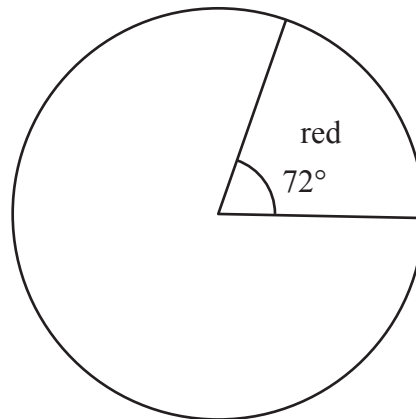
Answer all TWELVE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1

Colour	Number of bricks
red	
yellow	
green	50
Total	130



A bag contains red bricks, yellow bricks and green bricks only.
The incomplete table and an incomplete pie chart give information about the colours of the bricks in the bag.

(a) Find the number of red bricks.

(2)

A box contains 9 red bricks and 6 green bricks only.

Asha takes a brick from the bag and a brick from the box.

(b) Complete the tree diagram opposite.

(2)

(c) Calculate the probability that exactly one of the bricks is green.

(2)

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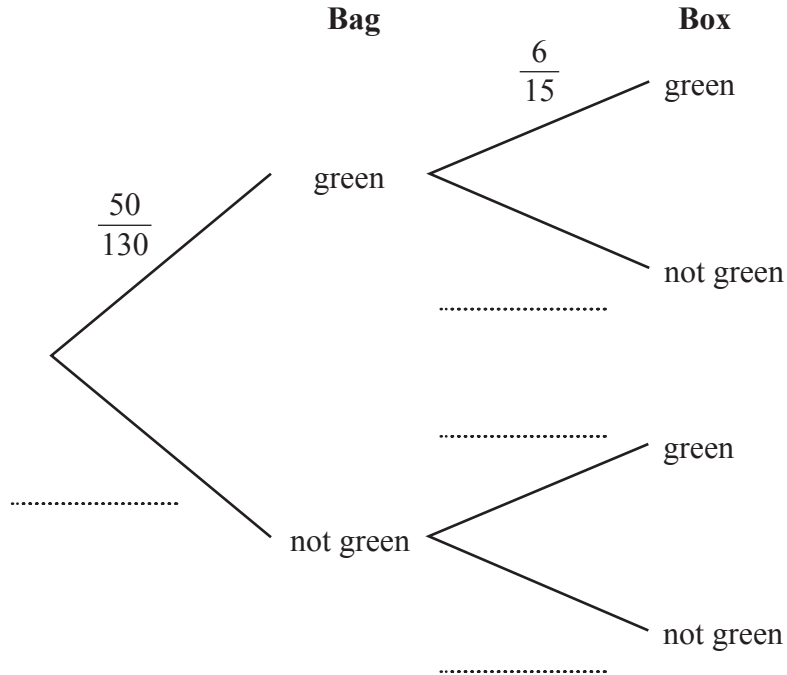


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Question 1 continued



(Total for Question 1 is 6 marks)



- 2 A farmer grows 300 pumpkins.

The pumpkins are small or medium or giant.

It cost the farmer \$1.25 to grow each small pumpkin.

He sells each small pumpkin for \$1.30

- (a) Calculate the percentage profit the farmer makes on each small pumpkin he sells. (2)

The farmer sells each medium pumpkin for 20% more than he sells each small pumpkin.

- (b) Calculate the price, in \$, that the farmer sells each medium pumpkin for. (2)

Of the 300 pumpkins, 28% are small.

- (c) Calculate the number of small pumpkins the farmer grows. (2)

The remaining pumpkins are medium or giant.

The ratio of medium pumpkins to giant pumpkins is 3 : 5

- (d) Calculate the number of giant pumpkins the farmer grows. (2)

The farmer sells all of his giant pumpkins for the same price.

The farmer's profit from giant pumpkins is

30% of the selling price of the first 50 giant pumpkins sold,

60% of the selling price of the next 40 giant pumpkins sold,

90% of the selling price of the remaining giant pumpkins sold.

- (e) Calculate the percentage of the total selling price of the giant pumpkins that is the farmer's profit from giant pumpkins. (4)
Give your answer to the nearest whole number.

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Question 2 continued

Handwriting practice area with horizontal dotted lines.

(Total for Question 2 is 12 marks)



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(continued from page 10)



4 Each interior angle of a regular polygon is 172°

(a) Calculate the number of sides of the polygon.

(2)

The length of each side of the regular polygon is 5.2 cm to 2 significant figures.

(b) Calculate, in cm^2 to 3 significant figures, the upper bound of the area of the polygon.

(6)

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Sum of interior angles of polygon
 $(2n - 4)$ right angles



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(continued from page 10)



5 Part of the curve C with equation $y = -\frac{1}{2}x^2 + x + \frac{7}{2}$ is drawn on the grid.

- (a) By drawing a suitable straight line on the grid, find estimates, to one decimal place, for the solutions of the equation

$$-\frac{1}{2}x + 1 + \frac{1}{2}x^{-1} = 0 \quad (2)$$

The equation of curve D is given by

$$y = x^3 + x^2 - 3x$$

- (b) Complete the table of values for $y = x^3 + x^2 - 3x$, giving your values to 2 decimal places where necessary.

x	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
y	2		3	1.63	0	-1.13			6

(2)

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

(2)

Curve C and curve D intersect twice in the range $-2 \leq x \leq 2$

- (d) (i) Write down the coordinates, to one decimal place, of these 2 points of intersection.

(1)

- (ii) Work out the equation of the line that passes through these 2 points of intersection.

Give your answer in the form $y = mx + c$ where the values of m and c are given to one decimal place.

Show your working clearly.

(3)

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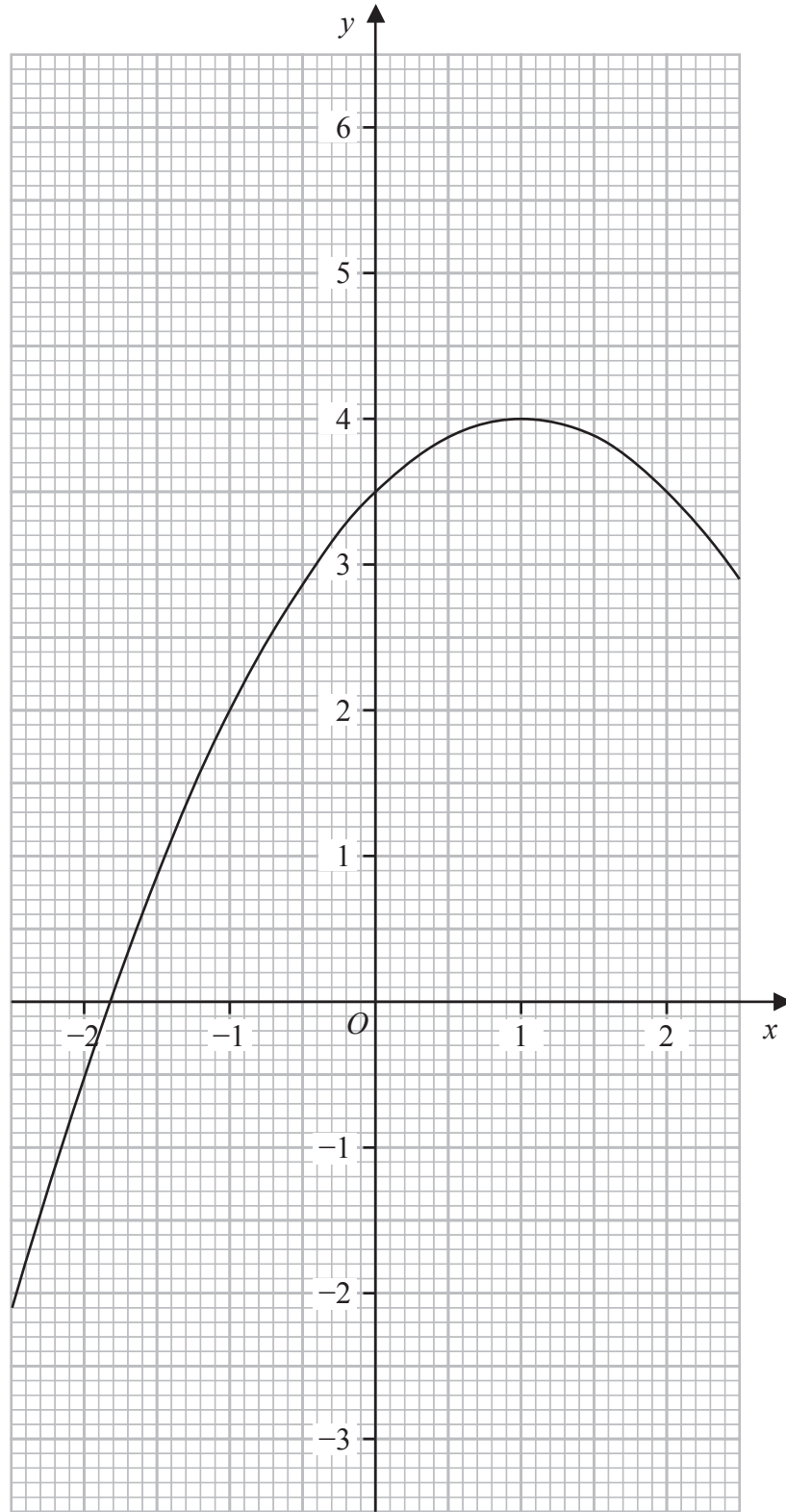
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Question 5 continued



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



Question 5 continued

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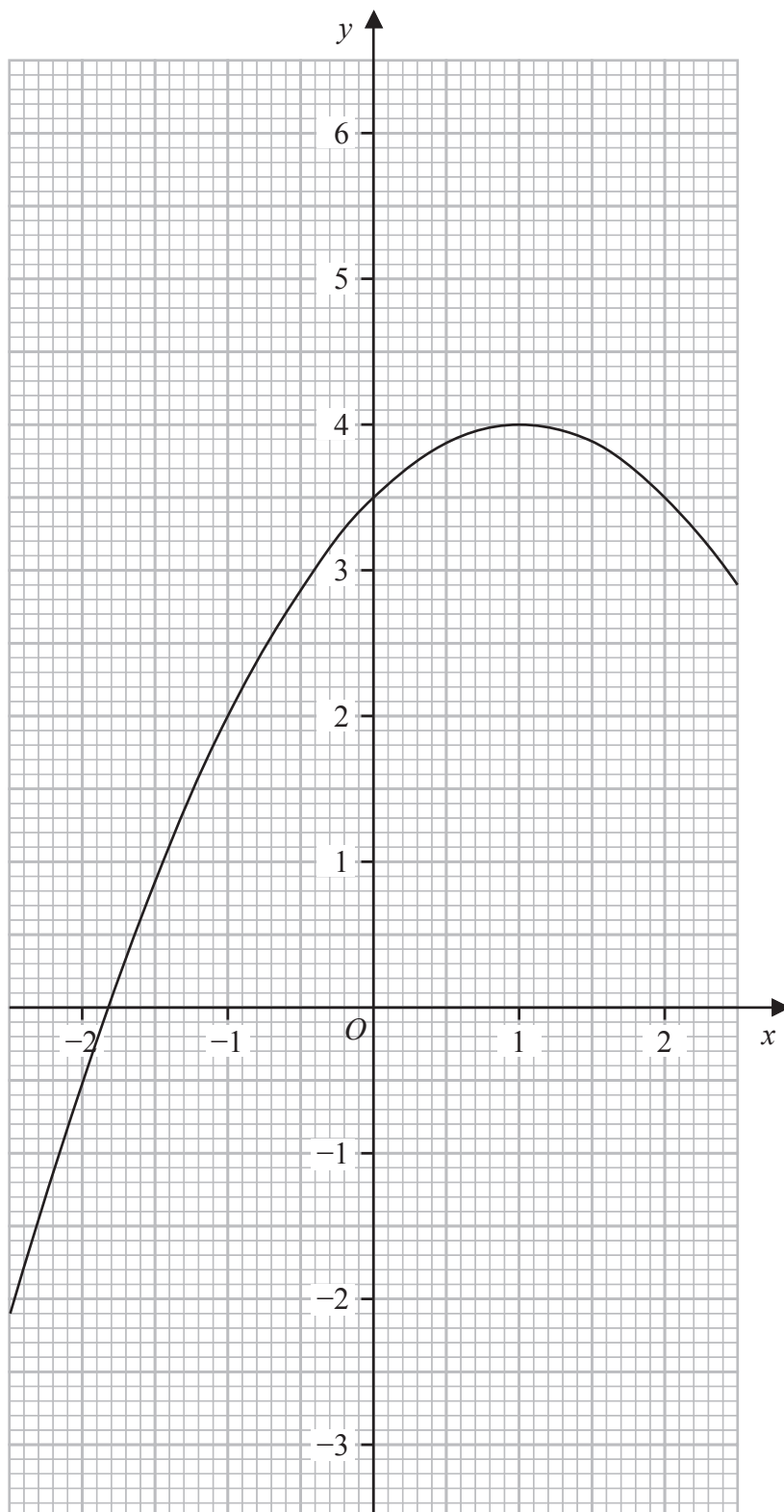
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Question 5 continued

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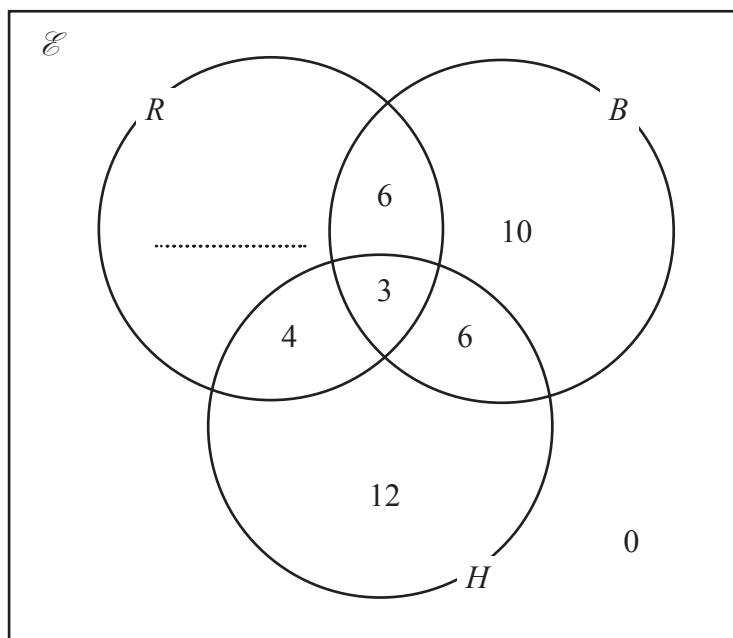
(Total for Question 5 is 10 marks)



- 6 The Venn diagram shows information about the numbers of students who play Rugby (R), Basketball (B) or Hockey (H).

The number of students who do not play Basketball is 35

- (a) Use this information to complete the Venn diagram.



(1)

- (b) Find

(i) $n(H \cap B)$

(1)

(ii) $n(H \cup B)$

(1)

(iii) $n([R' \cap B] \cup H)$

(1)

One of the students is selected at random.

Given that this student plays Hockey,

- (c) calculate the probability that they also play Rugby.

Give your answer in the form $\frac{m}{n}$ where m and n are integers.

(2)

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Question 6 continued

Handwriting practice area with 20 horizontal dotted lines.

(Total for Question 6 is 6 marks)



7 The functions f , g and h are defined as

$$f : x \mapsto x^2 - 2x$$

$$g : x \mapsto 1 + \frac{2}{x} \quad x \neq 0$$

$$h : x \mapsto \frac{5x - 4}{x + 3} \quad x \neq -3$$

(a) Find $f(-3)$

(1)

(b) Find the inverse function h^{-1} , giving your answer in the form $h^{-1} : x \mapsto \dots$

(3)

(c) Solve $fg(x) = \frac{x}{54} - 1$

(4)

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Question 7 continued

Handwriting practice area with 20 horizontal dotted lines.

(Total for Question 7 is 8 marks)



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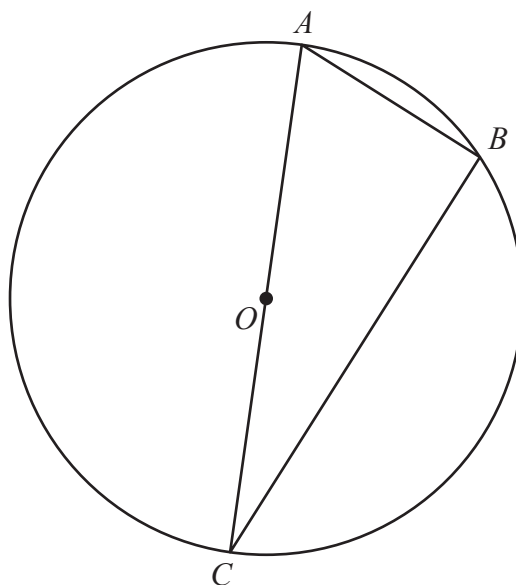


Diagram **NOT**
accurately drawn

Figure 1

Figure 1 shows three points A , B and C on a circle with centre O where AOC is a diameter of the circle.

The length of AB is 2 cm less than the length of BC

Given that $AC \leq \frac{5}{4}BC$

calculate the range of possible values for the length, in cm to one decimal place, of BC

(7)

$$\left[\text{Solutions of } ax^2 + bx + c = 0 \text{ are } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \right]$$

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Question 8 continued

Handwriting practice area with 20 horizontal dotted lines.

(Total for Question 8 is 7 marks)



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Question 9 continued

Handwriting practice area with horizontal dotted lines.

(Total for Question 9 is 8 marks)



10 Triangle A and triangle B are drawn on the grid opposite.

- (a) Describe fully the single transformation that maps triangle A onto triangle B (3)

Triangle A is transformed to triangle C under an enlargement with scale factor 3 and centre of enlargement $(6, -2)$

- (b) On the grid, draw and label triangle C (2)

Triangle A is transformed to triangle D under a reflection in the line with equation $y = -3$

- (c) On the grid, draw and label triangle D (2)

Triangle B is transformed to triangle E under the transformation with matrix $\mathbf{P}$ where

$$\mathbf{P} = \begin{pmatrix} -k & 1 \\ k-3 & 0 \end{pmatrix}$$

Triangle E is transformed to triangle F under the transformation with matrix $\mathbf{Q}$ where

$$\mathbf{Q} = \begin{pmatrix} k & 1 \\ k^2 - 1 & k \end{pmatrix}$$

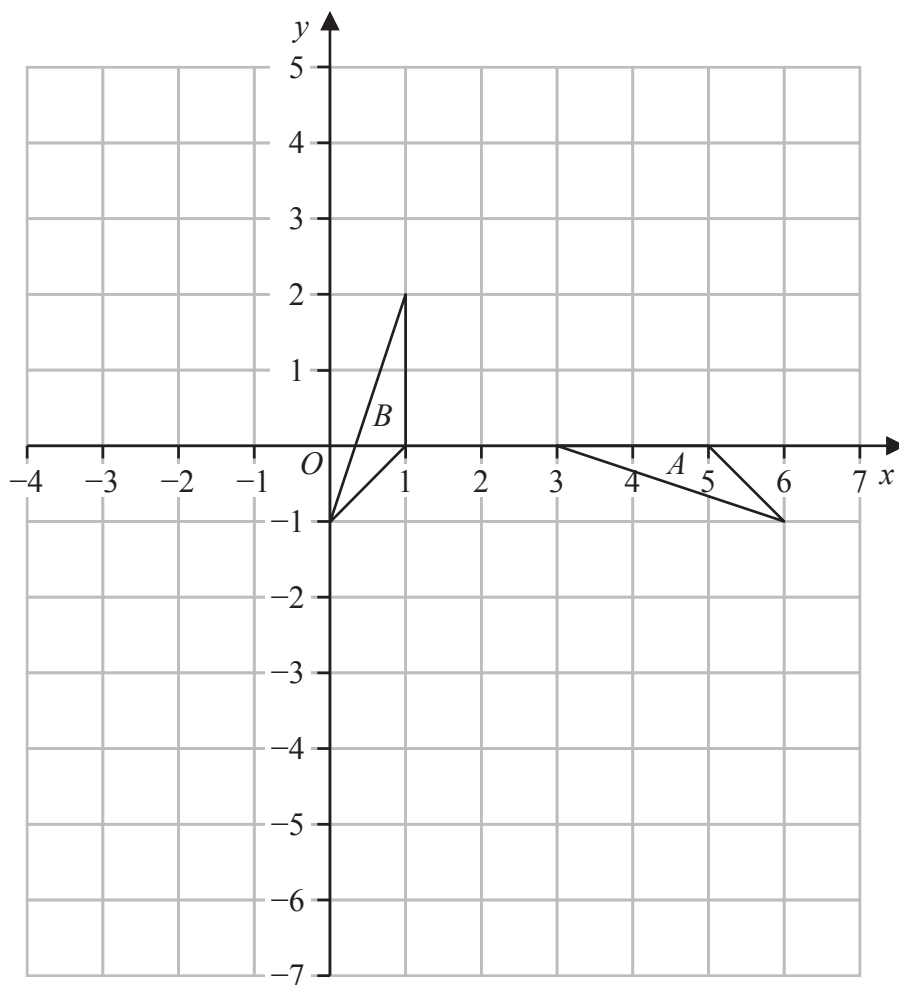
Triangle F is the image of triangle B under the matrix $\mathbf{N}$

Given that the determinant of $\mathbf{N}$ is 2

- (d) find the coordinates of the vertices of triangle F (7)

$$\left[\text{Determinant of matrix } \begin{pmatrix} a & b \\ c & d \end{pmatrix} = ad - bc \right]$$

Question 10 continued



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



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Question 10 continued

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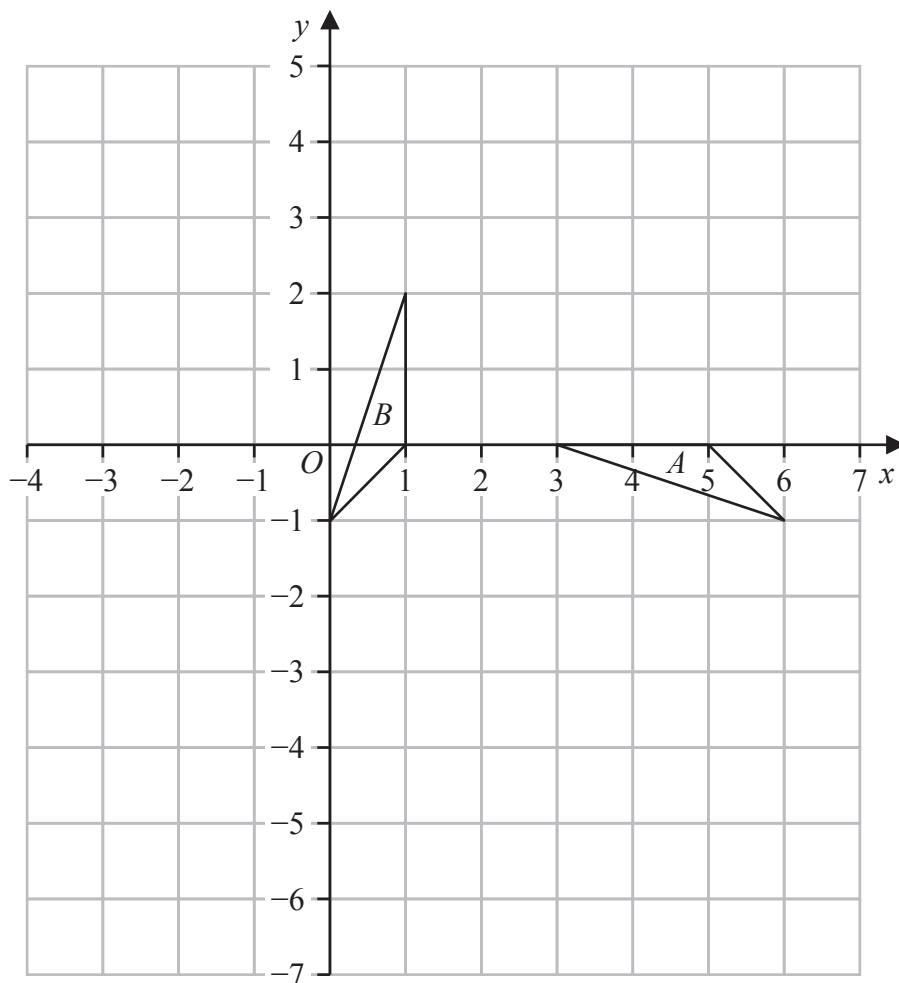
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Question 10 continued

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(Total for Question 10 is 14 marks)



(2)

$$y = 4 + 10t - 6t^2$$

(2)

$$d = 4t + 5t^2 - 2t^3 \quad t \geq 0$$

(5)

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Solutions of $ax^2 + bx + c = 0$ are $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

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Question 11 continued

Handwriting practice area with 20 horizontal dotted lines.

(Total for Question 11 is 9 marks)



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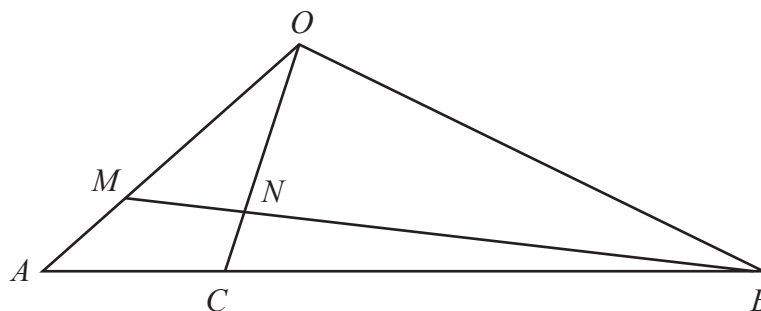
Diagram **NOT**
accurately drawn**Figure 2**

Figure 2 shows the triangle OAB in which $\vec{OA} = 3\mathbf{a}$ and $\vec{OB} = 15\mathbf{b}$

C is the point on AB such that $\vec{AC} = \frac{1}{3} \vec{AB}$

N is the point on OC such that $\vec{ON} = \frac{3}{4} \vec{OC}$

(a) Find and simplify an expression for $\vec{BN}$ in terms of $\mathbf{a}$ and $\mathbf{b}$

(3)

M is the point on OA such that B, N and M are collinear.

(b) Find the ratio $OM : MA$
Show your working clearly.

(5)

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Question 12 continued

Handwriting practice area with 20 horizontal dotted lines.

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TOTAL FOR PAPER IS 100 MARKS

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