Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE

Tuesday 6 June 2023

Afternoon (Time: 2 hours 30 minutes)

Paper reference **4MB1/02**

Mathematics B
PAPER 2

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of 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 7 2 9 2 0 A 0 1 3 2

Pearson

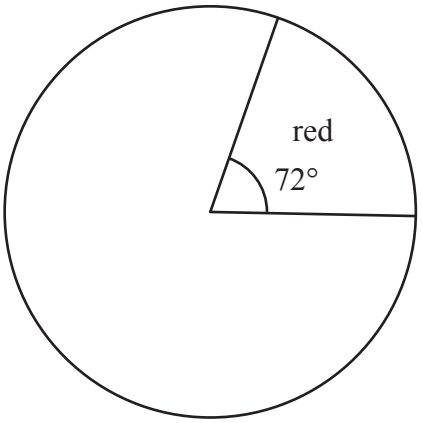
Answer all TWELVE questions.

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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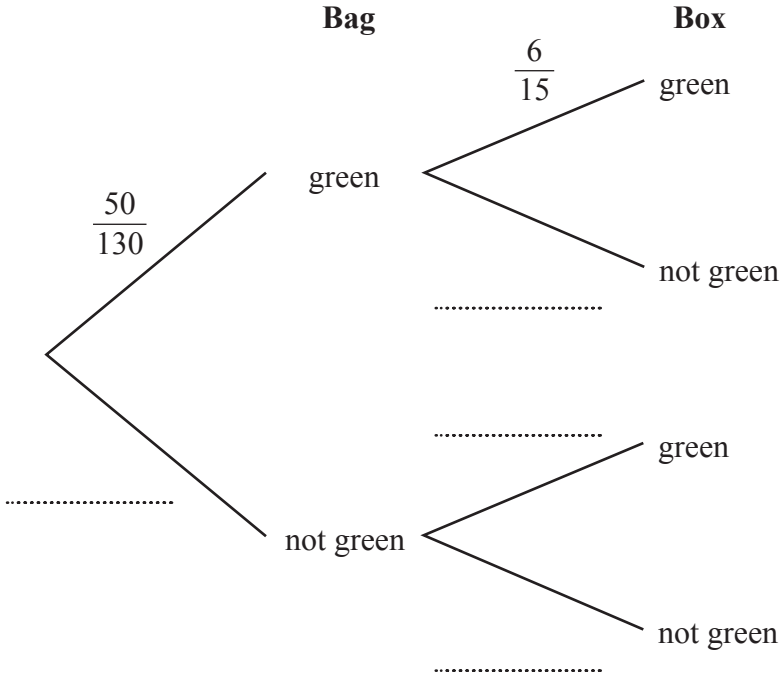
Question 1 continued



(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.
Give your answer to the nearest whole number.

(4)

Question 2 continued

(Total for Question 2 is 12 marks)

3 The table below shows information about the prices of secondhand cars for sale at a garage.

Price of secondhand car ($$x$)	**Frequency**
$6000 < x \leqslant 12000$	3
$12000 < x \leqslant 20000$	23
$20000 < x \leqslant 34000$	21
$34000 < x \leqslant 40000$	34
$40000 < x \leqslant 62000$	10

Calculate an estimate, in dollars, for the mean price of a secondhand car at this garage.

(4)

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Question 3 continued

(Total for Question 3 is 4 marks)

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)

$$\begin{bmatrix}\textbf{Sum of interior angles of polygon}\\ (2n-4) \text{ right angles}\end{bmatrix}$$

Question 4 continued

(Total for Question 4 is 8 marks)

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

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

(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 $-2 \leqslant x \leqslant 2$

(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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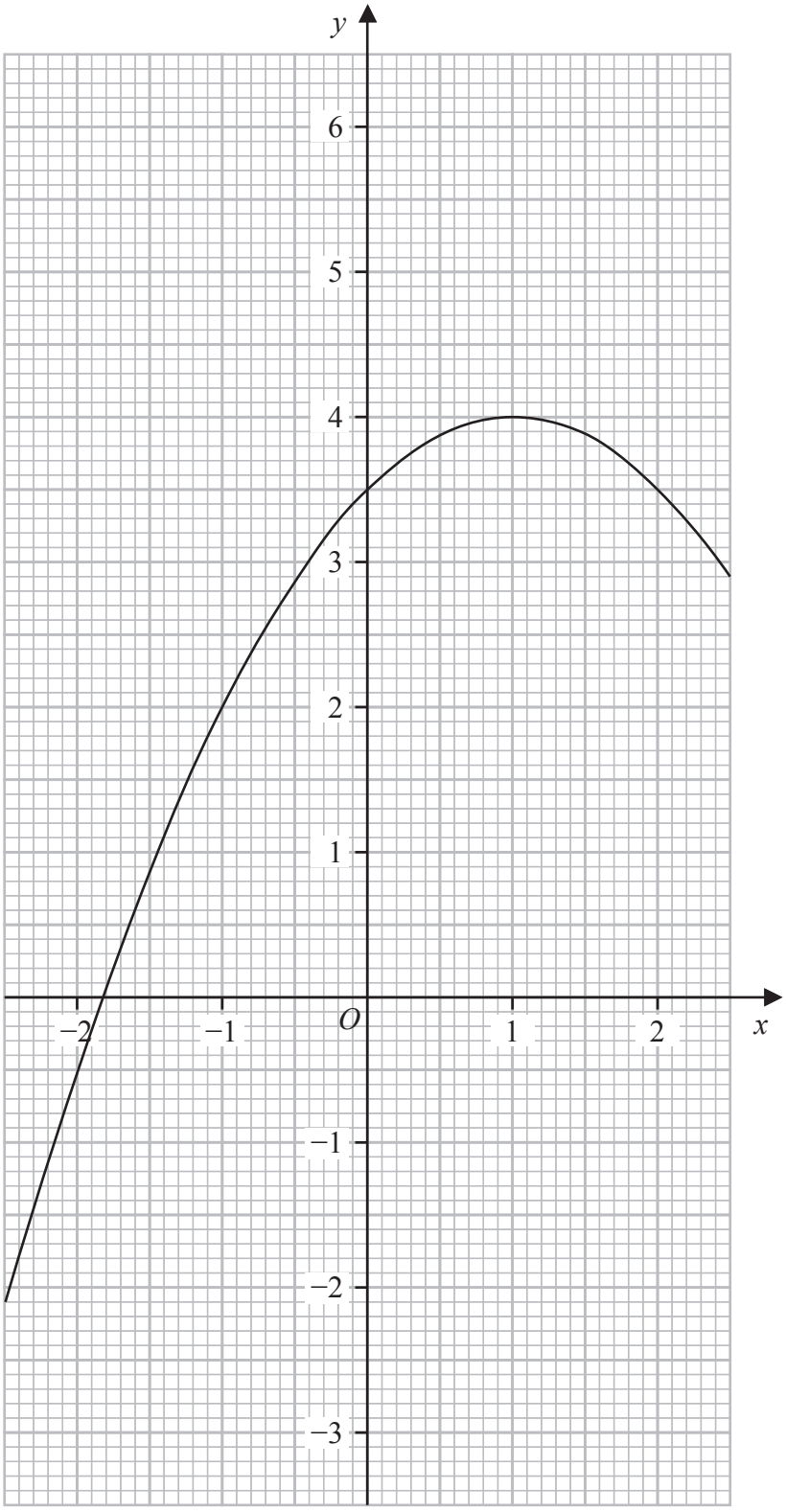
Question 5 continued

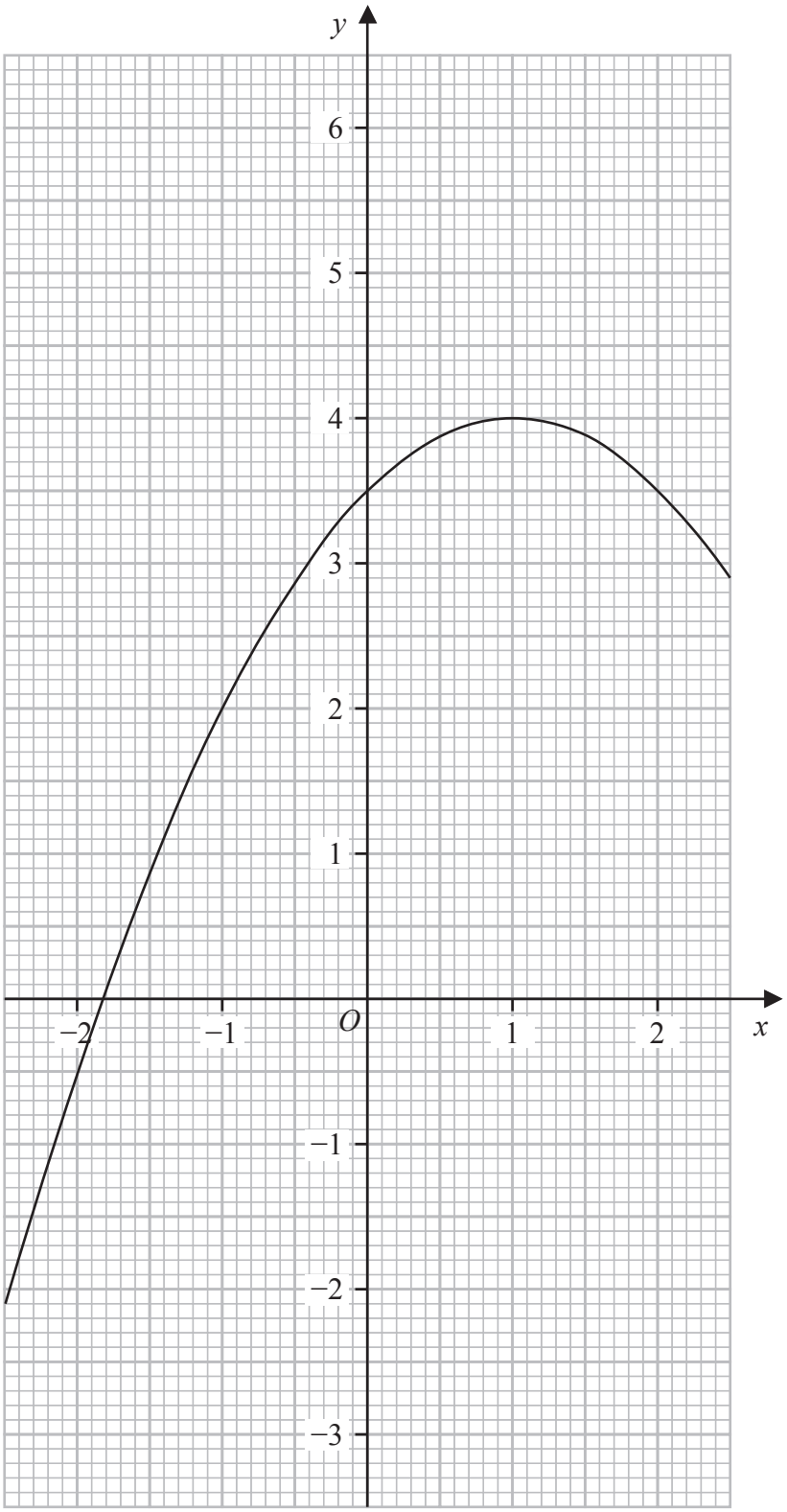


Turn over for a spare grid if you need to redraw your curve.

Question 5 continued

Question 5 continued

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

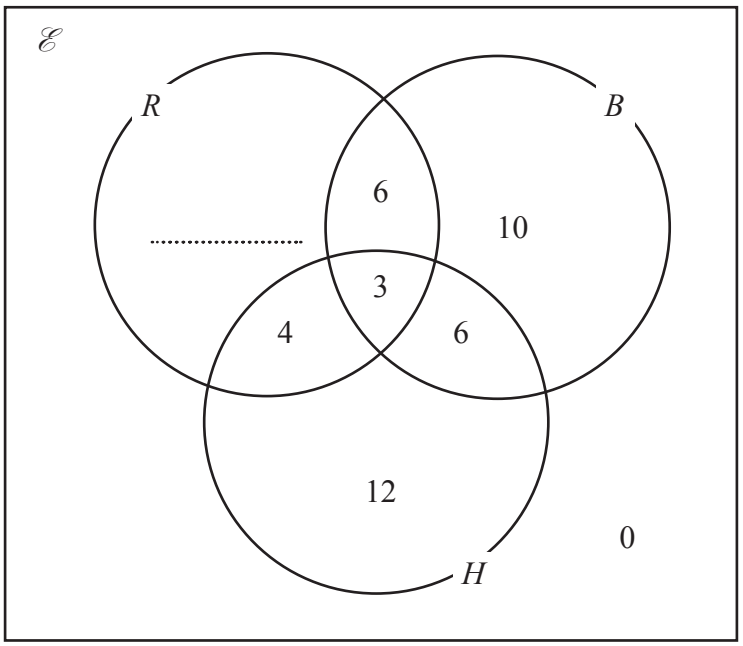


(Total for Question 5 is 10 marks)

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) $\mathrm{n}(H \cap B)$

(1)

(ii) $\mathrm{n}(H \cup B)$

(1)

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

(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

(Total for Question 6 is 6 marks)

7 The functions f, g and h are defined as

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

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

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

(a) Find $f(-3)$

(1)

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

(3)

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

(4)

Question 7 continued

(Total for Question 7 is 8 marks)

8

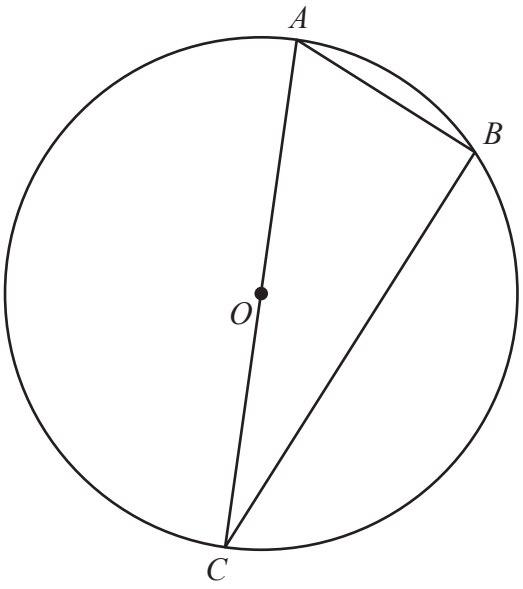

Diagram **NOT** accurately drawn

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 $AC \leqslant \frac{5}{4} BC$

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

(7)

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

Question 8 continued

(Total for Question 8 is 7 marks)

9 $f(x) = 3x^3 + ax^2 - 20x + b$ where a and b are integers.

$(x + 4)$ is a factor of $f(x)$
$(x - 2)$ is a factor of $f(x)$

(a) Use the factor theorem to find the value of a and the value of b

(3)

One solution of the equation $8x^3 - 18x^2 + 5x + 6 = 0$ is $\frac{3}{2}$

(b) Without using a calculator and showing all your working, find the other 2 solutions of the equation.
Give your answers in exact form.

(5)

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

Question 9 continued

(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 **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 **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 **N**

Given that the determinant of **N** is 2

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

(7)

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

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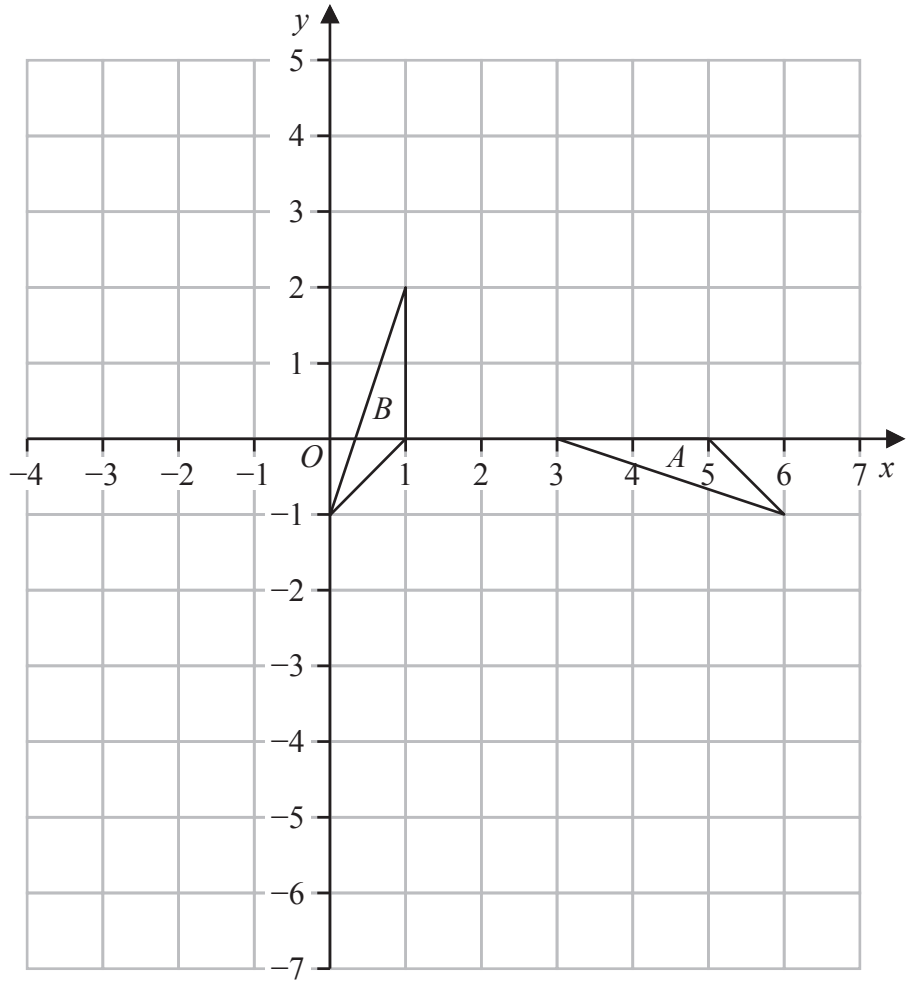
Question 10 continued



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Question 10 continued

Question 10 continued

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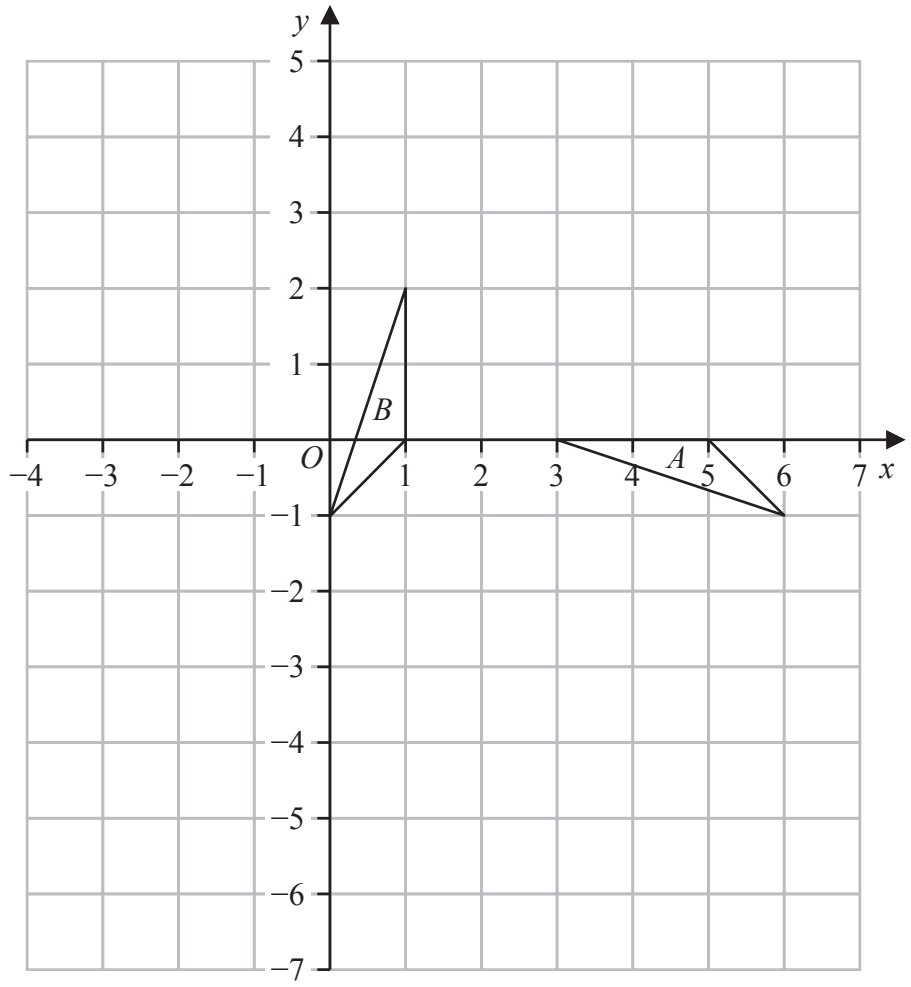

(Total for Question 10 is 14 marks)

11 (a) Differentiate $4 + 10t - 6t^2$

(2)

A rocket moves vertically so that at time t seconds, the velocity, v m/s is given by

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

(b) Find the time, in seconds, when the rocket stops accelerating vertically.

(2)

The vertical displacement, d metres, of the rocket at time t seconds, is given by

$$d = 4t + 5t^2 - 2t^3 \qquad t \geqslant 0$$

The rocket is launched from a height of k metres above horizontal ground.
The height, in metres, above ground when the rocket is first instantaneously at rest is 20 metres.

(c) Find the value of k

(5)

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

Question 11 continued

(Total for Question 11 is 9 marks)

12

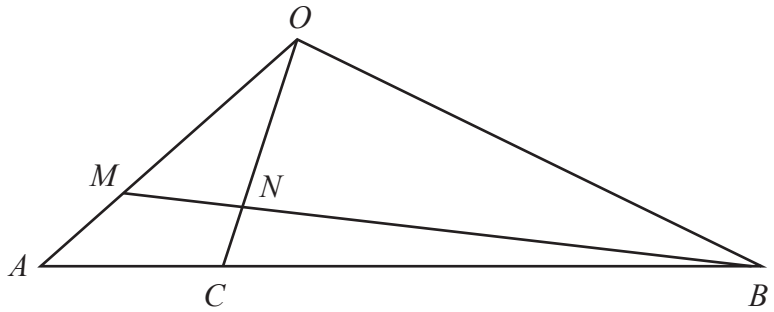

Diagram **NOT** accurately drawn

Figure 2

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

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

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

(a) Find and simplify an expression for $\overrightarrow{BN}$ in terms of **a** and **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)

Question 12 continued

Question 12 continued

(Total for Question 12 is 8 marks)

TOTAL FOR PAPER IS 100 MARKS

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