Pearson Edexcel International Advanced Level

Thursday 9 October 2025

Morning (Time: 1 hour 30 minutes)

Paper reference **WMA11/01A**

Mathematics

International Advanced Subsidiary/Advanced Level
Pure Mathematics P1
Question paper

You must have:
Answer book (sent separately).
Do not return this question paper with the answer book.

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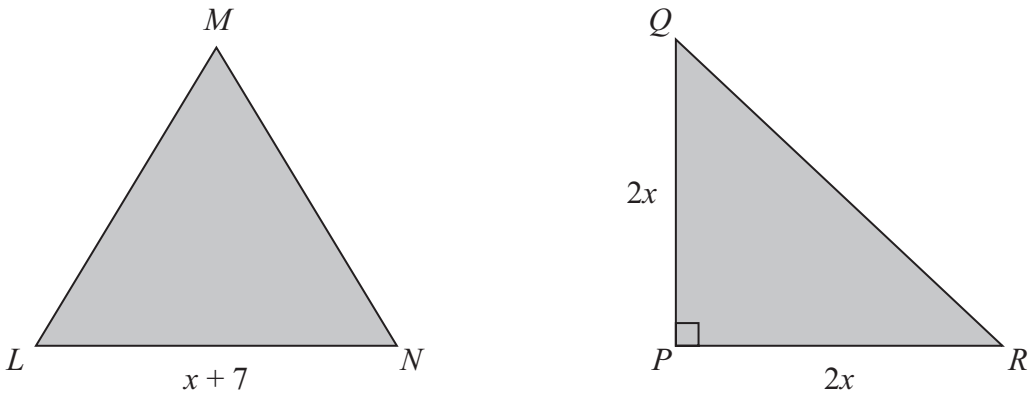


Figure 1

In this question you must show all stages of your working.
Solutions relying on calculator technology are not acceptable.

Figure 1 shows a sketch of a triangle *LMN* and a sketch of a triangle *PQR*.

Triangle *LMN* is an equilateral triangle with sides $(x + 7)$ cm.

Triangle *PQR* is a right-angled isosceles triangle with $PQ = PR = 2x$ cm and angle $QPR = 90°$

(a) Find, in its simplest form in terms of x, the length QR.

(2)

Given that the perimeter of triangle *LMN* is equal to the perimeter of triangle *PQR*,

(b) find the value of x, writing your answer in the form $a\sqrt{2} + b$, where a and b are integers.

(5)

(Total for Question 1 is 7 marks)

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2. **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

A curve has equation

$$y = x(x + 3)(x - 2)$$

(a) Find, in simplest form, $\frac{dy}{dx}$

(3)

(b) Hence find the range of values for x such that

$$\frac{dy}{dx} \geqslant 2$$

(4)

(Total for Question 2 is 7 marks)

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3. **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

Solve the equation

$$2y^2 + 1 = \frac{15}{y^2}$$

(5)

(Total for Question 3 is 5 marks)

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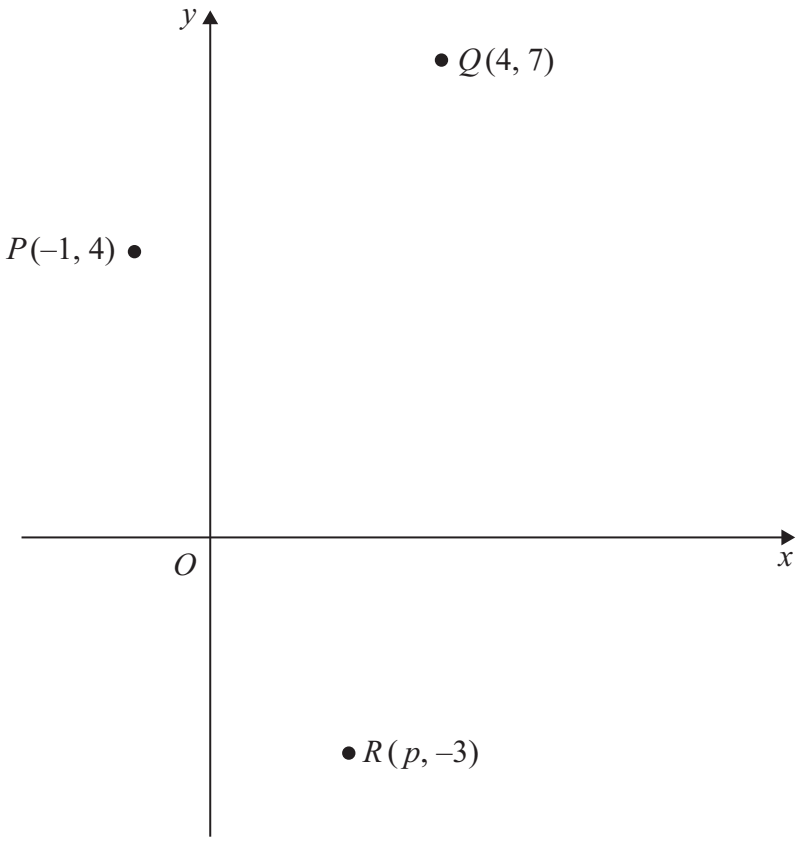


Figure 2

Figure 2 shows the points P, Q and R.

Points P and Q have coordinates $(-1, 4)$ and $(4, 7)$ respectively.

(a) Find an equation for the straight line passing through points P and Q.

Give your answer in the form $ax + by + c = 0$ where a, b and c are integers.

(3)

The point R has coordinates $(p, -3)$, where p is a positive constant.

Given that angle $QPR = 90°$,

(b) find the value of p.

(*Solutions relying on calculator technology are not acceptable.*)

(3)

(Total for Question 4 is 6 marks)

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5. Find

$$\int \frac{4\sqrt{x} - 3}{2x^2} \mathrm{d}x \qquad x > 0$$

writing the answer in its simplest form.

(5)

(Total for Question 5 is 5 marks)

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6. **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

The equation

$$k(3x^2 + 8x + 9) = 2 - 6x$$

where k is a real constant, has no real roots.

Find the range of possible values for k.

(7)

(Total for Question 6 is 7 marks)

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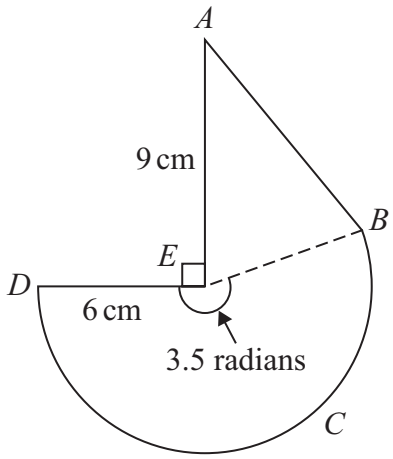


Diagram not drawn to scale

Figure 3

In this question you must show detailed reasoning.

Figure 3 shows the design for a company logo.

The design consists of a triangle *ABE* joined to a sector *BCDE* of a circle with radius 6 cm and centre *E*.
The line *AE* is perpendicular to the line *DE* and the length of *AE* is 9 cm.

The size of angle *DEB* is 3.5 radians, as shown in Figure 3.

(a) Find the length of the arc *BCD*.

(2)

Find, to one decimal place,

(b) the perimeter of the logo,

(3)

(c) the area of the logo.

(4)

(Total for Question 7 is 9 marks)

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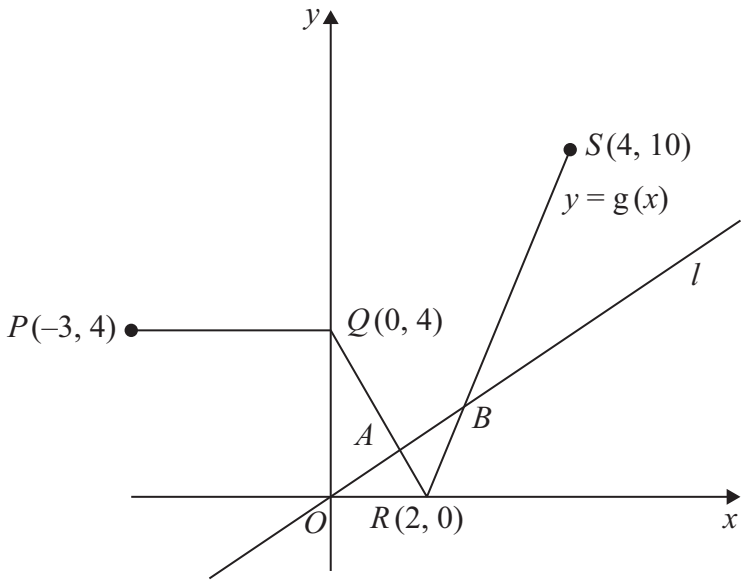


Figure 4

Figure 4 shows a sketch of the graph of $y = g(x)$, $-3 \leqslant x \leqslant 4$ and part of the line l with equation $y = \frac{1}{2}x$

The graph of $y = g(x)$ consists of three line segments, from $P(-3, 4)$ to $Q(0, 4)$, from $Q(0, 4)$ to $R(2, 0)$ and from $R(2, 0)$ to $S(4, 10)$.

The line l intersects $y = g(x)$ at the points A and B as shown in Figure 4.

(a) Use algebra to find the x coordinate of the point A and the x coordinate of the point B.
Show each step of your working and give your answers as exact fractions.

(6)

(b) Sketch the graph with equation

$$y = \frac{3}{2}g(x) \qquad -3 \leqslant x \leqslant 4$$

On your sketch show the coordinates of the points to which P, Q, R and S are transformed.

(2)

(Total for Question 8 is 8 marks)

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9. The curve C has equation $y = f(x)$, $x > 0$ where

$$f'(x) = 30 + \frac{6 - 5x^2}{\sqrt{x}}$$

Given that the point $P(4, -8)$ lies on C,

(a) find the equation of the normal to C at P, giving your answer in the form $y = mx + c$, where m and c are constants.

(4)

(b) Find $f(x)$, giving each term in its simplest form.

(5)

(Total for Question 9 is 9 marks)

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10. (a) On the axes in the answer book sketch and clearly label the graphs of

(i) $y = x(a - x)$

(ii) $y = x^2(b - x)$

where a and b are positive constants $b > a$

Show clearly the coordinates of all the points where the curves cross or meet the coordinate axes.

(5)

(b) Show that the x-coordinates of the points of intersection of

$$y = x(4 - x) \quad \text{and} \quad y = x^2(7 - x)$$

are given by the solutions to the equation

$$x(x^2 - 8x + 4) = 0$$

(2)

The point A lies on both of the curves and the x and y coordinates of A are both positive.

(c) Find the exact coordinates of A, leaving the answer in the form $\left(p + q\sqrt{3},\ r + s\sqrt{3}\right)$, where p, q, r and s are integers.

(*Solutions relying on calculator technology are not acceptable.*)

(5)

(Total for Question 10 is 12 marks)

TOTAL FOR PAPER IS 75 MARKS

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Please check the examination details below before entering your candidate information

Candidate surname StemUp Model Solution | Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Thursday 9 October 2025

Morning (Time: 1 hour 30 minutes)

Paper reference **WMA11/01A**

Mathematics

International Advanced Subsidiary/Advanced Level
Pure Mathematics P1
Answer Book

You must have:
Question paper (sent separately)
Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 10 questions in this question paper. The total mark for this paper is 75.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

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Question 1

Write the answer to Question 1 on these 2 pages

(a) $QR^2 = (2x)^2 + (2x)^2 = 4x^2 + 4x^2 = 8x^2$

$QR = \sqrt{(8x^2)} = \sqrt{8}\ x$

$QR = 2\sqrt{2}\ x$ cm

(b) Perimeter $LMN = 3(x + 7) = 3x + 21$

Perimeter $PQR = 2x + 2x + 2\sqrt{2}\ x = 4x + 2\sqrt{2}\ x$

$3x + 21 = 4x + 2\sqrt{2}\ x$

$21 = x + 2\sqrt{2}\ x$

$(1 + 2\sqrt{2})x = 21$

$$x = \frac{21}{1 + 2\sqrt{2}}$$

$$x = \frac{21}{(2\sqrt{2} + 1)} \times \frac{(2\sqrt{2} - 1)}{(2\sqrt{2} - 1)} = \frac{21(2\sqrt{2} - 1)}{8 - 1} = \frac{21(2\sqrt{2} - 1)}{7}$$

$x = 3(2\sqrt{2} - 1)$

$x = 6\sqrt{2} - 3$

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Question 1 continued

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(Total for Question 1 is 7 marks)

Question 2

Write the answer to Question 2 on these 2 pages

(a) $y = x(x + 3)(x - 2) = x(x^2 + x - 6) = x^3 + x^2 - 6x$

$\frac{dy}{dx} = 3x^2 + 2x - 6$

(b) $3x^2 + 2x - 6 \geq 2$

$3x^2 + 2x - 8 \geq 0$

Critical values: $3x^2 + 2x - 8 = 0 \Rightarrow (3x - 4)(x + 2) = 0$

$x = \frac{4}{3}$, $x = -2$

Positive x^2 coefficient, so ≥ 0 outside the roots:

$x \leq -2$ or $x \geq \frac{4}{3}$

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Question 2 continued

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(Total for Question 2 is 7 marks)

Question 3

Write the answer to Question 3 on these 2 pages

$2y^2 + 1 = \frac{15}{y^2}$

Multiply by y^2: $2y^4 + y^2 = 15$

$2y^4 + y^2 - 15 = 0$

$(2y^2 - 5)(y^2 + 3) = 0$

$y^2 = \frac{5}{2}$ or $y^2 = -3$ (no real solutions)

$y = \pm\sqrt{\left(\frac{5}{2}\right)} = \pm\frac{\sqrt{5}}{\sqrt{2}} = \pm\frac{\sqrt{10}}{2}$

$y = \frac{\sqrt{10}}{2}$ or $y = -\frac{\sqrt{10}}{2}$

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Question 3 continued

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(Total for Question 3 is 5 marks)

Question 4

Write the answer to Question 4 on these 2 pages

(a) Gradient $PQ = \frac{7-4}{4-(-1)} = \frac{3}{5}$

$y - 4 = \frac{3}{5}(x - (-1))$

$5y - 20 = 3x + 3$

$3x - 5y + 23 = 0$

(b) Angle QPR = 90°, so PR is perpendicular to PQ

Gradient $PR = -\frac{5}{3}$

$\frac{-3-4}{p-(-1)} = -\frac{5}{3} \Rightarrow \frac{-7}{p+1} = -\frac{5}{3}$

$21 = 5(p + 1)$

$21 = 5p + 5 \Rightarrow 5p = 16$

$p = \frac{16}{5}$

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Question 4 continued

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(Total for Question 4 is 6 marks)

Question 5

Write the answer to Question 5 on these 2 pages

$$\frac{4\sqrt{x}-3}{2x^2} = \frac{4x^{1/2}}{2x^2} - \frac{3}{2x^2} = 2x^{-3/2} - \frac{3}{2}x^{-2}$$

$$\int \frac{4\sqrt{x}-3}{2x^2}\,dx = \int \left(2x^{-3/2} - \frac{3}{2}x^{-2}\right) dx$$

$$= \frac{2x^{-1/2}}{-1/2} - \frac{3}{2} \times \frac{x^{-1}}{-1} + c$$

$$= -4x^{-1/2} + \frac{3}{2}x^{-1} + c$$

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Question 5 continued

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(Total for Question 5 is 5 marks)

Question 6

Write the answer to Question 6 on these 2 pages

$k(3x^2 + 8x + 9) = 2 - 6x$

$3kx^2 + 8kx + 9k - 2 + 6x = 0$

$3kx^2 + (8k + 6)x + (9k - 2) = 0$

$a = 3k, \quad b = 8k + 6, \quad c = 9k - 2$

No real roots: $b^2 - 4ac < 0$

$(8k + 6)^2 - 4(3k)(9k - 2) < 0$

$64k^2 + 96k + 36 - 108k^2 + 24k < 0$

$-44k^2 + 120k + 36 < 0$

$11k^2 - 30k - 9 > 0$

Critical values: $11k^2 - 30k - 9 = 0 \Rightarrow (11k + 3)(k - 3) = 0$

$k = -\frac{3}{11}, \quad k = 3$

Positive k^2 coefficient, so > 0 outside the roots:

$k < -\frac{3}{11}$ or $k > 3$

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Question 6 continued

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(Total for Question 6 is 7 marks)

Question 7

Write the answer to Question 7 on these 2 pages

(a) Arc BCD $= r\theta = 6 \times 3.5 = 21$ cm

(b) Angle AEB $= 2\pi - \frac{\pi}{2} - 3.5 = \frac{3\pi}{2} - 3.5 = 1.212388...$ rad

Cosine rule: $AB^2 = 9^2 + 6^2 - 2 \times 9 \times 6 \cos\left(\frac{3\pi}{2} - 3.5\right)$

$AB^2 = 117 - 108 \times 0.350783... = 79.115411...$

$AB = 8.894684...$ cm

Perimeter = AE + ED + arc BCD + AB

$= 9 + 6 + 21 + 8.894684... = 44.894684...$

Perimeter = 44.9 cm (1 d.p.)

(c) Area of triangle ABE $= \frac{1}{2} \times 6 \times 9 \times \sin\left(\frac{3\pi}{2} - 3.5\right) = 25.284330...$

Area of sector BCDE $= \frac{1}{2} \times 6^2 \times 3.5 = 63$

Area of logo $= 25.284330... + 63 = 88.284330...$

Area = 88.3 cm^2 (1 d.p.)

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Question 7 continued

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(Total for Question 7 is 9 marks)

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Question 8

Write the answer to Question 8 on these 4 pages

(a) Line QR: gradient $= \frac{0-4}{2-0} = -2$, so $y = -2x + 4$

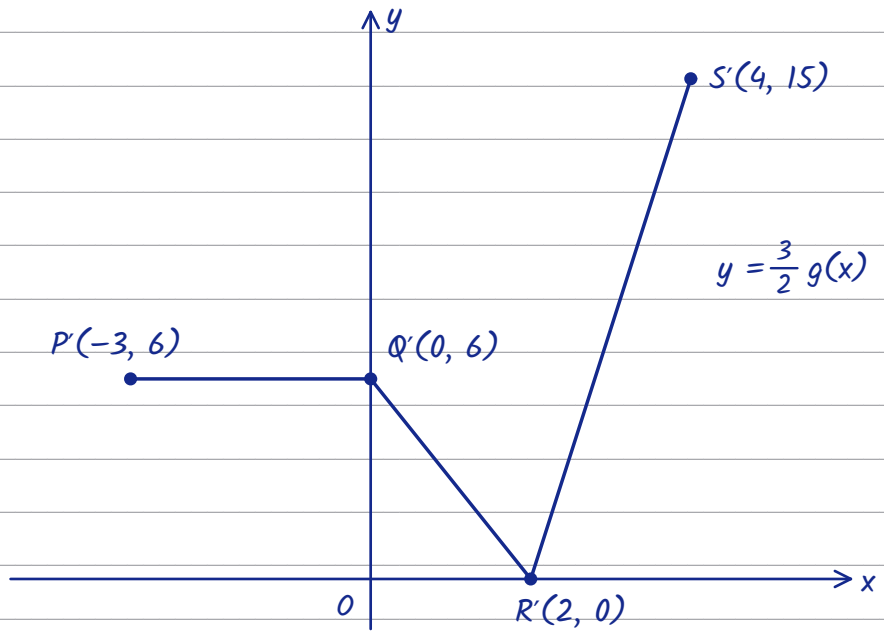
A: $\frac{1}{2}x = -2x + 4 \Rightarrow \frac{5}{2}x = 4 \Rightarrow x = \frac{8}{5}$

Line RS: gradient $= \frac{10-0}{4-2} = 5$, so $y - 0 = 5(x - 2)$, $y = 5x - 10$

B: $\frac{1}{2}x = 5x - 10 \Rightarrow \frac{9}{2}x = 10 \Rightarrow x = \frac{20}{9}$

x coordinate of A $= \frac{8}{5}$, x coordinate of B $= \frac{20}{9}$

(b) $y = \frac{3}{2}g(x)$: stretch parallel to the y-axis, scale factor $\frac{3}{2}$



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Question 8 continued

Question 8 continued

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Question 8 continued

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(Total for Question 8 is 8 marks)

Question 9

Write the answer to Question 9 on these 2 pages

(a) $f'(4) = 30 + \frac{6 - 5 \times 4^2}{\sqrt{4}} = 30 + \frac{-74}{2} = 30 - 37 = -7$

Gradient of normal $= \frac{1}{7}$

$y - (-8) = \frac{1}{7}(x - 4)$

$y = \frac{1}{7}x - \frac{4}{7} - 8$

$y = \frac{1}{7}x - \frac{60}{7}$

(b) $f'(x) = 30 + \frac{6 - 5x^2}{x^{1/2}} = 30 + 6x^{-1/2} - 5x^{3/2}$

$f(x) = 30x + \frac{6x^{1/2}}{1/2} - \frac{5x^{5/2}}{5/2} + c$

$f(x) = 30x + 12x^{1/2} - 2x^{5/2} + c$

$P(4, -8)$: $-8 = 30(4) + 12(4)^{1/2} - 2(4)^{5/2} + c$

$-8 = 120 + 24 - 64 + c \Rightarrow -8 = 80 + c \Rightarrow c = -88$

$f(x) = 30x + 12x^{1/2} - 2x^{5/2} - 88$

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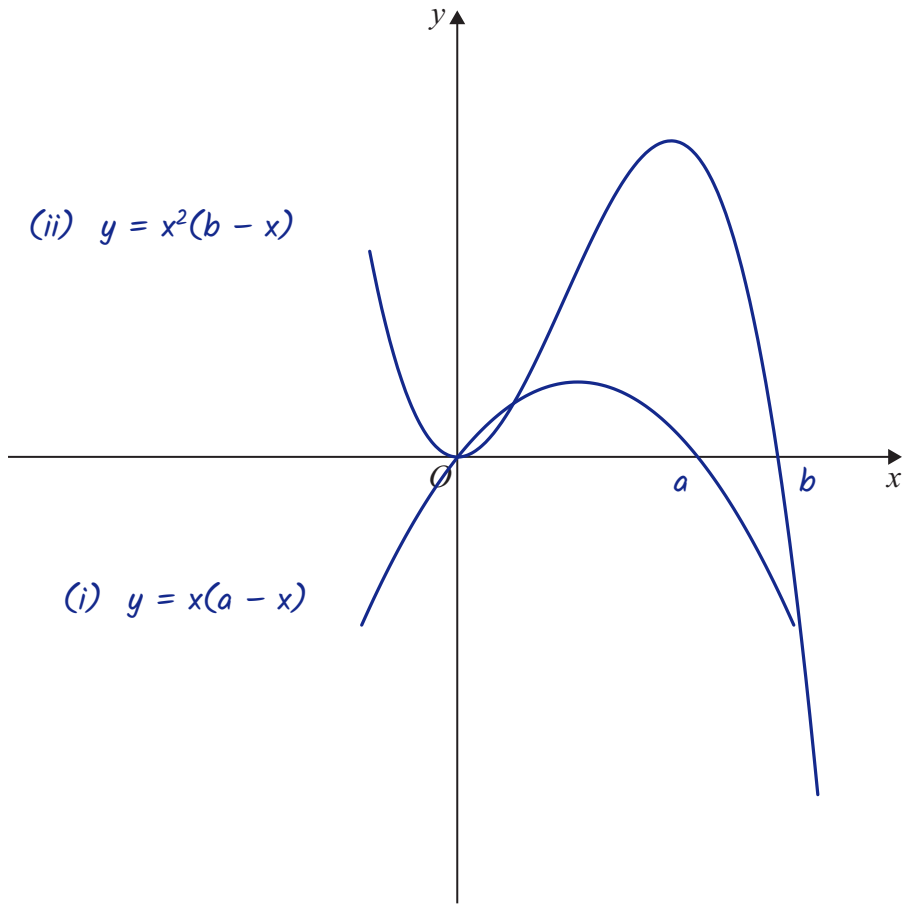
Question 9 continued

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(Total for Question 9 is 9 marks)

Question 10

Write the answer to Question 10 on these 3 pages



(a) Sketch above: (i) crosses x-axis at (0, 0) and (a, 0);
(ii) touches x-axis at (0, 0) (minimum) and crosses at (b, 0).

(b) $x(4 - x) = x^2(7 - x)$

$4x - x^2 = 7x^2 - x^3$

$x^3 - 8x^2 + 4x = 0$

$x(x^2 - 8x + 4) = 0$ as required

(c) $x^2 - 8x + 4 = 0$

$x = \frac{8 \pm \sqrt{(64 - 16)}}{2} = \frac{8 \pm \sqrt{48}}{2} = \frac{8 \pm 4\sqrt{3}}{2} = 4 \pm 2\sqrt{3}$

$x = 4 + 2\sqrt{3}$: $y = x(4 - x) = (4 + 2\sqrt{3})(-2\sqrt{3}) < 0$, so reject

$x = 4 - 2\sqrt{3} > 0$: $y = x(4 - x) = (4 - 2\sqrt{3})(4 - (4 - 2\sqrt{3}))$

$y = (4 - 2\sqrt{3})(2\sqrt{3}) = 8\sqrt{3} - 4 \times 3 = 8\sqrt{3} - 12$ (> 0)

$A(4 - 2\sqrt{3}, \ -12 + 8\sqrt{3})$

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Question 10 continued

Question 10 continued

(Total for Question 10 is 12 marks)

TOTAL FOR PAPER IS 75 MARKS

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