

Please write clearly in block capitals.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature

I declare this is my own work.

INTERNATIONAL A-LEVEL

MATHEMATICS

(9660/MA03) Unit P2 Pure Mathematics

Friday 30 May 2025

07:00 GMT

Time allowed: 2 hours 30 minutes

Materials

- For this paper you must have the OxfordAQA Booklet of Formulae and Statistical Tables (enclosed).
- You may use a graphical calculator.

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 120.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- Show all necessary working; otherwise marks may be lost.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
TOTAL	



1 (a) Use the mid-ordinate rule with five strips to find an estimate for

$$\int_0^1 1 - e^{(2x-x^2)} dx$$

[4 marks]

[illegible]

Answer _____



[3 marks]

[illegible]

Answer

Turn over for the next question

7

Turn over ►



2 It is given that for $x > 2$ the curves with equations

$$y = 3 \ln x \quad \text{and} \quad y = x^2 - 4x - 5$$

intersect at a single point where $x = \alpha$

2 (a) Show that α lies between 5 and 6

[2 marks]

2 (b) Show that the equation $3 \ln x = x^2 - 4x - 5$ can be rearranged into the form

$$x = 2 + \sqrt{3(3 + \ln x)}$$

[2 marks]



2 (c) Use the iterative formula

$$x_{n+1} = 2 + \sqrt{3(3 + \ln x_n)}$$

with $x_1 = 5$ to find the value of x_2 and the value of x_3

Give your values correct to three decimal places.

[2 marks]

$x_2 =$ _____ $x_3 =$ _____

6

Turn over for the next question

Turn over ►



- 3 (a)** Express $8\sin\theta + 15\cos\theta$ in the form $R\sin(\theta + \alpha)$ where $R > 0$ and $0^\circ < \alpha < 90^\circ$

Give your value of α in degrees to one decimal place.

[3 marks]

Answer _____

- 3 (b) (i)** Hence write down the minimum value of $|8\sin\theta + 15\cos\theta|$

[1 mark]

Answer _____

- 3 (b) (ii)** Find the smallest positive value of θ at which the minimum value in **part (b)(i)** occurs.

Give your value in degrees to one decimal place.

[1 mark]

Answer _____



$$\cot^2\left(2x - \frac{\pi}{6}\right) = 5 - \operatorname{cosec}\left(2x - \frac{\pi}{6}\right)$$

[5 marks]

[illegible]

Answer _____

10

4 A curve has equation

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

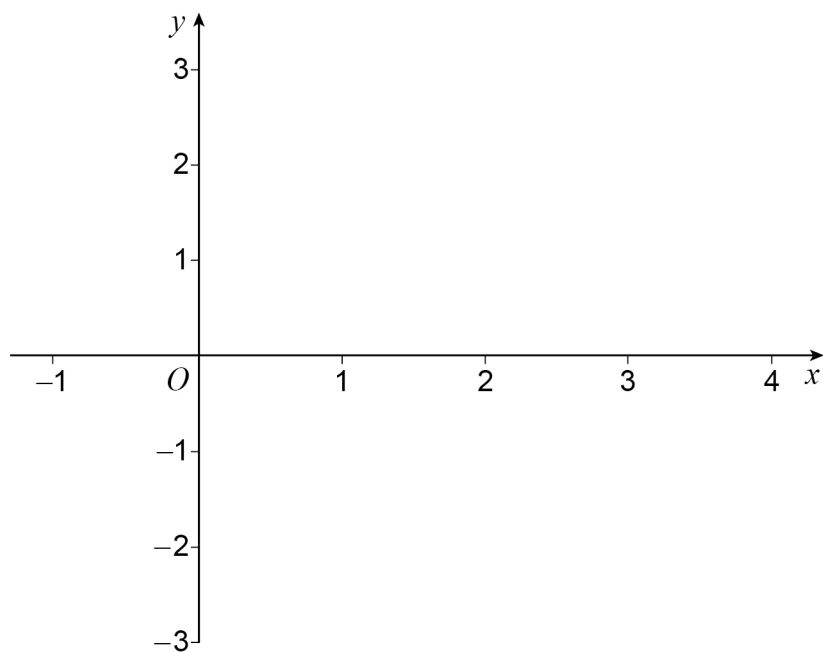
4 (a) (i) Find the exact coordinates of the points where the curve crosses the x -axis.

[3 marks]

Answer _____

4 (a) (ii) Sketch the curve on the axes below.

[2 marks]



- 4 (b) Solve the inequality $2 - |x^2 - 3x| \leq 0$

[2 marks]

Answer _____

- 4 (c) Describe a single geometrical transformation that maps the graph of $y = |x^2 - 3x|$ onto the graph of $y = -|x^2 - 3x|$

[2 marks]

Turn over for the next question

Turn over ►



5

$$f(x) = (2x - 3)(kx^2 + x - 5) \quad \text{and} \quad g(x) = (2x + 3)(2x^2 + kx + 3)$$

where k is a constant.

When $f(x)$ is divided by $(2x-1)$ the remainder is R

When $g(x)$ is divided by $(2x-1)$ the remainder is also R

5 (a) Find the value of k and the value of R

[4 marks]

[illegible]

$$k = \quad \quad \quad R =$$



[4 marks]

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

Answer _____

8

Turn over for the next question

Turn over ►





$$\cos^2 x \frac{dy}{dx} = 2 - 5y \quad \text{for } y < 0.4$$

Give your answer in the form $y = f(x)$

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

5



8

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

The point $D(-4, -2)$ lies on C

8 (a) Find an equation of the tangent to C at D

Give your answer in the form $px + qy = r$ where p , q and r are integers.

[6 marks]

[illegible]

Answer _____



8 (b) The tangent to C at D intersects the x -axis at A and the y -axis at B

Find the exact area of triangle OAB where O is the origin.

[2 marks]

Answer _____

8

Turn over for the next question

Turn over ►



Use integration by parts twice to find the exact value of

Give your answer in the form $a+be^c$ where a , b and c are constants.

[illegible]

[illegible]

Answer

Turn over for the next question

Turn over ►



10 (a) It is given that $y = \frac{\cos x}{\sin x}$

Use the quotient rule to show that

$$\frac{dy}{dx} = -\operatorname{cosec}^2 x$$

[2 marks]

10 (b) It is given that $y = \ln(\operatorname{cosec} x - \cot x)$

Show that

$$\frac{dy}{dx} = \operatorname{cosec} x$$

[2 marks]

Use **part (a)** and **part (b)** to find the volume of the solid formed by rotating R through 2π radians about the x -axis.

Give your answer to three decimal places.

[6 marks]

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Answer

10

Turn over ►



- 11** A curve is defined by the parametric equations

$$x = 3 - \sin t \quad \text{and} \quad y = 2 - \tan t$$

- 11 (a)** Find a Cartesian equation of the curve.

[3 marks]

Answer _____

- 11 (b)** Find in terms of t an expression for $\frac{dy}{dx}$

[3 marks]

Answer _____



Give your answer in the form $y = mx + c$ where m and c are exact.

[4 marks]

[illegible]

Answer

Turn over for the next question

Turn over ►



[4 marks]

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Answer

[2 marks]

Answer



[1 mark]

Answer

$$\frac{28x^2 - 60x + 50}{(5 + 4x)(5 - 2x)^2} = D + Ex + Fx^2$$

[4 marks]

Find $\int \frac{x}{x^2 - x - 6} dx$

Give your answer in the form $k \ln(f(x))$ where k is a constant.

[5 marks]

[illegible]

Answer



Give your answer as a fraction.

[7 marks]

[illegible]

Answer

12

Turn over ►



- 14 (a)** Find a vector equation of the line l_1 which passes through the point $A(8, -1, 4)$ and the point $B(6, -2, 2)$

[1 mark]

Answer _____

- 14 (b)** The line l_2 has equation $\mathbf{r} = \begin{bmatrix} 7 \\ 3 \\ -3 \end{bmatrix} + \mu \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$

- 14 (b) (i)** The lines l_1 and l_2 intersect.

Find the coordinates of the point of intersection.

[3 marks]

Answer _____



Give your answer in degrees to one decimal place.

[3 marks]

Answer

Give your answer in an exact form.

[5 marks]

Answer

END OF QUESTIONS

12



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