

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

INTERNATIONAL A-LEVEL MATHEMATICS

(9660/MA03) Unit P2 Pure Mathematics

Monday 13 January 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	
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10	
11	
12	
13	
14	
TOTAL	



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ANSWER IN THE SPACES PROVIDED**



2 (b) A curve has equation $y = 5^{(1-x)}$

2 (b) (i) The curve intersects the line $y = 2x - 3$ at a single point where $x = \alpha$

Show that α lies between 1.6 and 1.7

[2 marks]

2 (b) (ii) The equation $5^{(1-x)} = 2x - 3$ can be rearranged into the form $x = 0.5(3 + 5^{(1-x)})$

Use the iterative formula $x_{n+1} = 0.5(3 + 5^{(1-x_n)})$ with $x_1 = 1.6$ to find the value of x_2 and the value of x_3

Give your values to three decimal places.

[2 marks]

$x_2 =$ _____ $x_3 =$ _____

8

Turn over for the next question

Turn over ►



3 (a) It is given that

$$y = (3 - 4x^2)^{10}$$

Find $\frac{dy}{dx}$

[2 marks]

Answer _____

3 (b) It is given that

$$y = x \ln(4x) + 2 \tan(3x)$$

Find $\frac{dy}{dx}$

[4 marks]

Answer _____



4 The coordinates of the point A are $(2, -3, -1)$

The coordinates of the point B are $(-2, -1, 4)$

4 (a) Find the vector \overrightarrow{AB}

[1 mark]

Answer _____

4 (b) Find $|\overrightarrow{AB}|$

[2 marks]

Answer _____

4 (c) The line l has equation $\mathbf{r} = \begin{bmatrix} 3 \\ b \\ -15 \end{bmatrix} + \lambda \begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix}$ where b is a constant.

4 (c) (i) Calculate the acute angle between \overrightarrow{AB} and the line l

Give your answer to the nearest 0.1°

[3 marks]

Answer _____



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6 The functions f and g are defined by

$$f(x) = 4 \sin\left(\frac{x}{3}\right) \quad \text{for } -\frac{3\pi}{2} \leq x \leq \frac{3\pi}{2}$$

$$g(x) = |x| \quad \text{for all real values of } x$$

6 (a) The inverse of f is f^{-1}

Find $f^{-1}(x)$

[3 marks]

Answer _____

6 (b) (i) Write down an expression for $gf(x)$

[1 mark]

Answer _____

6 (b) (ii) Find the range of $gf(x)$

[2 marks]

Answer _____



- 6 (c)** Describe a sequence of **two** geometrical transformations that maps the graph of $y = \sin x$ onto the graph of $y = 4\sin\left(\frac{x}{3}\right)$

[4 marks]

10

Turn over for the next question

Turn over ►



- 7 (a) (i) Express $16\cos\theta - 30\sin\theta$ in the form $R\cos(\theta + \alpha)$ where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$

Give the value of α in radians to three significant figures.

[3 marks]

Answer _____

- 7 (a) (ii) Hence, or otherwise, solve the equation

$$16\cos(y+2) - 30\sin(y+2) = 17$$

Give all values of y to two decimal places in the interval $-\pi < y < \pi$

[3 marks]

Answer _____



10 (a) Find $\int \left(\frac{1}{4}e^{2x} - 3e^{-2x} \right) dx$

[2 marks]

Answer _____

10 (b) The diagram shows:

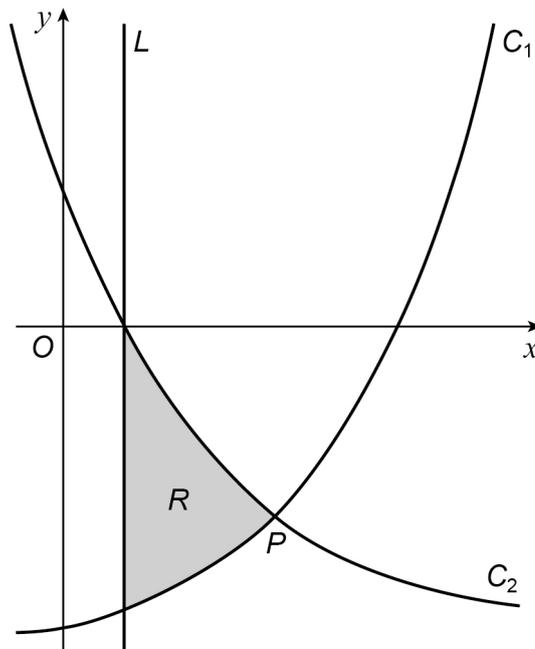
the curve C_1 with equation $y = \frac{1}{4}(e^{2x} - 9)$

the curve C_2 with equation $y = 3e^{-2x} - 2$

the line L with equation $x = \frac{1}{2} \ln\left(\frac{3}{2}\right)$

the shaded region R

the point P , where the curves C_1 and C_2 intersect.



11 The equation of a curve is

$$2e^{4x} + 6y^2 = e^x y^3$$

The curve has exactly one stationary point.

The coordinates of the stationary point of the curve are (a, b) where a and b are constants.

11 (a) Find $\frac{dy}{dx}$

[3 marks]

Answer _____

11 (b) Show that $b = 2e^a$

[2 marks]



11 (c) Find the exact value of a and the exact value of b

[4 marks]

$a =$ _____ $b =$ _____

9

Turn over for the next question

Turn over ►



14 (c) (i) Use your answers to **part (a)** and **part (b)** to show that

$$\frac{4x+4}{(a-bx)(b-ax)} = \frac{4}{b-a}(D+Ex+Fx^2)$$

for small values of x

Give D , E and F in terms of a and b

[2 marks]

14 (c) (ii) In the case where $b = 2a$ show that

$$\frac{4x+4}{(a-bx)(b-ax)} = \frac{1}{a^2}(K+Lx+Mx^2)$$

where K , L and M are rational numbers.

[2 marks]

END OF QUESTIONS



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