



Cambridge International AS & A Level

CANDIDATE
NAME



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MATHEMATICS

9709/21

Paper 2 Pure Mathematics 2

May/June 2025

1 hour 15 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages. Any blank pages are indicated.

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- 1 Given that $y = 6x \cos(x^2 + 1)$, find an expression for $\frac{dy}{dx}$. [2]





- 2 (a) Use logarithms to solve the inequality $4^x < 0.05$. Give your answer in the form $x < a$, where the value of a is correct to 3 significant figures. [2]

- (b) Solve the inequality $|3x+8| < 9$. [3]

- (c) Hence state the integers that satisfy both of the inequalities in parts (a) and (b). [1]

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- 3 (a) Sketch, on a single diagram, the graphs of $y = 3e^{-2x}$ and $y = \sec x$ for values of x such that $0 \leq x < \frac{1}{2}\pi$. [2]

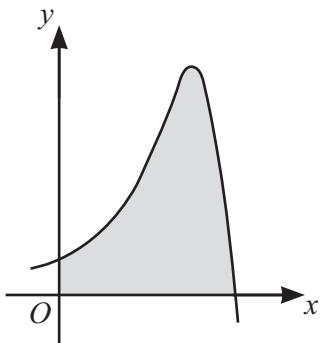
- (b) Show that the x -coordinate of the point of intersection of the two graphs satisfies the equation $x = \frac{1}{2}\ln(3\cos x)$. [2]

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- (c) Use an iterative formula, based on the equation in part (b), to find the x -coordinate of the point of intersection correct to 3 decimal places. Give the result of each iteration to 5 decimal places. [3]

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The diagram shows the curve with equation $y = 6e^{2x} - e^{3x}$. The shaded region is bounded by the axes and the curve.

- (a) Find the exact x -coordinate of the maximum point. [3]





(b) Find the area of the shaded region. Give your answer in the form $\frac{p}{q}$, where p and q are integers. [4]





- 5** The polynomial $p(x)$ is defined by

$$p(x) = ax^3 + bx^2 - ax - 24,$$

where a and b are constants. It is given that $(2x - 3)$ is a factor of $p(x)$ and that the remainder is -15 when $p(x)$ is divided by $(x + 1)$.

- (a) Find the values of a and b .

[4]





(b) Hence factorise $p(x)$ completely.

(c) Hence solve the equation $p(3 \operatorname{cosec} \theta) = 0$ for $90^\circ < \theta < 270^\circ$.

[2]





6 The parametric equations of a curve are

$$x = \frac{2t+1}{3t+4}, \quad y = 2 \ln(3t+4),$$

where $t > -\frac{4}{3}$.

- (a) Show that $\frac{dy}{dx}$ can be expressed in the form $c(3t+4)$ and state the value of the constant c . [5]





- (b) It is given that the gradient of the curve at the point $(a, \ln 100)$ is m .

Find the values of a and m .

[4]

- (c) State whether the curve represents a decreasing function or an increasing function or neither. Give a reason for your answer. [1]





- 7 (a) Prove that $\sin^2 2x + 4\cos^2 x \cos 2x \equiv 4\cos^4 x$. [3]

- (b) Find the set of possible values of the constant k for which the equation

$$\sin^2 2x + 4\cos^2 x \cos 2x + 5 = k$$

has no real solutions.

[2]





(c) Find the exact value of $\int_{-\frac{1}{3}\pi}^{\frac{1}{3}\pi} \sqrt{\sin^2 t + 4\cos^2\left(\frac{1}{2}t\right)} \cos t \, dt$.

[4]





Additional page

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