



Cambridge International AS & A Level

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NAME



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MATHEMATICS

9709/32

Paper 3 Pure Mathematics 3

May/June 2025

1 hour 50 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 75.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

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1 Solve the equation $\frac{e^x + 2e^{-x}}{e^x - 3} = 4$. Give your answer correct to 3 decimal places. [5]





2 (a) Expand $(6-x)(1-2x)^{-\frac{3}{2}}$ in ascending powers of x , up to and including the term in x^2 , simplifying the coefficients. [4]

(b) State the set of values of x for which the expansion is valid. [1]





3 On an Argand diagram shade the region whose points represent complex numbers z which satisfy both the inequalities $|z - 3i| \leq 2$ and $\frac{1}{4}\pi \leq \arg(z - 1 - 2i) \leq \frac{3}{4}\pi$. [5]





4 Solve the equation $3 \cot x - 4 \cot 2x = 3$ for $0^\circ \leq x \leq 180^\circ$.

[6]





5 The square roots of $-1 - 4\sqrt{5}i$ can be expressed in the Cartesian form $x + iy$, where x and y are real and exact.

By first forming a quartic equation in x or y , find the square roots of $-1 - 4\sqrt{5}i$ in exact Cartesian form.

[5]





6 (a) By sketching a suitable pair of graphs, show that the equation

$$|x-2| = 2 \sin \frac{1}{2}x$$

has only one root in the interval $0 < x < \pi$.

[2]

(b) Show by calculation that this root lies between 1 and 1.5.

[2]

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(c) Use the iterative formula $x_{n+1} = 2 - 2 \sin \frac{1}{2}x_n$ with an initial value of 1.03 to calculate the root correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]





7 (a) Express $7 \sin \theta + 24 \cos \theta$ in the form $R \cos(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$. Give the value of α correct to 4 decimal places. [3]





(b) Hence solve the equation $7 \sin \frac{1}{3}x + 24 \cos \frac{1}{3}x = 24.5$ for $0 < x < \pi$.





8 The variables x and θ satisfy the differential equation

$$\sin 2\theta \frac{dx}{d\theta} = (4x+3)\cos 2\theta,$$

and $x = 0$ when $\theta = \frac{1}{12}\pi$.

Solve the differential equation and obtain an expression for x in terms of θ .

[7]

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9 With respect to the origin O , the points A , B and C have position vectors given by

$$\overrightarrow{OA} = \begin{pmatrix} 1 \\ -4 \\ 2 \end{pmatrix}, \quad \overrightarrow{OB} = \begin{pmatrix} -2 \\ 1 \\ 3 \end{pmatrix} \quad \text{and} \quad \overrightarrow{OC} = \begin{pmatrix} 2 \\ 3 \\ 5 \end{pmatrix}.$$

(a) Find a vector equation for the line through A and B .

[2]

(b) Using a scalar product, find the exact value of $\cos BAC$.

[4]





(c) Hence find the exact area of triangle ABC .

(c) Hence find the exact area of triangle ABC . [3]





10 (a) Find the quotient and remainder when x^2 is divided by $1+4x^2$.

[2]

(b) Find the exact value of $\int_0^{0.5} x \tan^{-1}(2x) dx$.

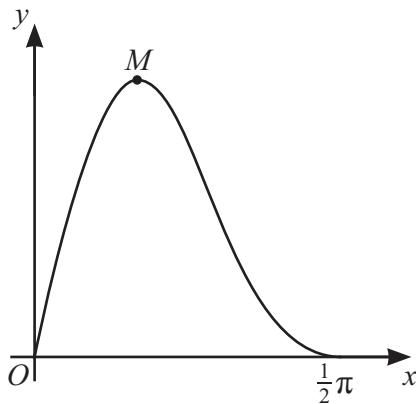
[6]





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The diagram shows the graph of $y = 5 \sin 2x \cos^2 x$ for $0 \leq x \leq \frac{1}{2}\pi$ and its maximum point M .

(a) Find the exact x -coordinate of M . [6]





(b) By using the substitution $u = \cos x$, find the area of the region bounded by the curve, the x -axis between $x = 0$ and $x = \frac{1}{4}\pi$, and the line $x = \frac{1}{4}\pi$. [5]





Additional page

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