Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

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 $|z-3\mathrm{i}| \leqslant 2$ and $\frac{1}{4}\pi \leqslant \arg(z-1-2\mathrm{i}) \leqslant \frac{3}{4}\pi$. [5]

4 Solve the equation $3\cot x - 4\cot 2x = 3$ for $0° \leqslant x \leqslant 180°$. [6]

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

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

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

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

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 $0 < x < \pi$. [4]

8 The variables x and θ satisfy the differential equation

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

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

Solve the differential equation and obtain an expression for x in terms of θ. [7]

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

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

(a) Find a vector equation for the line through A and B. [2]

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(b) Using a scalar product, find the exact value of $\cos BAC$. [4]

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(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 $\int_0^{0.5} x\tan^{-1}(2x)\,\mathrm{d}x$. [6]

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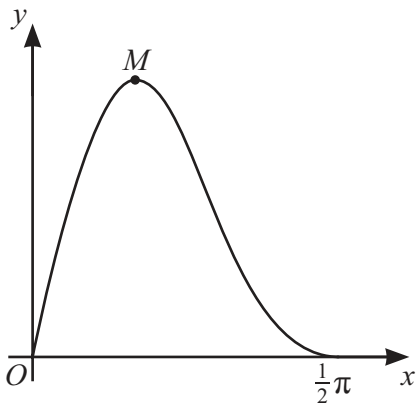

The diagram shows the graph of $y = 5\sin 2x\cos^2 x$ for $0 \leqslant x \leqslant \frac{1}{2}\pi$ and its maximum point M.

(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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