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.

DC (PQ/SW) 342945/3

[Turn over

BLANK PAGE

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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(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]

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

(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]

.....

.....

.....

.....

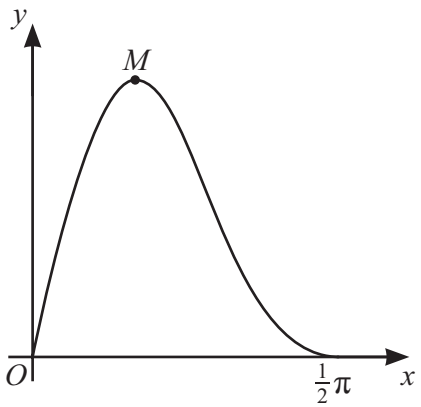
.....

.....

.....

.....

11



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

If you use the following page to complete the answer to any question, the question number must be clearly shown.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....