Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS **9709/33**

Paper 3 Pure Mathematics 3 **October/November 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.

[Turn over

1 Solve the inequality $|3x+2| < 3|2x-1|$. [4]

2 Find the quotient and the remainder when $3x^4 - 2x^2$ is divided by $x + 1$. [3]

3 Solve the equation $2^{3x-4} = \frac{3}{5^x}$. Give your answer in the form $\frac{\ln m}{\ln n}$, where m and n are integers. [4]

4 On an Argand diagram shade the region whose points represent complex numbers z which satisfy both the inequalities $|z+2\mathrm{i}| \leqslant 3$ and $|z+2\mathrm{i}| \leqslant |z-2+4\mathrm{i}|$. [5]

5 **(a)** Show that $\cos 4x + 2\sin^2 x - 1 \equiv 8\sin^4 x - 6\sin^2 x$. [4]

(b) Hence solve the equation $\cos 4x + 2\sin^2 x - 1 = 0$ for $-180° \leqslant x \leqslant 180°$. [4]

6 Find the exact value of $\int_0^{\frac{1}{6}\pi} x^2 \sin 2x \, \mathrm{d}x$. [6]

7 Solve the equation $\frac{5z}{2-\mathrm{i}} - zz^* + 20 + 8\mathrm{i} = 0$. Give your answers in the form $x + \mathrm{i}y$, where x and y are real. [6]

8 The curve with equation $y = e^{-5x} \ln 5x$ has a stationary point at $x = p$.

(a) Show that p satisfies the equation $\ln 5p = \frac{1}{5p}$. [3]

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(b) By sketching a suitable pair of graphs, show that the equation in part **(a)** has only one root. [2]

(c) Show by calculation that $0.2 < p < 0.6$. [2]

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(d) It is given that the equation in part **(a)** can be written in the form $p = \frac{1}{5}\exp\left(\frac{1}{5p}\right)$, where $\exp(x)$ denotes e^x.

Use an iterative formula based on this rearrangement to calculate p correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

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9 The line l_1 passes through the point (3, 1, −6) and is parallel to the vector $2\mathbf{i}+\mathbf{j}+4\mathbf{k}$.

The line l_2 passes through the point (−1, 3, −6) and is perpendicular to the vector $3\mathbf{i}-2\mathbf{j}+\mathbf{k}$. The direction vector for l_2 has no component in the x-direction.

(a) Write down a vector equation for l_1 and find a vector equation for l_2. [3]

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(b) Calculate the acute angle between l_1 and l_2. [3]

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(c) Find the position vector of the point of intersection of l_1 and l_2. [3]

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10 **(a)** Express $\frac{2}{1-9y^2}$ in partial fractions. [2]

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(b) The variables x and y satisfy the differential equation

$$2\cos^2 3x\frac{\mathrm{d}y}{\mathrm{d}x} = 1-9y^2,$$

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

Solve the differential equation and obtain an expression for y in terms of x. [6]

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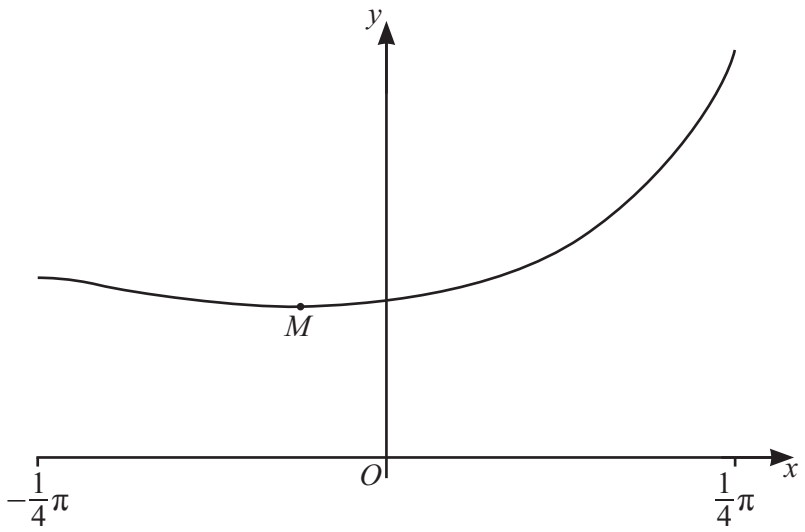

The diagram shows the graph of $y = \sec^2 x\sqrt{3+2\tan x}$ for $-\frac{1}{4}\pi \leqslant x \leqslant \frac{1}{4}\pi$, and its minimum point M.

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

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(b) Using the substitution $u = 3 + 2\tan x$, find the exact value of the area of the region bounded by the curve, the x-axis and the lines $x = -\frac{1}{4}\pi$ and $x = \frac{1}{4}\pi$. [6]

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Additional page

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