Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS **9709/35**

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 $3^{4-2x} = 5(6^{x-1})$. Give your answer correct to 3 significant figures. [4]

2 Solve the equation $3\cot\theta - 4\operatorname{cosec}^2\theta + 5 = 0$ for $-\pi \leqslant \theta \leqslant \pi$. [5]

3 The complex numbers s and t are given by

$$s = 5(\cos 0.25 + \mathrm{i}\sin 0.25) \qquad \text{and} \qquad t = 6\mathrm{e}^{3\mathrm{i}}.$$

(a) Express $\frac{s}{t}$ in the form $r\mathrm{e}^{\mathrm{i}\theta}$, where $-\pi < \theta \leqslant \pi$ and $r > 0$. [2]

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(b) In an Argand diagram with origin O, the points A and B represent the complex numbers s and $\frac{s}{t}$ respectively.

By considering the line segments OA and OB, or otherwise, state the two geometric effects of dividing a complex number by $6\mathrm{e}^{3\mathrm{i}}$. [2]

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4 Find the exact coordinates of the stationary point of the curve with equation $y = 3x^3 \ln x^4$, for $x > 0$. [5]

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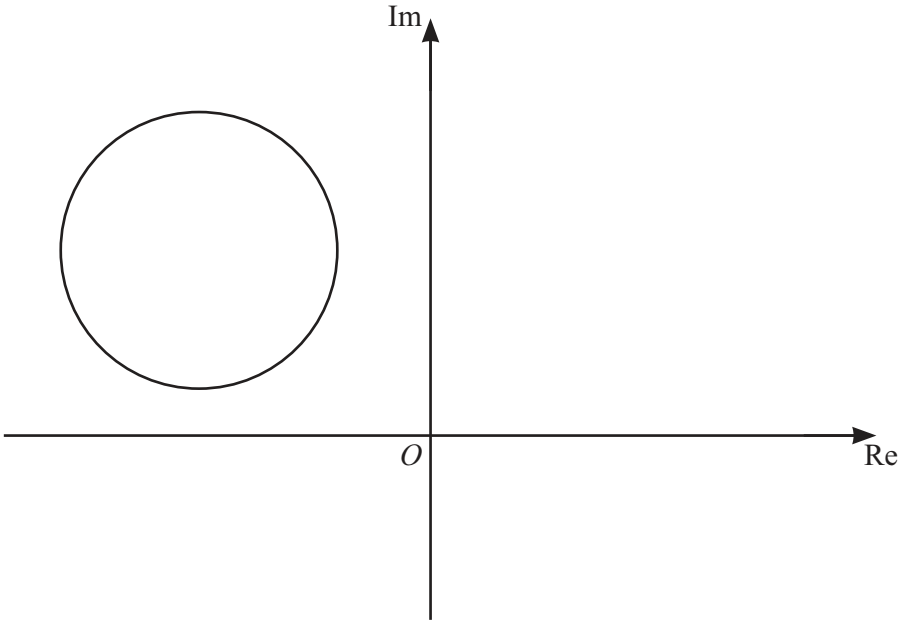

The diagram shows the locus of points representing the complex numbers, z, satisfying $|z+5-4\mathrm{i}|=3$.

(a) For the points on this locus, determine the maximum and minimum possible values of $|z|$. [3]

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(b) For the points on this locus, determine the minimum possible value of $\arg z$. [3]

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6 The parametric equations of a curve are

$$x = \frac{2}{\cos 3t} \qquad \text{and} \qquad y = \tan 3t,$$

for $0 \leqslant t \leqslant 2\pi$.

(a) Show that $\frac{\mathrm{d}y}{\mathrm{d}x}$ can be written as $A \operatorname{cosec} 3t$, where A is a constant to be found. [5]

(b) Find an equation of the normal to the curve at the point where $t = \frac{1}{12}\pi$. Give your answer in the form $y = mx + c$, where the constants m and c are exact. [4]

7 The equation of a curve is $y = \tan^{-1}(4x)$.

(a) Find the exact values of x when the gradient of the curve is $\frac{1}{4}$. [3]

(b) Find the exact value of $\int_0^{0.25} y \, \mathrm{d}x$. [5]

8 **(a)** By sketching a suitable pair of graphs, show that the equation $\sec 2x = -2x - \frac{1}{2}$ has exactly one root in the interval $0 \leqslant x \leqslant \frac{1}{2}\pi$. [2]

(b) Show by calculation that this root lies between 0.8 and 1.2. [2]

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(c) Show that, if a sequence of real values given by the iterative formula

$$x_{n+1} = \frac{1}{2}\cos^{-1}\left(\frac{-2}{4x_n + 1}\right)$$

converges, then it converges to the root of the equation in part **(a)**. [2]

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(d) Use this iterative formula to calculate this root correct to 3 decimal places. Give the result of each iteration to 5 decimal places. [3]

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9 **(a)** Express $\frac{12x^2+55x-2}{(3x-2)(x+6)}$ in partial fractions. [5]

(b) Hence obtain the expansion of $\frac{12x^2+55x-2}{(3x-2)(x+6)}$ in ascending powers of x, up to and including the term in x^2. [4]

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

$$\overrightarrow{OA} = 2\mathbf{i} - \mathbf{j} - 6\mathbf{k}, \qquad \overrightarrow{OB} = b\mathbf{i} - 2\mathbf{j} + 3\mathbf{k} \qquad \text{and} \qquad \overrightarrow{OC} = -4\mathbf{i} + 5\mathbf{j} - 2\mathbf{k}.$$

(a) It is given that $\left|\overrightarrow{AB}\right| = \left|\overrightarrow{BC}\right|$.

Find the value of b. [3]

(b) A, B, C and D are the vertices of a rhombus.

Find the position vector of D. [2]

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(c) Calculate angle ABC. [3]

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11 The variables x and y satisfy the differential equation

$$(x^2+3)\frac{\mathrm{d}y}{\mathrm{d}x} = \mathrm{e}^{3y}(x-2).$$

It is given that $y = 0$ when $x = 0$.

Solve the differential equation, and find the value of y when $x = 2$. [8]

Additional page

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