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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8260058308

MATHEMATICS **9709/35**

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. Any blank pages are indicated.

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1 **(a)** Sketch the graph of $y = |3x - 6|$. [1]

(b) Solve the inequality $5x - 3 < |3x - 6|$. [3]

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2 On a sketch of an Argand diagram, shade the region which represents complex numbers z satisfying both the inequalities $|z-1-3\mathrm{i}| \leqslant 2$ and $|z| \geqslant 4$. [4]

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3 The variables x and y satisfy the equation $Ay = b^x$, where A and b are constants.

(a) Show that the graph of $\ln y$ against x is a straight line. [2]

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(b) When $x = 3.4$, $\ln y = 0.86$ and when $x = 5.7$, $\ln y = 2.56$.

Find the value of A and the value of b. Give your answers correct to 2 significant figures. [3]

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4 The equation of a curve is $x^2 \ln 2y - y \ln\left(2 + x^2\right) = \ln 6$.

Find the exact value of the gradient of the curve at the point (2, 3). Give your answer in simplified form. [5]

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5 Find the complex numbers, z, which satisfy the equation

$$zz^* + 5iz + 2 - 10i = 0.$$

Give your answers in the form $x + iy$, where x and y are real. [5]

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6 A curve has equation $y = \dfrac{\tan x}{5 + 2\sin x}$.

(a) Express $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ as a simplified fraction in terms of $\sin x$. [4]

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(b) Show that the curve has no stationary points. [2]

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7 **(a)** Use the substitution $u = x^2 - 3$ to show that

$$\int_{\sqrt{7}}^{\sqrt{12}} \frac{4x^3}{\sqrt{x^2-3}}\,\mathrm{d}x = \int_a^b \frac{2(u+3)}{\sqrt{u}}\,\mathrm{d}u,$$

where a and b are values to be found. [4]

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(b) Hence, find the exact value of $\int_{\sqrt{7}}^{\sqrt{12}} \frac{4x^3}{\sqrt{x^2-3}}\,\mathrm{d}x$. [4]

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8 **(a)** Express $3\sqrt{3}\sin\left(\theta+\frac{1}{6}\pi\right)-2\sin\theta$ in the form $R\sin(\theta+\alpha)$, where $R>0$ and $0<\alpha<\frac{1}{2}\pi$. Give the exact value of R and state the value of α correct to 3 decimal places. [5]

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(b) Hence, solve the equation $3\sqrt{3}\sin\left(2x+\frac{1}{6}\pi\right)-2\sin 2x=\sqrt{6}$ for $0<x<\pi$. [4]

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9 The equations of two lines are given by

$$l_1: \ \mathbf{r} = (2\mathbf{i} + \mathbf{j} + 4\mathbf{k}) + \lambda(\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}),$$
$$l_2: \ \mathbf{r} = (3\mathbf{i} - \mathbf{j} + 5\mathbf{k}) + \mu(2\mathbf{i} + 3\mathbf{j} + a\mathbf{k}).$$

(a) Find the value of a for which l_1 is perpendicular to l_2. [2]

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(b) Find the value of a for which l_1 and l_2 intersect. [4]

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(c) Find the values of a for which the acute angle between l_1 and l_2 is equal to $\cos^{-1}\left(\frac{5}{14}\right)$. [4]

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10 The constant a is such that $\int_0^a xe^{\frac{1}{2}x}\,dx = 6$.

(a) Show that $a = 2 + e^{-\frac{1}{2}a}$. [5]

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(b) Verify by calculation that a lies between 2.2 and 2.4. [2]

(c) Use an iterative formula based on the equation in part **(a)** to determine a correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

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11 A fungal disease is affecting some of the trees in a forest. The fraction of the trees affected after t years is denoted by x. The rate of increase of x is proportional to the product of the fraction of the trees affected and the fraction of the trees **not** affected.

(a) Explain why, after t years, $\frac{\mathrm{d}x}{\mathrm{d}t} = kx(1-x)$, where k is a constant. [1]

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(b) When the disease is first detected, one quarter of the trees are affected.
Two years later, one third of the trees are affected.

Solve the differential equation to find the number of years from the time when the disease is first detected until the time when three quarters of the trees are affected. Give your answer correct to the nearest year. [8]

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