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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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[3]

[illegible]

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





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 $x^2 \ln 2y - y \ln(2 + x^2) = \ln 6$.

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

This image shows a full page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page, typical of notebook or legal stationery. There are no margins, text, or other markings on the page.



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]

[illegible]



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

(a) Express $\frac{dy}{dx}$ as a simplified fraction in terms of $\sin x$. [4]

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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

[illegible]



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

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

where a and b are values to be found.

[4]

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

[4]





- 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]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



(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]




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

- [illegible]

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- This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.



(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]

This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for letter height. The entire page is otherwise blank, with no margins, text, or other markings.



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

(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]

[3]





- 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, $\frac{dx}{dt} = kx(1-x)$, 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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[illegible]

[illegible]



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