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MATHEMATICS

9709/35

Paper 3 Pure Mathematics 3

May/June 2026

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. Do **not** use correction fluid or tape.
- 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.



- 1 (a) Find the coefficient of x^2 in the expansion of $\frac{2+3x}{(2+x)^3}$. [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)** State the set of values of x for which the expansion is valid. [1]





2 A curve has equation $3x \ln y = x^2 - 4y^3$ for $x > 0$.

Find the gradient of the curve at the point where $y = 1$.

[4]

This image shows a full page of a blank document template. It features approximately 28 evenly spaced horizontal dotted lines across the entire width of the page, providing a guide for handwriting practice or general note-taking. The background is plain white, and there are no margins, headers, or footers present.

3 The variables x and y satisfy the equation $yx^a = k$, where a and k are constants.

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

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(b) When $x = 5$, $y = 0.72$ and when $x = 2.3$, $y = 5$.

Find the values of a and k . Give your answers correct to 2 significant figures. [3]

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4 (a) Solve the inequality $|x + 4| > |3x - 1|$.

[3]

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(b) Hence, find the largest integer n for which $|3^{0.05n} + 4| > |3^{1+0.05n} - 1|$.

[2]

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- 5 A curve has equation $y = \frac{\sin 2x}{3 + \cos x}$ for $0 < x < \pi$.

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

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(b) Hence, find an equation of the normal to the curve at the point where $x = \frac{1}{2}\pi$. Give your answer in an exact form. [2]

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- [7]



7 It is given that $\frac{2+ai}{a-3i} = \lambda(1-5i)$, where a and λ are real constants.

(a) Show that $a^2 - 5a + 6 = 0$.

[4]

[illegible]



(b) Hence, find the possible values of a and the corresponding values of λ .

[3]

[illegible]



- 8 (a)** By sketching a suitable pair of graphs, show that the equation $\sec\left(\frac{1}{3}x\right) = 3e^{-x}$ has exactly one root in the interval $0 < x < \pi$. [2]

- (b) The root is denoted by α . Show that $1 < \alpha < 1.1$. [2]

[illegible]



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

$$x_{n+1} = \ln\left(3 \cos\left(\frac{1}{3}x_n\right)\right)$$

converges, then it converges to α .

[2]

(d) Use this iterative formula, with initial value $x_1 = 1$, to calculate α correct to 3 decimal places. Give the result of each iteration to 5 decimal places.

[3]





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(b) Hence, show that, when α has the value found in **9(a)**,

$$\int_0^\alpha \frac{68}{(5 \cos \theta - 3 \sin \theta)^2} d\theta = \frac{51}{20}. \quad [4]$$

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.



10 (a) Use the substitution $x = 2 \sin u$ to show that

$$\int_0^1 \frac{3x^3}{\sqrt{4-x^2}} dx = \int_a^b 24 \sin^3 u \, du,$$

where a and b are exact values to be found.

[4]

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(b) Hence, find the exact value of $\int_0^1 \frac{3x^3}{\sqrt{4-x^2}} dx$.

[4]



- 11 Relative to a fixed point, O , the points A , B , C and D have position vectors

$$\overrightarrow{OA} = \begin{pmatrix} 2 \\ 3 \\ 5 \end{pmatrix}, \quad \overrightarrow{OB} = \begin{pmatrix} 3 \\ 1 \\ 4 \end{pmatrix}, \quad \overrightarrow{OC} = \begin{pmatrix} -1 \\ 0 \\ -1 \end{pmatrix} \quad \text{and} \quad \overrightarrow{OD} = \begin{pmatrix} -3 \\ 4 \\ 1 \end{pmatrix}.$$

- (a) Show that $ABCD$ is a trapezium, and **not** a parallelogram. [4]

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- (b) Show that the distance from A to the line through C and D is $\frac{9}{2}\sqrt{2}$. [5]

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(c) Find the exact area of $ABCD$. Give your answer in simplified form. [3]

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