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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

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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.

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1 **(a)** Find the coefficient of x^2 in the expansion of $\frac{2+3x}{(2+x)^3}$. [4]

(b) State the set of values of x for which the expansion is valid. [1]

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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]

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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]

(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 $y = \dfrac{\sin 2x}{3 + \cos x}$ for $0 < x < \pi$.

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

(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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6 A curve is such that the gradient of the curve at any point is proportional to the y-coordinate at that point. The curve passes through the points $(2, e^2)$ and $(5, e^3)$.

Form and solve a differential equation to find y in terms of x. [7]

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

(a) Show that $a^2 - 5a + 6 = 0$. [4]

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(b) Hence, find the possible values of a and the corresponding values of λ. [3]

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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]

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

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

converges, then it converges to α. [2]

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(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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9 **(a)** Express $5\cos\theta - 3\sin\theta$ in the form $R\cos(\theta+\alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$. State the exact value of R, and give the value of α in the form $\tan^{-1}(p)$, where p is a rational number. [3]

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

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

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

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

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

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

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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]

(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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