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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 6618996640 *

MATHEMATICS **9709/22**

Paper 2 Pure Mathematics 2 **February/March 2025**

1 hour 15 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 50.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages.

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1 Solve the equation $\ln(3x+1) - \ln(x-5) = \ln 7$. [3]

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2 A curve passes through the point with coordinates $\left(\frac{1}{2}\pi, 5\right)$ and is such that $\frac{\mathrm{d}y}{\mathrm{d}x} = 4\sec^2\left(\frac{1}{2}x\right)$.

Find the equation of the curve. [3]

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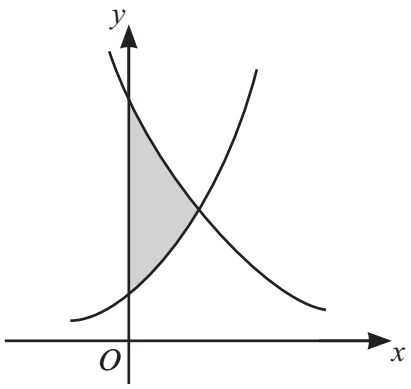
3



The diagram shows the curves $y = e^{2x}$ and $y = 8e^{-x}$. The shaded region is bounded by the two curves and the y-axis.

(a) Show that the x-coordinate of the point of intersection of the two curves is $\ln 2$. [2]

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(b) Find the area of the shaded region. [3]

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4 A curve has equation $y = \dfrac{4\sin x}{3+\cos 2x}$ for values of x such that $0 \leqslant x \leqslant 2\pi$.

(a) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$. [2]

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(b) Hence find the coordinates of the stationary points of the curve. [4]

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5 **(a)** Sketch on the same diagram the graphs of $y = |2x - 3|$ and $y = \ln(x + 1)$. [2]

The x-coordinates of the points where the graphs intersect are denoted by α and β, where $\alpha < \beta$.

(b) Show that $\alpha = 1.5 - 0.5\ln(\alpha + 1)$. [1]

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(c) Use an iterative formula, based on the equation in part **(b)**, to find the value of α correct to 3 significant figures. Give the result of each iteration to 5 significant figures. [3]

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(d) Show by calculation that $2.055 < \beta < 2.065$. [2]

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6 **(a)** Find the quotient and remainder when $18x^3 - 6x^2 - 30x + 4$ is divided by $(3x - 1)$. [3]

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(b) Hence find $\int_1^5 \frac{18x^3 - 6x^2 - 30x + 4}{3x - 1}\,\mathrm{d}x$. Give your answer in the form $a - \ln b$, where a and b are integers. [5]

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7 **(a)** Express $6\sin\theta - 4\cos\theta$ in the form $R\sin(\theta - \alpha)$, where $R > 0$ and $0° < \alpha < 90°$. Give the exact value of R and the value of α correct to 2 decimal places. [3]

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(b) Hence solve the equation $6\sin\theta - 4\cos\theta + 5 = 0$ for $0° < \theta < 360°$. [4]

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(c) As the value of β varies, find the greatest possible value of

$$(3\sin 4\beta - 2\cos 4\beta)^2 + 15$$

and determine the smallest positive value of β, in degrees, for which this greatest value occurs. [3]

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8 A curve has equation $3e^{2x}y + 4e^{3x} + y^3 = 18$.

(a) Show that $\frac{dy}{dx} = \frac{-2e^{2x}y - 4e^{3x}}{e^{2x} + y^2}$. [4]

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(b) Show that the curve has no stationary points. [3]

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Additional page

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