Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS **9709/23**

Paper 2 Pure Mathematics 2 **May/June 2024**

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 **16** pages. Any blank pages are indicated.

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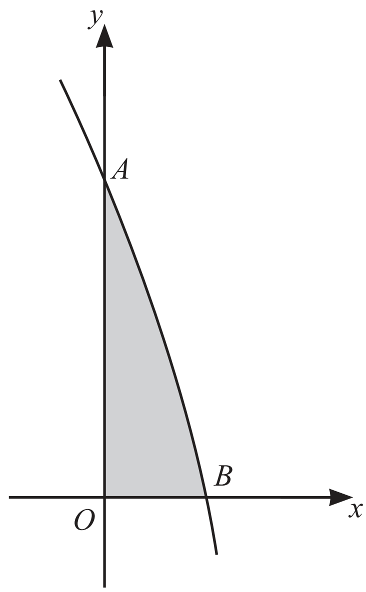
1 Solve the inequality $|5x+7| > |2x-3|$. [4]

2 Use logarithms to solve the equation $6^{2x-1} = 5e^{3x+2}$. Give your answer correct to 4 significant figures. [4]

3



The diagram shows the curve with equation $y = 8e^{-x} - e^{2x}$. The curve crosses the y-axis at the point A and the x-axis at the point B. The shaded region is bounded by the curve and the two axes.

(a) Find the gradient of the curve at A. [3]

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(b) Show that the x-coordinate of B is $\ln 2$ and hence find the area of the shaded region. [5]

4 A curve is defined by the parametric equations

$$x = 4\cos^2 t, \qquad y = \sqrt{3}\sin 2t,$$

for values of t such that $0 < t < \frac{1}{2}\pi$.

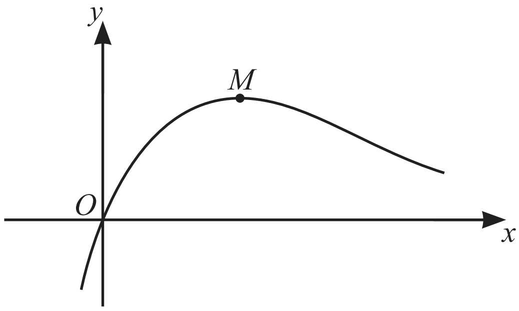
Find the equation of the normal to the curve at the point for which $t = \frac{1}{6}\pi$. Give your answer in the form $ax + by + c = 0$ where a, b and c are integers. [7]

5 The polynomial $\mathrm{p}(x)$ is defined by $\mathrm{p}(x) = 9x^3 + 18x^2 + 5x + 4$.

(a) Find the quotient when $\mathrm{p}(x)$ is divided by $(3x+2)$, and show that the remainder is 6. [3]

(b) Find the value of $\int_0^2 \frac{\mathrm{p}(x)}{3x+2}\,\mathrm{d}x$, giving your answer in the form $a + \ln b$ where a and b are integers. [5]

6



The diagram shows the curve with equation $y = \dfrac{\ln(2x+1)}{x+3}$. The curve has a maximum point M.

(a) Find an expression for $\dfrac{dy}{dx}$. [2]

(b) Show that the x-coordinate of M satisfies the equation $x = \dfrac{x+3}{\ln(2x+1)} - 0.5$. [2]

(c) Show by calculation that the x-coordinate of M lies between 2.5 and 3.0 . [2]

(d) Use an iterative formula based on the equation in part **(b)** to find the x-coordinate of M correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]

7 **(a)** Prove that $2\sin\theta\,\mathrm{cosec}\,2\theta \equiv \sec\theta$. [2]

(b) Solve the equation $\tan^2\theta + 7\sin\theta\,\mathrm{cosec}\,2\theta = 8$ for $-\pi < \theta < \pi$. [5]

(c) Find $\int 8\sin^2 \frac{1}{2}x \operatorname{cosec}^2 x \, dx$. [3]

Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.

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