Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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0329251367

MATHEMATICS **9709/23**

Paper 2 Pure Mathematics 2 **May/June 2021**

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 **(a)** Solve the equation $\ln(2 + x) - \ln x = 2 \ln 3$. [3]

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(b) Hence solve the equation $\ln(2 + \cot y) - \ln(\cot y) = 2 \ln 3$ for $0 < y < \frac{1}{2}\pi$. Give your answer correct to 4 significant figures. [2]

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2 The solutions of the equation $5|x| = 5 - 2x$ are $x = a$ and $x = b$, where $a < b$.

Find the value of $|3a - 1| + |7b - 1|$. [5]

3 Solve the equation $\sin(2\theta + 30°) = 5\cos(2\theta + 60°)$ for $0° < \theta < 180°$. [6]

4 **(a)** Find the exact value of $\int_0^2 6e^{2x+1}\,dx$. [3]

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(b) Find $\int (\tan^2 x + 4\sin^2 2x)\,dx$. [5]

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5 **(a)** Find the quotient when $x^4 - 32x + 55$ is divided by $(x - 2)^2$ and show that the remainder is 7. [3]

(b) Factorise $x^4 - 32x + 48$. [2]

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(c) Hence solve the equation $e^{-12y} - 32e^{-3y} + 48 = 0$, giving your answer in an exact form. [2]

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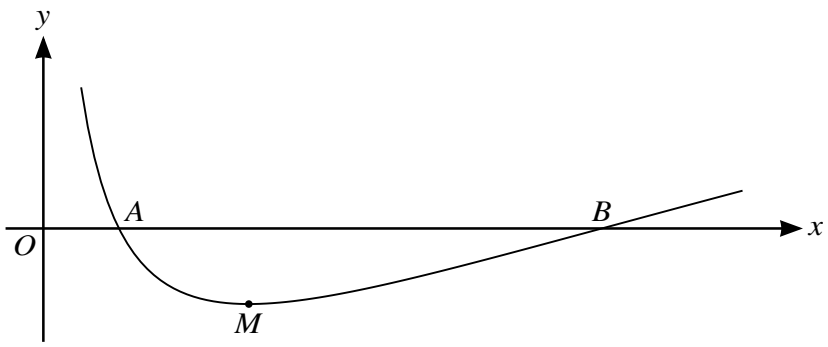
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The diagram shows the curve with equation

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

The curve crosses the x-axis at the points A and B, and has a minimum point M.

(a) Find the exact value of the gradient of the curve at each of the points A and B. [6]

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(b) Find the exact x-coordinate of M. [2]

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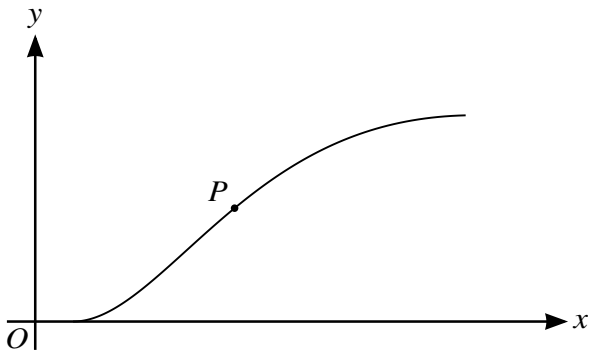
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The diagram shows the curve with parametric equations

$$x = 4t + e^{2t}, \qquad y = 6t \sin 2t,$$

for $0 \leqslant t \leqslant 1$. The point P on the curve has parameter p and y-coordinate 3.

(a) Show that $p = \dfrac{1}{2 \sin 2p}$. [1]

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(b) Show by calculation that the value of p lies between 0.5 and 0.6. [2]

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(c) Use an iterative formula, based on the equation in part **(a)**, to find the value of p correct to 3 significant figures. Use an initial value of 0.55 and give the result of each iteration to 5 significant figures. [3]

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(d) Find the gradient of the curve at P. [5]

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Additional Page

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

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