

Cambridge International AS & A Level

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MATHEMATICS

9709/21

Paper 2 Pure Mathematics 2

May/June 2023

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.

- 1 Use logarithms to solve the equation $12^x = 3^{2x+1}$. Give your answer correct to 3 significant figures. [4]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing 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.

- 2** A curve has equation $y = \frac{2 + 3 \ln x}{1 + 2x}$.

Find the equation of the tangent to the curve at the point $(1, \frac{2}{3})$. Give your answer in the form $ax + by + c = 0$, where a , b and c are integers. [5]

[illegible]

3 It is given that $\int_0^a (3e^{2x} - 1) dx = 12$, where a is a positive constant.

(a) Show that $a = \frac{1}{2} \ln(9 + \frac{2}{3}a)$. [4]

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(b) Use an iterative formula, based on the equation in (a), to find the value of a correct to 4 significant figures. Use an initial value of 1 and give the result of each iteration to 6 significant figures. [3]

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- 4 The polynomial $p(x)$ is defined by

$$p(x) = 2x^3 + 3x^2 + kx - 30,$$

where k is a constant. It is given that $(x - 3)$ is a factor of $p(x)$.

- (a) Find the value of k . [2]

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- (b) Hence find the quotient when $p(x)$ is divided by $(x - 3)$ and factorise $p(x)$ completely. [3]

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- (c) It is given that a is one of the roots of the equation $p(x) = 0$.

Given also that the equation $|4y - 5| = a$ is satisfied by two real values of y , find these two values of y . [3]

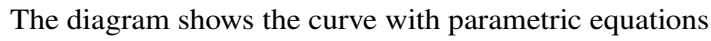
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for $-\frac{1}{4}\pi \leq t \leq \frac{1}{4}\pi$. The curve has a maximum point M .

- [illegible]

- (b) Find the coordinates of M , giving each coordinate correct to 3 significant figures. [5]

[illegible]

6 Show that $\int_{\frac{1}{2}\pi}^{\frac{1}{3}\pi} \left(4 \cos^2 2x + \frac{1}{\cos^2 x} \right) dx = \frac{3}{4}\sqrt{3} + \frac{1}{6}\pi - 1.$ [7]

[illegible]

- 7 (a) Express $7 \cos \theta + 24 \sin \theta$ in the form $R \cos(\theta - \alpha)$, where $R > 0$ and $0^\circ < \alpha < 90^\circ$. Give the value of α correct to 2 decimal places. [3]

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- (b) Solve the equation $7 \cos \theta + 24 \sin \theta = 18$ for $0^\circ < \theta < 360^\circ$. [4]

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$$\frac{150}{7 \cos \frac{1}{2}\beta + 24 \sin \frac{1}{2}\beta + 50}$$

Find the value of V and determine the smallest positive value of β (in degrees) for which the value of V occurs. [4]

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[illegible]

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