

Cambridge International AS & A Level

CANDIDATE
NAME

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CENTRE
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MATHEMATICS

9709/21

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.

- 1** A curve has equation $y = 2 \tan x - 5 \sin x$ for $0 \leq x < \frac{1}{2}\pi$.

Find the x -coordinate of the stationary point of the curve. Give your answer correct to 3 significant figures. [3]

[illegible]

2 A curve has equation $x^2 \ln y + y^2 + 4x = 9$.

Find the gradient of the curve at the point $(2, 1)$.

[5]

This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for letter height. The entire page is otherwise blank, with no text or other markings.

- 3 (a) Sketch on the same diagram the graphs of $y = |3x - 8|$ and $y = 5 - x$. [2]

- (b) Solve the inequality $|3x - 8| < 5 - x$. [4]

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- (c) Hence determine the largest integer N satisfying the inequality $|3e^{0.1N} - 8| < 5 - e^{0.1N}$. [2]

4 (a) Show that $3 \tan 2\theta + \tan(\theta + 45^\circ) \equiv \frac{\tan^2 \theta + 8 \tan \theta + 1}{1 - \tan^2 \theta}$. [4]

[illegible]

(b) Hence solve the equation $3 \tan 2\theta + \tan(\theta + 45^\circ) = 4$ for $0^\circ < \theta < 180^\circ$. [3]

This image shows a full page of a handwriting practice sheet. It consists of approximately 20 horizontal dotted lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.

- 5** A curve has equation $y = \frac{1+e^{2x}}{1+3x}$. The curve has exactly one stationary point P .

(a) Find $\frac{dy}{dx}$ and hence show that the x -coordinate of P satisfies the equation $x = \frac{1}{6} + \frac{1}{2}e^{-2x}$. [4]

[illegible]

- (b) Show by calculation that the x -coordinate of P lies between 0.35 and 0.45 . [2]

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- (c) Use an iterative formula based on the equation in part (a) to find the x -coordinate of P correct to 3 significant figures. Give the result of each iteration to 5 significant figures. [3]

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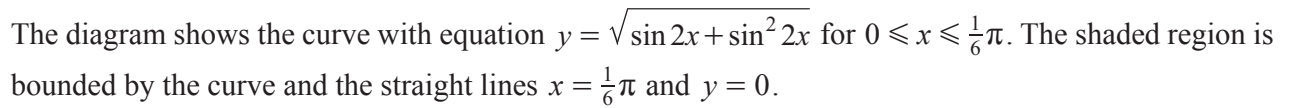
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- (b)** The shaded region is rotated completely about the x -axis.

Find the exact volume of the solid produced.

[6]

[illegible]

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

$$p(x) = 9x^3 + 6x^2 + 12x + k,$$

where k is a constant.

- (a) Find the quotient when $p(x)$ is divided by $(3x + 2)$ and show that the remainder is $(k - 8)$. [3]

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- (b) It is given that $\int_1^6 \frac{p(x)}{3x+2} dx = a + \ln 64$, where a is an integer.

Find the values of a and k . [6]

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