



Cambridge International AS & A Level

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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]

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]

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]

(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]

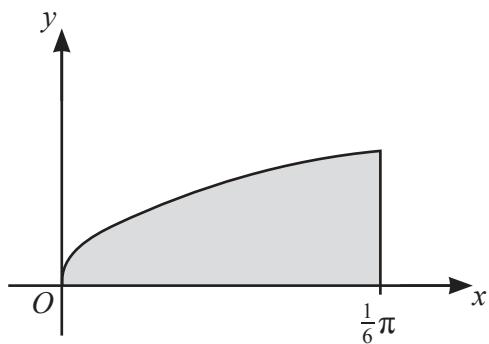
(b) Hence solve the equation $3 \tan 2\theta + \tan(\theta + 45^\circ) = 4$ for $0^\circ < \theta < 180^\circ$. [3]

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]

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

(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]



The diagram shows the curve with equation $y = \sqrt{\sin 2x + \sin^2 2x}$ for $0 \leq x \leq \frac{1}{6}\pi$. The shaded region is bounded by the curve and the straight lines $x = \frac{1}{6}\pi$ and $y = 0$.

(a) Use the trapezium rule with two intervals to find an approximation to the area of the shaded region. Give your answer correct to 2 significant figures. [3]

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

Find the exact volume of the solid produced.

[6]

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]

(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]

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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