Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

3967058319

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 $0 \leqslant x < \frac{1}{2}\pi$.

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 $\left|3\mathrm{e}^{0.1N} - 8\right| < 5 - \mathrm{e}^{0.1N}$. [2]

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

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

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

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

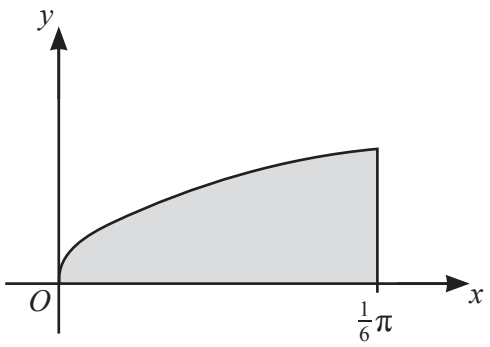
.....

.....

.....

.....

6



The diagram shows the curve with equation $y = \sqrt{\sin 2x + \sin^2 2x}$ for $0 \leqslant x \leqslant \frac{1}{6}\pi$. 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 $\mathrm{p}(x)$ is defined by

$$\mathrm{p}(x) = 9x^3 + 6x^2 + 12x + k,$$

where k is a constant.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) It is given that $\int_1^6 \frac{\mathrm{p}(x)}{3x+2}\,\mathrm{d}x = a + \ln 64$, 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.

BLANK PAGE

BLANK PAGE