Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

4969108877

MATHEMATICS **9709/22**

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.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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]

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

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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

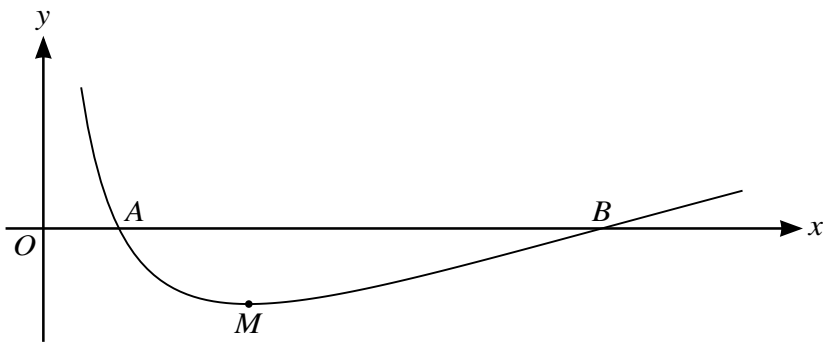
.....

.....

.....

.....

6



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]

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

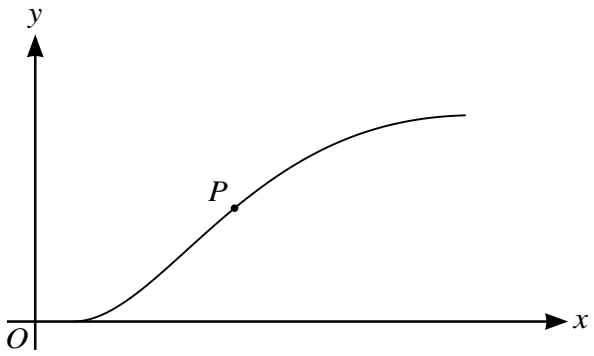
.....

.....

.....

.....

7



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]

.....

.....

.....

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

.....

.....

.....

.....

.....

(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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....