Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

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5416651015

MATHEMATICS **9709/22**

Paper 2 Pure Mathematics 2 **February/March 2022**

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.

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1 Solve the equation $|5x - 2| = |4x + 9|$. [3]

2 A curve has equation $y = 7 + 4\ln(2x + 5)$.

Find the equation of the tangent to the curve at the point $(-2, 7)$, giving your answer in the form $y = mx + c$. [5]

3 The variables x and y satisfy the equation $y = 3^{2a}a^x$, where a is a constant. The graph of $\ln y$ against x is a straight line with gradient 0.239.

(a) Find the value of a correct to 3 significant figures. [3]

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(b) Hence find the value of x when $y = 36$. Give your answer correct to 3 significant figures. [2]

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4 **(a)** Show that $\sin 2\theta \cot \theta - \cos 2\theta \equiv 1$. [3]

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(b) Hence find the exact value of $\sin \frac{1}{6}\pi \cot \frac{1}{12}\pi$. [2]

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(c) Find the smallest positive value of θ (in radians) satisfying the equation

$$\sin 2\theta \cot \theta - 3 \cos 2\theta = 1.$$ [2]

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5 **(a)** Given that $y = \tan^2 x$, show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = 2\tan x + 2\tan^3 x$. [2]

(b) Find the exact value of $\displaystyle\int_{\frac{1}{4}\pi}^{\frac{1}{3}\pi} (\tan x + \tan^2 x + \tan^3 x)\,\mathrm{d}x$. [6]

6 The polynomial $\mathrm{p}(x)$ is defined by

$$\mathrm{p}(x) = 4x^3 + 16x^2 + 9x - 15.$$

(a) Find the quotient when $\mathrm{p}(x)$ is divided by $(2x + 3)$, and show that the remainder is -6. [3]

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(b) Find $\displaystyle\int \frac{\mathrm{p}(x)}{2x + 3}\,\mathrm{d}x$. [2]

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(c) Factorise $p(x) + 6$ completely and hence solve the equation

$$p(\text{cosec } 2\theta) + 6 = 0$$

for $0° < \theta < 135°$. [5]

7 A curve has equation $e^{2x}y - e^{y} = 100$.

(a) Show that $\frac{dy}{dx} = \frac{2e^{2x}y}{e^{y} - e^{2x}}$. [3]

(b) Show that the curve has no stationary points. [2]

It is required to find the x-coordinate of P, the point on the curve at which the tangent is parallel to the y-axis.

(c) Show that the x-coordinate of P satisfies the equation

$$x = \ln 10 - \tfrac{1}{2}\ln(2x - 1).$$ [4]

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(d) Use an iterative formula, based on the equation in part **(c)**, to find the x-coordinate of P correct to 3 significant figures. Use an initial value of 2 and give the result of each iteration to 5 significant figures. [3]

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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.

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