Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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5604704581

MATHEMATICS **9709/21**

Paper 2 Pure Mathematics 2 **May/June 2020**

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. Blank pages are indicated.

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1 Solve the equation

$$\ln(x + 1) - \ln x = 2 \ln 2.$$ [3]

2 The polynomial $p(x)$ is defined by

$$p(x) = 6x^3 + ax^2 + 9x + b,$$

where a and b are constants. It is given that $(x - 2)$ and $(2x + 1)$ are factors of $p(x)$.

Find the values of a and b. [5]

3 A curve has parametric equations

$$x = e^t - 2e^{-t}, \qquad y = 3e^{2t} + 1.$$

Find the equation of the tangent to the curve at the point for which $t = 0$. [5]

4 **(a)** Sketch, on the same diagram, the graphs of $y = |3x + 2a|$ and $y = |3x - 4a|$, where a is a positive constant.

Give the coordinates of the points where each graph meets the axes. [3]

(b) Find the coordinates of the point of intersection of the two graphs. [3]

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(c) Deduce the solution of the inequality $|3x + 2a| < |3x - 4a|$. [1]

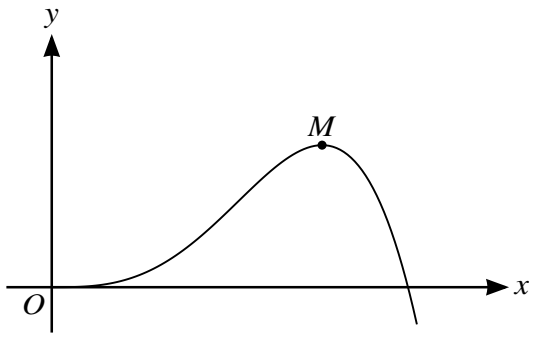
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The diagram shows part of the curve with equation $y = x^3 \cos 2x$. The curve has a maximum at the point M.

(a) Show that the x-coordinate of M satisfies the equation $x = \sqrt[3]{1.5x^2 \cot 2x}$. [3]

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(b) Use the equation in part **(a)** to show by calculation that the x-coordinate of M lies between 0.59 and 0.60. [2]

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

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6 **(a)** Prove that

$$\sin 2\theta(\operatorname{cosec}\theta - \sec\theta) \equiv \sqrt{8}\cos\left(\theta + \tfrac{1}{4}\pi\right). \quad [5]$$

(b) Solve the equation

$$\sin 2\theta(\operatorname{cosec}\theta - \sec\theta) = 1$$

for $0 < \theta < \frac{1}{2}\pi$. Give the answer correct to 3 significant figures. [2]

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(c) Find $\int \sin x\left(\operatorname{cosec}\frac{1}{2}x - \sec\frac{1}{2}x\right) \mathrm{d}x$. [3]

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7 **(a)** Find the quotient when $9x^3 - 6x^2 - 20x + 1$ is divided by $(3x + 2)$, and show that the remainder is 9. [3]

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(b) Hence find $\int_1^6 \frac{9x^3 - 6x^2 - 20x + 1}{3x + 2} \, dx$, giving the answer in the form $a + \ln b$ where a and b are integers. [5]

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(c) Find the exact root of the equation $9e^{9y} - 6e^{6y} - 20e^{3y} - 8 = 0$. [4]

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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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