Cambridge Assessment International Education

# Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*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.




**[Turn over**

**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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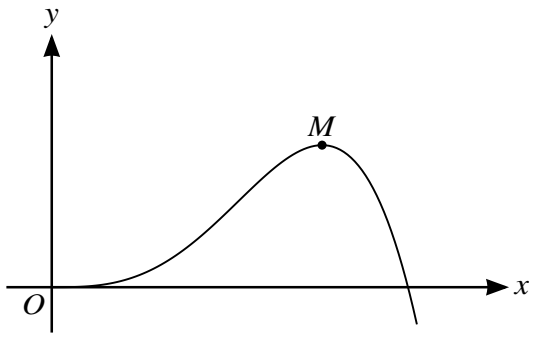
**5**




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

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

**(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

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