



## Cambridge International AS & A Level

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**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.

1 Solve the equation

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

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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]

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- 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]

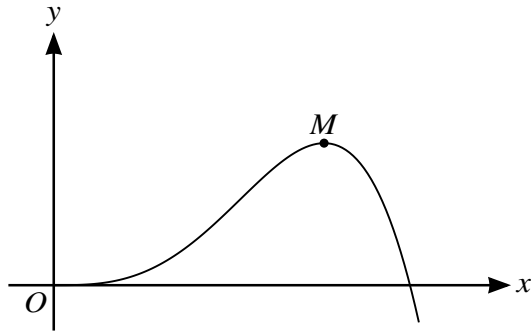
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The diagram shows part of the curve with equation  $y = x^3 \cos 2x$ . The curve has a maximum at the point  $M$ .

- (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

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

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(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  $\int \sin x(\operatorname{cosec} \frac{1}{2}x - \sec \frac{1}{2}x) dx$ . [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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