Cambridge International AS Level

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CANDIDATE NAME

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2128789371

MATHEMATICS **9709/21**

Paper 2 Pure Mathematics 2 **(P2)** **May/June 2019**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.

This document consists of **12** printed pages.

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1 Show that $\ln(x^3 - 4x) - \ln(x^2 - 2x) \equiv \ln(x + 2)$. [3]

2 **(i)** Solve the inequality $|3x - 5| < |x + 3|$. [4]

(ii) Hence find the greatest integer n satisfying the inequality $\left|3^{0.1n+1} - 5\right| < \left|3^{0.1n} + 3\right|$. [2]

3 Find the equation of the normal to the curve

$$x^2 \ln y + 2x + 5y = 11$$

at the point (3, 1). [7]

4 **(a)** Find $\int \tan^2 3x \, \mathrm{d}x$. [3]

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(b) Find the exact value of $\int_0^1 \frac{\mathrm{e}^{3x} + 4}{\mathrm{e}^x} \, \mathrm{d}x$. Show all necessary working. [4]

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

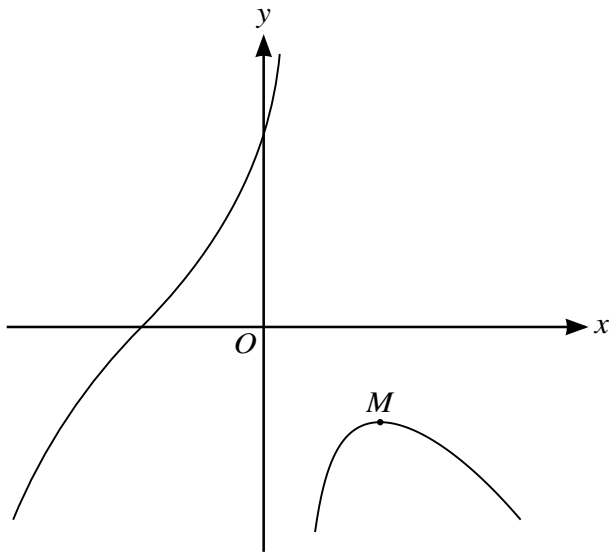
$$p(x) = 5x^3 + ax^2 + bx - 16,$$

where a and b are constants. It is given that $(x - 2)$ is a factor of $p(x)$ and that the remainder is 27 when $p(x)$ is divided by $(x + 1)$.

(i) Find the values of a and b. [5]

(ii) Hence factorise $p(x)$ completely. [3]

6



The diagram shows the curve with equation $y = \dfrac{8 + x^3}{2 - 5x}$. The maximum point is denoted by M.

(i) Find an expression for $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ and determine the gradient of the curve at the point where the curve crosses the x-axis. [4]

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(ii) Show that the x-coordinate of the point M satisfies the equation $x = \sqrt{(0.6x + 4x^{-1})}$. [2]

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

7 **(i)** Show that $2\,\text{cosec}\,2\theta\cot\theta \equiv \text{cosec}^2\,\theta$. [3]

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(ii) Hence show that $\text{cosec}^2\,15° \tan 15° = 4$. [2]

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(iii) Solve the equation $2\,\text{cosec}\,\phi\,\cot\frac{1}{2}\phi + \text{cosec}\,\frac{1}{2}\phi = 12$ for $-360° < \phi < 360°$. Show all necessary working. [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.

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