

CANDIDATE
NAME

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MATHEMATICS

9709/22

Paper 2 Pure Mathematics 2 (P2)

February/March 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.



- 1** Solve the equation $\sec^2 \theta + \tan^2 \theta = 5 \tan \theta + 4$ for $0^\circ < \theta < 180^\circ$. Show all necessary working. [4]

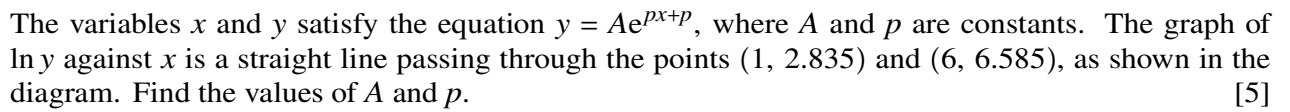
[illegible]

- 2** Given that x satisfies the equation $|2x + 3| = |2x - 1|$, find the value of

$$|4x - 3| - |6x|.$$

[4]

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the entire width of the page. There are no margins, text, or other markings present.

- 4 (i) Find the quotient when $4x^3 + 8x^2 + 11x + 9$ is divided by $(2x + 1)$, and show that the remainder is 5. [3]

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- (ii) Show that the equation $4x^3 + 8x^2 + 11x + 4 = 0$ has exactly one real root. [3]

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- 5 The equation of a curve is $y = \frac{e^{2x}}{4x+1}$ and the point P on the curve has y -coordinate 10.

(i) Show that the x -coordinate of P satisfies the equation $x = \frac{1}{2} \ln(40x + 10)$. [2]

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(ii) Use the iterative formula $x_{n+1} = \frac{1}{2} \ln(40x_n + 10)$ with $x_1 = 2.3$ to find the x -coordinate of P correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]

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- (iii) Find the gradient of the curve at P , giving the answer correct to 3 significant figures. [4]

[illegible]

6 (a) Show that $\int_1^4 \left(\frac{2}{x} + \frac{2}{2x+1} \right) dx = \ln 48$. [5]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

(b) Find $\int \sin 2x (\cot x + 2 \operatorname{cosec} x) dx$.

[6]

[illegible]

for $0 \leq t \leq \frac{1}{2}\pi$. At the point P on the curve, the gradient of the curve is 2.

- (ii) Show that the value of the parameter at P satisfies the equation $2 \sin 2t - 4 \cos 2t = 1$. [4]

This image shows a full page of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page, typical of notebook or legal stationery. There are no margins, text, or other markings on the page.

- (ii) By first expressing $2 \sin 2t - 4 \cos 2t$ in the form $R \sin(2t - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$, find the coordinates of P . Give each coordinate correct to 3 significant figures. [7]

[illegible]

[illegible]

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