



Cambridge International AS & A Level

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MATHEMATICS**9709/21**

Paper 2 Pure Mathematics 2

October/November 2022**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 **16** pages. Any blank pages are indicated.



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[4]

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dotted lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, leaving ample room for writing practice. There is no text or other markings on the page.

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.

[4]

[illegible]

6

4 (a) By sketching a suitable pair of graphs on the same diagram, show that the equation

$$e^{-\frac{1}{2}x} = x^5$$

has exactly one real root. [2]

(b) Use the iterative formula $x_{n+1} = \sqrt[5]{e^{-\frac{1}{2}x_n}}$ to determine the root correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]

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[5]

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

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

$$p(x) = 12x^3 - 9x^2 + 8x - 4.$$

- (a)** Find the quotient when $p(x)$ is divided by $(4x - 3)$ and show that the remainder is 2. [3]

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- (b)** Hence find $\int_2^{12} \left(\frac{p(x)}{4x - 3} - 3x^2 \right) dx$, giving your answer in the form $a + \ln b$. [6]

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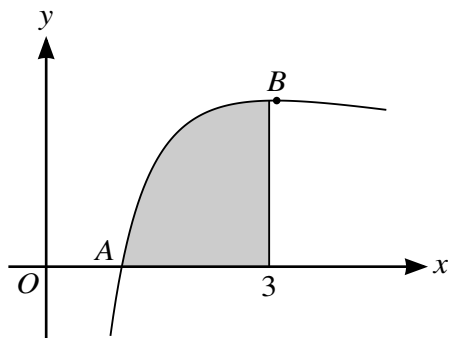
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(a) Find the gradient of the curve at A. [3]

[illegible]

- (b) Show by calculation that the x -coordinate of B lies between 3.0 and 3.1. [3]

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- (c) Use the trapezium rule with two intervals to find an approximation to the area of the shaded region. Give your answer correct to 2 decimal places. [3]

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8 The expression $f(\theta)$ is defined by $f(\theta) = 12 \sin \theta \cos \theta + 16 \cos^2 \theta$.

- (a) Express $f(\theta)$ in the form $R \cos(2\theta - \alpha) + k$, where $R > 0$, $0 < \alpha < \frac{1}{2}\pi$ and k is a constant. State the values of R and k , and give the value of α correct to 4 significant figures. [5]

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- (b) Find the smallest positive value of θ satisfying the equation $f(\theta) = 17$. [3]

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(c) Find $\int f(\theta) \, d\theta$. [2]

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[illegible]

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