



Cambridge International AS & A Level

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MATHEMATICS

9709/21

Paper 2 Pure Mathematics 2

October/November 2024

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.



1 The variables x and y satisfy the equation $a^{2y} = e^{3x+k}$, where a and k are constants. The graph of y against x is a straight line.

(a) Use logarithms to show that the gradient of the straight line is $\frac{3}{2 \ln a}$. [1]

(b) Given that the straight line passes through the points $(0.4, 0.95)$ and $(3.3, 3.80)$, find the values of a and k . [4]





2 Solve the inequality $|x-7| > 4x + 3$.

[4]





3 The function f is defined by $f(x) = \tan^2\left(\frac{1}{2}x\right)$ for $0 \leq x < \pi$.

(a) Find the exact value of $f'\left(\frac{2}{3}\pi\right)$. [3]





(b) Find the exact value of $\int_0^{\frac{1}{2}\pi} (f(x) + \sin x) dx$.

[4]





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

$$p(x) = ax^3 - ax^2 - 15x + 18,$$

where a is a constant. It is given that $(x + 2)$ is a factor of $p(x)$.

(a) Find the value of a .

[2]

(b) Hence factorise $p(x)$ completely.

[3]







5 It is given that $\int_a^{a^3} \frac{10}{2x+1} dx = 7$, where a is a constant greater than 1.

(a) Show that $a = \sqrt[3]{0.5e^{1.4}(2a+1) - 0.5}$.

[5]

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(b) Use an iterative formula, based on the equation in part (a), to find the value of a correct to 3 significant figures. Use an initial value of 2 and give the result of each iteration to 5 significant figures. [3]





6 A curve has parametric equations

$$x = \frac{e^{2t} - 2}{e^{2t} + 1}, \quad y = e^{3t} + 1.$$

(a) Find an expression for $\frac{dy}{dx}$ in terms of t . [4]





(b) Find the exact gradient of the curve at the point where the curve crosses the y -axis.

[3]





7 (a) Prove that $\cos(\theta+30^\circ)\cos(\theta+60^\circ) \equiv \frac{1}{4}\sqrt{3} - \frac{1}{2}\sin 2\theta$.

(b) Solve the equation $5 \cos(2\alpha + 30^\circ) \cos(2\alpha + 60^\circ) = 1$ for $0^\circ < \alpha < 90^\circ$.

[4]





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(c) Show that the exact value of $\cos 20^\circ \cos 50^\circ + \cos 40^\circ \cos 70^\circ$ is $\frac{1}{2}\sqrt{3}$. [3]





Additional page

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