



Cambridge International AS & A Level

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

MATHEMATICS 9709/22

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.

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Use logarithms to show that the equation $5^{8y} = 6^{7x}$ can be expressed in the form $y = kx$. Give the valor of the constant k correct to 3 significant figures.										



2 Let $f(x) = 4 \sin^2 3x$.

(a)	Find the value of $f'(\frac{1}{4}\pi)$.	[3]
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		•••••
		•••••
(b)	Find $\int f(x) dx$.	[3]



A curve has equation $6e^{-x}y^2 + e^{2x} - 12y + 7 = 0$.

Find the gradient of the curve at the point $(\ln 3, 2)$.	[6]
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4 (a) Sketch the graphs of $y = 1 + e^{2x}$ and y = |x - 4| on the same diagram.

[2]

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(b) The two graphs meet at the point P.

Show that the *x*-coordinate of *P* satisfies the equation $x = \frac{1}{2} \ln(3 - x)$.

[2]

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(c)

figures.	[3

5 The polynomial p(x) is defined by

$$p(x) = ax^3 + bx^2 - ax + 8,$$

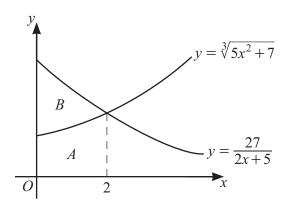
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where a and b are constants. It is given that (x+2) is a factor of p(x), and that the remainder is 24 when p(x) is divided by (x-2).

(a)	Find the values of a and b .	[4]



(b)	Factorise $p(x)$ and hence show that the equation $p(x) = 0$ has exactly one real root.	[3]
(c)	Solve the equation $p(\frac{1}{2}\csc\theta) = 0$ for $-90^{\circ} < \theta < 90^{\circ}$.	[3]
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The diagram shows the curves with equations $y = \sqrt[3]{5x^2 + 7}$ and $y = \frac{27}{2x + 5}$ for $x \ge 0$. The curves meet at the point (2,3).

Region A is bounded by the curve $y = \sqrt[3]{5x^2 + 7}$ and the straight lines x = 0, x = 2 and y = 0. Region B is bounded by the two curves and the straight line x = 0.

(a)	Use the trapezium rule with two intervals to find an approximation to the area of region A. Give your answer correct to 3 significant figures. [3]



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(D)	are constants. [3]
(a)	Deduce an approximation to the area of region P. Give your answer correct to 2 significant figures
(c)	Deduce an approximation to the area of region <i>B</i> . Give your answer correct to 3 significant figures. [1]
(d)	State, with a reason, whether your answer to part (c) is an over-estimate or an under-estimate of the area of region B .

(a) Express $4 \sin \theta \sin(\theta + 60^\circ)$ in the form

 $a + R \sin(2\theta - \alpha)$,

where a and R are positive integers and $0^{\circ} < \alpha < 90^{\circ}$.	[6]
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(b) Hence find the smallest positive value of θ satisfying the equation

$\frac{1}{5} + 4\sin\theta\sin(\theta + 60^\circ) = 0.$	[3]
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