

Cambridge International AS & A Level

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

MATHEMATICS 9709/21

Paper 2 Pure Mathematics 2

May/June 2023

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 [].

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2	A augus has aquation v =	$2 + 3 \ln x$
4	A curve has equation $y =$	1+2x

Find the equation of the tangent to the curve at the point $(1, \frac{2}{3})$. $ax + by + c = 0$, where a , b and c are integers.	Give your answer in the form [5]

1)	Show that $a = \frac{1}{2} \ln(9 + \frac{2}{3}a)$.	[4]
)	Use an iterative formula, based on the equation in (a), to find the value of a correct to figures. Use an initial value of 1 and give the result of each iteration to 6 significant	
		•••••

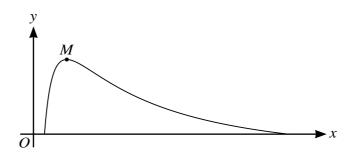
4	The	polyn	omial	p(x)) is	defined	bv
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$$p(x) = 2x^3 + 3x^2 + kx - 30,$$

where k is a constant. It is given that (x-3) is a factor of p(x).

(a)	Find the value of k .	[2]
		•••••
(b)	Hence find the quotient when $p(x)$ is divided by $(x-3)$ and factorise $p(x)$ completely.	[3]
		•••••
		•••••
(c)	It is given that a is one of the roots of the equation $p(x) = 0$.	
	Given also that the equation $ 4y - 5 = a$ is satisfied by two real values of y, find these two of y.	values [3]
		•••••
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5



The diagram shows the curve with parametric equations

$$x = 4e^{2t}$$
, $y = 5e^{-t}\cos 2t$,

for $-\frac{1}{4}\pi \le t \le \frac{1}{4}\pi$. The curve has a maximum point M.

(a)	Find an expression for $\frac{dy}{dx}$ in terms of t . [3]

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Show that $\int_{\frac{1}{4}\pi}^{\frac{\pi}{3}} \left(4\cos^2 2x + \frac{1}{\cos^2 x} \right) dx = \frac{3}{4}\sqrt{3} + \frac{1}{6}\pi - 1.$	
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7	(a)	Express $7 \cos \theta + 24 \sin \theta$ in the form $R \cos(\theta - \alpha)$, where $R > 0$ and $0^{\circ} < \alpha < 90^{\circ}$. Give the value of α correct to 2 decimal places. [3]
	(b)	Solve the equation $7\cos\theta + 24\sin\theta = 18$ for $0^{\circ} < \theta < 360^{\circ}$. [4]

(c) As	В	varies.	the	greatest	possible	value	of
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$$\frac{150}{7\cos\frac{1}{2}\beta + 24\sin\frac{1}{2}\beta + 50}$$

is denoted by V .
Find the value of V and determine the smallest positive value of β (in degrees) for which the value of V occurs.

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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