



Cambridge International AS & A Level

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

937319

MATHEMATICS 9709/31

Paper 3 Pure Mathematics 3

May/June 2025

1 hour 50 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 75.
- The number of marks for each question or part question is shown in brackets [].

This document has 20 pages.



1 (a) Sketch the graph of y = |2x - 3|.

[1]

(b)	Solve the inequality $3x-1 < 2x-3 $.	[2]



It is given that $2 \ln p + \ln(p-1) - \frac{1}{2} \ln(q+1) = 3$.

Find q in terms of p .	[3]
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	* 0000800000004 *
3	Find the complex numbers z for which

Find the complex numbers z for which $\frac{z+5i}{z-5}$ is real and $ z = \sqrt{17}$. Give your $z = x+iy$, where x and y are real.	answers in the form [6]
	•••••

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4 The parametric equations of a curve are

$x = \epsilon$	tan t	y = 3	$\tan^2 t$.

Find the equation of the tangent to the curve at the point $(e, 3)$. Give your answer in the where m and c are exact.	form $y = mx + c$, [6]

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5	The polynomial $3x^3 + pax^2 + 7a^2x + qa^3$ is denoted by $f(x)$, where p , q and a are constants and $a \ne 0$
	When $f(x)$ is divided by $(x+2a)$ the remainder is $-22a^3$. When $f(x)$ is divided by $(3x-a)$ the remainder is $-a^3$.
	Find the values of p and q .

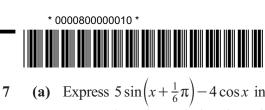


6 It is given that $z_1 = 3e^{\frac{1}{4}\pi i}$, $z_2 = \frac{3}{2}e^{\frac{1}{6}\pi i}$ and $\omega = 2e^{\frac{1}{2}\pi i}$.

(a) State the values of ωz_1 and ωz_2 . Give your answers in the form $r e^{i\theta}$, where r > 0 and $-\pi < \theta \le \pi$.

(b) On a sketch of an Argand diagram with origin O, show the points A, B, C and D representing the complex numbers z_1 , z_2 , ωz_1 and ωz_2 respectively. [2]

(c) State the geometric effects of multiplying z_1 and z_2 by ω . [2]



Express $5\sin\left(x+\frac{1}{6}\pi\right)-4\cos x$ in the form $R\sin(x-\alpha)$, where $R>0$ and $0<\alpha<\frac{1}{2}\pi$. State the exact value of R and give the value of α correct to 3 decimal places. [4]



2 decimal places.	$4\cos 2\theta = \sqrt{7}$ for $0 \le \theta \le \pi$. Give your answers co



With	th respect to the origin O , the points A and B have position vectors $2\mathbf{i} + 4\mathbf{k}$ and $5\mathbf{i} + \mathbf{j} + 6\mathbf{k}$ sectively. The line l_1 passes through the points A and B .
(a)	Find a vector equation for the line l_1 . [2]
The	line l_2 has equation $\mathbf{r} = 2\mathbf{i} + \mathbf{j} + 5\mathbf{k} + \mu(\mathbf{i} + 2\mathbf{j} + 3\mathbf{k})$.
(b)	Show that l_1 and l_2 do not intersect. [4]

* (13
(c)	Find the acute angle between the directions of l_1 and l_2 . [3]
(c)	Find the acute angle between the directions of l_1 and l_2 . [3]
(c)	



9 The constant a is such that $\int_{1}^{a} 6x \ln x \, dx = 4.$

(a)	Show that $a = \exp$	$\left(\frac{1}{6}\left(\frac{5}{a^2}+3\right)\right)$, where $\exp(x)$ denotes e^x .
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[5]

	15	
(b)	Verify by calculation that a lies between 2 and 2.1.	[
(c)	Use an iterative formula based on the equation in part (a) to determine a places. Give the result of each iteration to 4 decimal places.	
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10	(a)	Find the quotient and remainder when $x^3 + 5x^2 - 2x - 15$ is divided by $x^2 - 3$.	[3]
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(b) The variables x and y satisfy the differential equation

$$\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{x^3 + 5x^2 - 2x - 15}{6y(x^2 - 3)}.$$

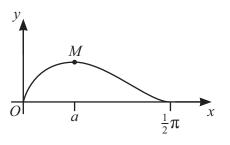
It is given that y = 2 when x = 2.

Solve the differential equation to obtain an expression for y^2 in terms of x .	[5]



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The diagram shows the curve $y = \cos x \sqrt{\sin 2x}$ for $0 \le x \le \frac{1}{2}\pi$. The curve has a maximum point at M, where x = a.

)	Find the exact value of <i>a</i> .	[6]
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)	The region enclosed between the x-axis and the curve is rotated through 2π radians about the x-axis.
	Find the exact volume of the solid generated. [5]

Additional page

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