

Cambridge International AS & A Level

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

MATHEMATICS 9709/03

Paper 3 Pure Mathematics 3

For examination from 2020

SPECIMEN PAPER

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 [].

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	Expand $(1+3x)^{-\frac{1}{3}}$ in ascending powers of x, up to and including the term in x^2 , simpli coefficients.	
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(b)	State the set of values of x for which the expansion is valid.	
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[1]

3	(a)	Sketch the	graph of $y =$	2x - 3	I.
_	···	~ 1100011 0110	D-00011		ı

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

4	The par	ametric	equations	of a	curve	are
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$$x = e^{2t-3}, y = 4 \ln t,$$

where t > 0. When t = a the gradient of the curve is 2.

Show that <i>a</i> satisfies the equation $a = \frac{1}{2}(3 - \ln a)$.	[4

(b)	Verify by calculation that this equation has a root between 1 and 2.	[2]
(c)	Use the iterative formula $a_{n+1} = \frac{1}{2}(3 - \ln a_n)$ to calculate a correct to 2 decimal places, showing	
	result of each iteration to 4 decimal places.	[3]
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(b)	Show that $\int_{0}^{\sqrt{3}} x \tan^{-1} x dx = \frac{2}{3} \pi - \frac{1}{3} \sqrt{3}$.	
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(b)		

Find $\frac{u}{v}$ in the form $x + iy$, where x and y are real.	
State the argument of $\frac{u}{v}$.	

In an Argand diagram, with origin O, the points A, B and C represent the complex numbers u, v and u-v respectively.

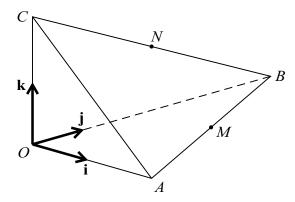
Show that angle $AOB = \frac{1}{4}\pi$ radians.	
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$R > 0$ and $0^{\circ} < \alpha < 90^{\circ}$. Give the value of R correct to 4 significant figures and the value correct to 2 decimal places.

(h)	Hence	solve	the	equation
		, 1101100	30110	uiv	cquation

$COS(x + 43) I = V \angle SIII x = 2$	$\cos(x + 45^\circ)$) — √	$\sqrt{2}$	$\sin x$	=	2.
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for $0^{\circ} < x < 360^{\circ}$.	[4]

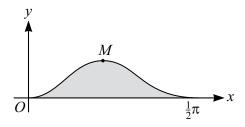


In the diagram, OABC is a pyramid in which OA = 2 units, OB = 4 units and OC = 2 units. The edge OC is vertical, the base OAB is horizontal and angle $AOB = 90^{\circ}$. Unit vectors **i**, **j** and **k** are parallel to OA, OB and OC respectively. The midpoints of AB and BC are M and N respectively.

Express the vectors \overrightarrow{ON} and \overrightarrow{CM} in terms of \mathbf{i} , \mathbf{j} and \mathbf{k} .	

	Calculate the angle between the directions of ON and CM .	[
		•••••
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e)	Show that the length of the perpendicular from M to ON is $\frac{3}{5}\sqrt{5}$.	[

9



The diagram shows the curve $y = \sin^2 2x \cos x$ for $0 \le x \le \frac{1}{2}\pi$, and its maximum point M.

Find the x -coordinate of M .		

<i>x</i> -	axis.
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10 In a chemical reaction, a compound X is formed from two compounds Y and Z.

The masses in grams of X, Y and Z present at time t seconds after the start of the reaction are x, 10 - x and 20 - x respectively. At any time the rate of formation of X is proportional to the product of the masses of Y and Z present at the time. When t = 0, x = 0 and $\frac{dx}{dt} = 2$.

(a) Show that x and t satisfy the differential equation

	$\frac{\mathrm{d}x}{\mathrm{d}t} = 0.01(10 - x)(20 - x).$	[1]
))	Solve this differential equation and obtain an expression for x in terms of t .	[9]

State what happens to the value of x when t becomes large. [1]

(c)

Additional page

If you use the must be clearly	following lined p shown.	age to complet	e the answer(s	s) to any quest	ion(s), the ques	stion number(s)
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