

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

MATHEMATICS

9709/32

Paper 3 Pure Mathematics 3 (P3)

October/November 2019

1 hour 45 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** the questions in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 75.

This document consists of **19** printed pages and **1** blank page.



BLANK PAGE



- 1** Solve the equation $5 \ln(4 - 3^x) = 6$. Show all necessary working and give the answer correct to 3 decimal places. [3]

Handwriting practice paper with horizontal lines and a circular logo in the bottom right corner.

- [5]

A series of horizontal dotted lines for writing.

A circular logo located at the bottom right corner of the page. It features a grey outer ring with the words "GO AHEAD" written in white capital letters. Inside the ring, there is a red arrow pointing towards the right. The logo is partially cut off by the edge of the page.

- 3** The polynomial $x^4 + 3x^3 + ax + b$, where a and b are constants, is denoted by $p(x)$. When $p(x)$ is divided by $x^2 + x - 1$ the remainder is $2x + 3$. Find the values of a and b . [5]

[illegible]

- 4** (i) Express $(\sqrt{6}) \sin x + \cos x$ in the form $R \sin(x + \alpha)$, where $R > 0$ and $0^\circ < \alpha < 90^\circ$. State the exact value of R and give α correct to 3 decimal places. [3]

Handwriting practice lines on a page. The page contains 20 horizontal dotted lines for writing practice. A small circular logo is visible in the bottom right corner, featuring the text 'AHEAD' and a red dot.

(ii) Hence solve the equation $(\sqrt{6}) \sin 2\theta + \cos 2\theta = 2$, for $0^\circ < \theta < 180^\circ$.

[4]

Blank lined paper for writing.

- 5** The equation of a curve is $2x^2y - xy^2 = a^3$, where a is a positive constant. Show that there is only one point on the curve at which the tangent is parallel to the x -axis and find the y -coordinate of this point. [7]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. In the bottom right corner, there is a small, partially visible circular logo with the word "AHEAD" written inside it. The rest of the page is empty.

$$\sin \frac{1}{2} \theta \frac{dx}{d\theta} = (x + 2) \cos \frac{1}{2} \theta$$

for $0 < \theta < \pi$. It is given that $x = 1$ when $\theta = \frac{1}{3}\pi$. Solve the differential equation and obtain an expression for x in terms of $\cos \theta$. [8]

[illegible]

$$z + \frac{iz}{z^*} - 2 = 0,$$

where z^* denotes the complex conjugate of z . Give your answer in the form $x + iy$, where x and y are real. [5]

A series of horizontal dotted lines for writing.

A circular logo in the bottom right corner with the text "GO AHEAD" in a stylized font. The logo is partially cut off by the edge of the page.

- (ii) In the first quadrant the two loci intersect at the point P . Find the exact argument of the complex number represented by P . [2]

[illegible]

8 Let $f(x) = \frac{2x^2 + x + 8}{(2x - 1)(x^2 + 2)}$.

(i) Express $f(x)$ in partial fractions.

[5]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. In the bottom right corner, there is a small, partially visible circular logo. The logo has a blue border and contains the word "AHEAD" in white capital letters. The rest of the logo is cut off by the edge of the page.

- (ii) Hence, showing full working, find $\int_1^5 f(x) dx$, giving the answer in the form $\ln c$, where c is an integer. [5]

AHEAD

- 9 It is given that $\int_0^a x \cos \frac{1}{3}x \, dx = 3$, where the constant a is such that $0 < a < \frac{3}{2}\pi$.

(i) Show that a satisfies the equation

$$a = \frac{4 - 3 \cos \frac{1}{3}a}{\sin \frac{1}{3}a}. \quad [5]$$

[illegible]

- (ii) Verify by calculation that a lies between 2.5 and 3.

[2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (iii) Use an iterative formula based on the equation in part (i) to calculate a correct to 3 decimal places. Give the result of each iteration to 5 decimal places.

[3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

10 The line l has equation $\mathbf{r} = \mathbf{i} + 3\mathbf{j} - 2\mathbf{k} + \lambda(\mathbf{i} - 2\mathbf{j} + 3\mathbf{k})$. The plane p has equation $2x + y - 3z = 5$.

(i) Find the position vector of the point of intersection of l and p . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Calculate the acute angle between l and p . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Handwriting practice paper with 20 horizontal dotted lines.

[illegible]

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.