

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.

Kambridge Math & Physics
kambridgemp.com

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

Cambridge Math & Physics

kambridgemp.com

- [5]

Cambridge Math & Physics
kambridgemp.com

- 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]

Cambridge Math & Physics

kambridgemp.com

- 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]

Cambridge Math & Physics
kamdridgemp.com

Cambridge Math & Physics

kambridgemp.com

- Cambridge Math & Physics
- kambridgemp.com

Kambridge Math & Physics
kambridgemp.com

6 The variables x and θ satisfy the differential equation

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

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]

Kambridge Math & Physics

kambridgemp.com

Kambridge Math & Physics
kambridgemp.com

- 7 (a)** Find the complex number z satisfying the equation

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

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

Cambridge Math & Physics
kamdridgemp.com

- (b) (i) On a single Argand diagram sketch the loci given by the equations $|z - 2i| = 2$ and $\text{Im } z = 3$, where $\text{Im } z$ denotes the imaginary part of z . [2]

- (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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

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

[5]

Cambridge Math & Physics
kamdbridgemp.com

- (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]

Cambridge Math & Physics

kambridgemp.com

- 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

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

Cambridge Math & Physics

kambridgemp.com

- (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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- Cambridge Math & Physics
- kambridgemp.com

Cambridge Math & Physics

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.