



Cambridge International AS & A Level

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MATHEMATICS**9709/32**

Paper 3 Pure Mathematics 3

October/November 2024**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. Any blank pages are indicated.



- [4]

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[5]

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4 Solve the equation $5^x = 5^{x+2} - 10$. Give your answer correct to 3 decimal places. [3]

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5 (a) The complex number u is given by

$$u = \frac{(\cos \frac{1}{7}\pi + i \sin \frac{1}{7}\pi)^4}{\cos \frac{1}{7}\pi - i \sin \frac{1}{7}\pi}.$$

Find the exact value of $\arg u$.

[2]

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(b) The complex numbers u and u^* are plotted on an Argand diagram.

Describe the single geometrical transformation that maps u onto u^* and state the exact value of $\arg u^*$.

[2]

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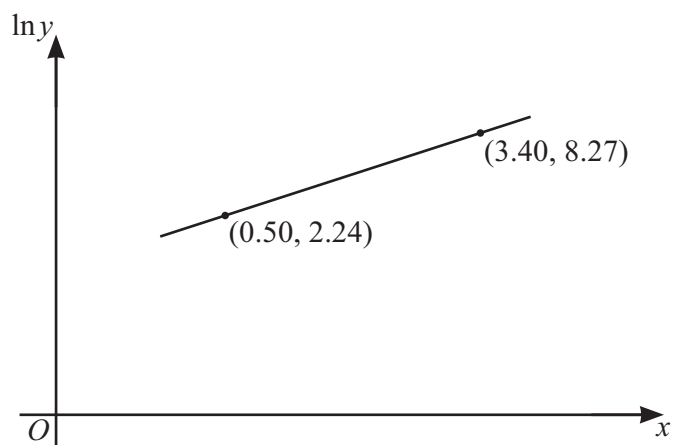
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6



The variables x and y satisfy the equation $ay = b^x$, where a and b are constants. The graph of $\ln y$ against x is a straight line passing through the points $(0.50, 2.24)$ and $(3.40, 8.27)$, as shown in the diagram.

Find the values of a and b . Give each value correct to 1 significant figure. [4]

[illegible]



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[3]

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- (b) Hence solve the equation $\tan^3 2\theta + 2 \tan 4\theta - \tan 2\theta = 0$ for $0 < \theta < \pi$. Give your answers in exact form. [3]

This image shows a full page of a worksheet designed for handwriting practice. It features approximately 20 evenly spaced, horizontal dotted lines across the entire width of the page. The background is plain white, providing a clear guide for letter formation and alignment. There are no margins, text, or other markings present.



8 The parametric equations of a curve are

$$x = \tan^2 2t, \quad y = \cos 2t,$$

for $0 < t < \frac{1}{4}\pi$.

(a) Show that $\frac{dy}{dx} = -\frac{1}{2}\cos^3 2t$. [4]

[illegible]



- (b)** Hence find the equation of the normal to the curve at the point where $t = \frac{1}{8}\pi$. Give your answer in the form $y = mx + c$. [4]

[illegible]



9 With respect to the origin O , the points A , B and C have position vectors given by

$$\overrightarrow{OA} = \begin{pmatrix} 2 \\ 1 \\ -3 \end{pmatrix}, \quad \overrightarrow{OB} = \begin{pmatrix} 0 \\ 4 \\ 1 \end{pmatrix} \quad \text{and} \quad \overrightarrow{OC} = \begin{pmatrix} -3 \\ -2 \\ 2 \end{pmatrix}.$$

(a) The point D is such that $ABCD$ is a trapezium with $\overrightarrow{DC} = 3\overrightarrow{AB}$.

Find the position vector of D .

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(b) The diagonals of the trapezium intersect at the point P .

Find the position vector of P .

[5]

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(c) Using a scalar product, calculate angle ABC .

[4]





- 10 A balloon in the shape of a sphere has volume V and radius r . Air is pumped into the balloon at a constant rate of 40π starting when time $t = 0$ and $r = 0$. At the same time, air begins to flow out of the balloon at a rate of $0.8\pi r$. The balloon remains a sphere at all times.

- (a) Show that r and t satisfy the differential equation

$$\frac{dr}{dt} = \frac{50-r}{5r^2}. \quad [3]$$

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- (b) Find the quotient and remainder when $5r^2$ is divided by $50 - r$. [3]

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(c) Solve the differential equation in part (a), obtaining an expression for t in terms of r . [6]

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(d) Find the value of t when the radius of the balloon is 12. [1]

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- (b) Use the substitution $u = e^x$ and partial fractions to find the exact value of $\int_{\ln 3}^{\ln 5} f(x) dx$.

Give your answer in the form $\ln a$, where a is a rational number in its simplest form. [9]

[illegible]



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