

CANDIDATE
NAME

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MATHEMATICS

9709/32

Paper 3 Pure Mathematics 3 **(P3)**

May/June 2017

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.

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.



- 1** Solve the equation $\ln(x^2 + 1) = 1 + 2 \ln x$, giving your answer correct to 3 significant figures. [3]

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

2 Solve the inequality $|x - 3| < 3x - 4$.

[4]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- 3** (i) Express the equation $\cot \theta - 2 \tan \theta = \sin 2\theta$ in the form $a \cos^4 \theta + b \cos^2 \theta + c = 0$, where a , b and c are constants to be determined. [3]

[illegible]

(ii) Hence solve the equation $\cot \theta - 2 \tan \theta = \sin 2\theta$ for $90^\circ < \theta < 180^\circ$.

[2]

[illegible]

4 The parametric equations of a curve are

$$x = t^2 + 1, \quad y = 4t + \ln(2t - 1).$$

(i) Express $\frac{dy}{dx}$ in terms of t .

[3]

This image shows a full page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page, typical of notebook or legal stationery. There are no margins, text, or other markings on the page.

- (ii) Find the equation of the normal to the curve at the point where $t = 1$. Give your answer in the form $ax + by + c = 0$. [3]

This image shows a full page of primary-ruled paper. It features approximately 20 horizontal dotted lines spaced evenly down the page, providing a guide for handwriting practice. The paper is otherwise blank, with no margins, text, or other markings.

- $x = \frac{10}{(1+t)^2}$. At the beginning of the process $y = 100$.

[6]

[illegible]

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- (ii) Find the exact value approached by the mass of B as t becomes large. State what happens to the mass of A as t becomes large. [2]

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(i) It is given that u is a root of the equation $x^3 + ax^2 - 3x + b = 0$, where the constants a and b are real. Find the values of a and b . [4]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

- (ii) On a sketch of an Argand diagram, shade the region whose points represent complex numbers z satisfying both the inequalities $|z - u| < 1$ and $|z| < |z + i|$. [4]

- 7 (i) Prove that if $y = \frac{1}{\cos \theta}$ then $\frac{dy}{d\theta} = \sec \theta \tan \theta$. [2]

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- (ii) Prove the identity $\frac{1 + \sin \theta}{1 - \sin \theta} \equiv 2 \sec^2 \theta + 2 \sec \theta \tan \theta - 1$. [3]

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- (iii) Hence find the exact value of $\int_0^{\frac{1}{4}\pi} \frac{1 + \sin \theta}{1 - \sin \theta} d\theta$. [4]
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8 Let $f(x) = \frac{5x^2 - 7x + 4}{(3x + 2)(x^2 + 5)}$.

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

[5]

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 page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.

- (ii) Hence obtain the expansion of $f(x)$ in ascending powers of x , up to and including the term in x^2 . [5]

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- 9 Relative to the origin O , the point A has position vector given by $\overrightarrow{OA} = \mathbf{i} + 2\mathbf{j} + 4\mathbf{k}$. The line l has equation $\mathbf{r} = 9\mathbf{i} - \mathbf{j} + 8\mathbf{k} + \mu(3\mathbf{i} - \mathbf{j} + 2\mathbf{k})$.
- (i) Find the position vector of the foot of the perpendicular from A to l . Hence find the position vector of the reflection of A in l . [5]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

- (ii) Find the equation of the plane through the origin which contains l . Give your answer in the form $ax + by + cz = d$. [3]

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- (iii) Find the exact value of the perpendicular distance of A from this plane. [3]

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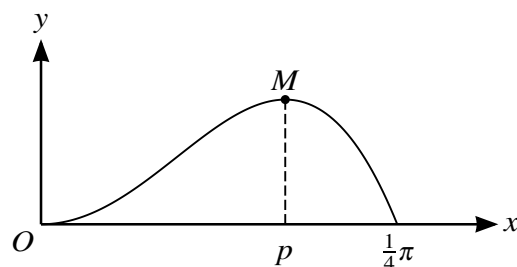
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The diagram shows the curve $y = x^2 \cos 2x$ for $0 \leq x \leq \frac{1}{4}\pi$. The curve has a maximum point at M where $x = p$.

- (i) Show that p satisfies the equation $p = \frac{1}{2} \tan^{-1} \left(\frac{1}{p} \right)$. [3]

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- (ii) Use the iterative formula $p_{n+1} = \frac{1}{2} \tan^{-1} \left(\frac{1}{p_n} \right)$ to determine the value of p correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

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- (iii) Find, showing all necessary working, the exact area of the region bounded by the curve and the x -axis. [5]

[illegible]

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