

CANDIDATE
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MATHEMATICS

9709/32

Paper 3 Pure Mathematics 3 (P3)

October/November 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.

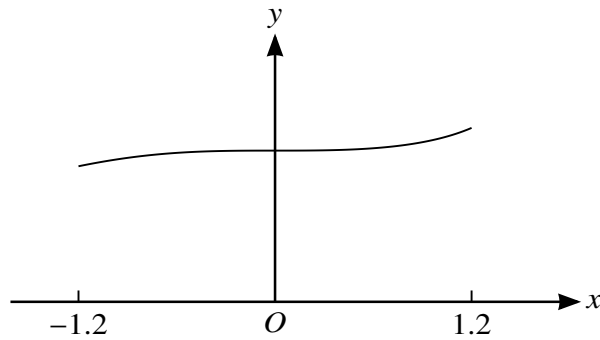
The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 75.

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



1



The diagram shows a sketch of the curve $y = \frac{3}{\sqrt{9-x^3}}$ for values of x from -1.2 to 1.2 .

- (i) Use the trapezium rule, with two intervals, to estimate the value of

$$\int_{-1.2}^{1.2} \frac{3}{\sqrt{9-x^3}} dx,$$

giving your answer correct to 2 decimal places.

[3]

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- (ii) Explain, with reference to the diagram, why the trapezium rule may be expected to give a good approximation to the true value of the integral in this case.

[1]

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- 2** Showing all necessary working, solve the equation $2 \log_2 x = 3 + \log_2(x + 1)$, giving your answer correct to 3 significant figures. [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.

- 3 By expressing the equation $\tan(\theta + 60^\circ) + \tan(\theta - 60^\circ) = \cot \theta$ in terms of $\tan \theta$ only, solve the equation for $0^\circ < \theta < 90^\circ$. [5]

[illegible]

- 4** The curve with equation $y = \frac{2 - \sin x}{\cos x}$ has one stationary point in the interval $-\frac{1}{2}\pi < x < \frac{1}{2}\pi$.

(i) Find the exact coordinates of this point.

[5]

[illegible]

[2]

[illegible]

5 The variables x and y satisfy the differential equation

$$(x + 1) \frac{dy}{dx} = y(x + 2),$$

and it is given that $y = 2$ when $x = 1$. Solve the differential equation and obtain an expression for y in terms of x . [7]

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of horizontal dashed lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.

(i) Show that $\frac{dy}{dx} = \frac{3x^2y - 3y^3}{9xy^2 - x^3}$. [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) Hence show that there are only two points on the curve at which the tangent is parallel to the x -axis and find the coordinates of these points. [4]

[illegible]

7 Throughout this question the use of a calculator is not permitted.

The complex number $1 - (\sqrt{3})i$ is denoted by u .

(i) Find the modulus and argument of u .

[2]

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(ii) Show that $u^3 + 8 = 0$.

[2]

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- (iii) On a sketch of an Argand diagram, shade the region whose points represent complex numbers z satisfying both the inequalities $|z - u| \leq 2$ and $\operatorname{Re} z \geq 2$, where $\operatorname{Re} z$ denotes the real part of z . [4]

8 Let $f(x) = \frac{8x^2 + 9x + 8}{(1-x)(2x+3)^2}$.

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

[5]

[illegible]

- (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 a handwriting practice worksheet. It consists of multiple sets of three horizontal dashed lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, leaving ample room for practicing various letters and words. There is no text or other markings on the page.

9 It is given that $\int_1^a x^{\frac{1}{2}} \ln x \, dx = 2$, where $a > 1$.

(i) Show that $a^{\frac{3}{2}} = \frac{7 + 2a^{\frac{3}{2}}}{3 \ln a}$. [5]

[illegible]

(ii) Show by calculation that a lies between 2 and 4.

[2]

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(iii) Use the iterative formula

$$a_{n+1} = \left(\frac{7 + 2a_n^{\frac{3}{2}}}{3 \ln a_n} \right)^{\frac{2}{3}}$$

to determine a correct to 3 decimal places. Give the result of each iteration to 5 decimal places.

[3]

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10 Two planes p and q have equations $x + y + 3z = 8$ and $2x - 2y + z = 3$ respectively.

- (i) Calculate the acute angle between the planes p and q . [4]

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- (ii) The point A on the line of intersection of p and q has y -coordinate equal to 2. Find the equation of the plane which contains the point A and is perpendicular to both the planes p and q . Give your answer in the form $ax + by + cz = d$. [7]

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