

Cambridge International AS & A Level

CANDIDATE
NAME

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CENTRE
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MATHEMATICS

9709/32

Paper 3 Pure Mathematics 3

February/March 2020

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. Blank pages are indicated.

- 1 (a) Sketch the graph of $y = |x - 2|$.

[1]

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

[3]

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2 Solve the equation $\ln 3 + \ln(2x + 5) = 2 \ln(x + 2)$. Give your answer in a simplified exact form. [4]

[illegible]

- 3 (a) By sketching a suitable pair of graphs, show that the equation $\sec x = 2 - \frac{1}{2}x$ has exactly one root in the interval $0 \leq x < \frac{1}{2}\pi$. [2]

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- (b) Verify by calculation that this root lies between 0.8 and 1. [2]

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- (c) Use the iterative formula $x_{n+1} = \cos^{-1}\left(\frac{2}{4-x_n}\right)$ to determine the root correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

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4 Find $\int_{\frac{1}{6}\pi}^{\frac{1}{3}\pi} x \sec^2 x \, dx$. Give your answer in a simplified exact form. [7]

[illegible]

5 (a) Show that $\frac{\cos 3x}{\sin x} + \frac{\sin 3x}{\cos x} = 2 \cot 2x$.

[4]

[illegible]

[illegible]

6 The variables x and y satisfy the differential equation

$$\frac{dy}{dx} = \frac{1 + 4y^2}{e^x}.$$

It is given that $y = 0$ when $x = 1$.

(a) Solve the differential equation, obtaining an expression for y in terms of x .

[7]

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(b) State what happens to the value of y as x tends to infinity.

[1]

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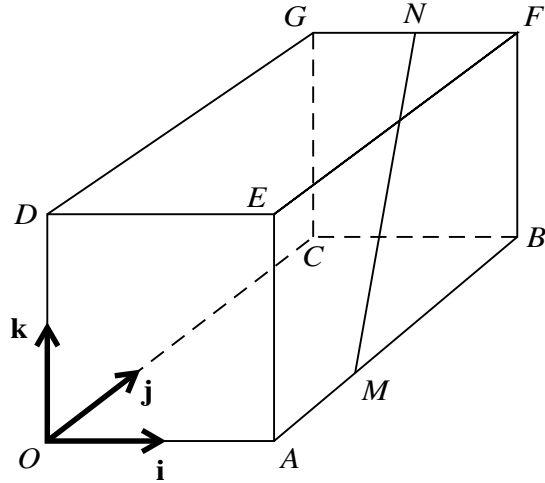
7 The equation of a curve is $x^3 + 3xy^2 - y^3 = 5$.

(a) Show that $\frac{dy}{dx} = \frac{x^2 + y^2}{y^2 - 2xy}$. [4]

[illegible]

- (b) Find the coordinates of the points on the curve where the tangent is parallel to the y-axis. [5]

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.



In the diagram, $OABCDEFG$ is a cuboid in which $OA = 2$ units, $OC = 3$ units and $OD = 2$ units. Unit vectors $\mathbf{i}$, $\mathbf{j}$ and $\mathbf{k}$ are parallel to OA , OC and OD respectively. The point M on AB is such that $MB = 2AM$. The midpoint of FG is N .

- (a) Express the vectors $\overrightarrow{OM}$ and $\overrightarrow{MN}$ in terms of $\mathbf{i}$, $\mathbf{j}$ and $\mathbf{k}$. [3]

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- (b) Find a vector equation for the line through M and N . [2]

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9 Let $f(x) = \frac{2 + 11x - 10x^2}{(1 + 2x)(1 - 2x)(2 + x)}$.

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

[5]

[illegible]

[illegible]

- 10 (a)** The complex numbers v and w satisfy the equations

$$v + iw = 5 \quad \text{and} \quad (1 + 2i)v - w = 3i.$$

Solve the equations for v and w , giving your answers in the form $x + iy$, where x and y are real.

[6]

This image shows a single sheet 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 paper.

- (b) (i)** On an Argand diagram, sketch the locus of points representing complex numbers z satisfying $|z - 2 - 3i| = 1$. [2]

- (ii) Calculate the least value of $\arg z$ for points on this locus. [2]

[illegible]

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