



Cambridge International AS & A Level

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MATHEMATICS**9709/31**

Paper 3 Pure Mathematics 3

October/November 2022**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.



2

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3

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

[1]

- (b)** Solve the inequality $3x + 5 < |2x + 1|$.

[3]

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- 2** On a sketch of an Argand diagram shade the region whose points represent complex numbers z satisfying the inequalities $|z| \leq 3$, $\operatorname{Re} z \geq -2$ and $\frac{1}{4}\pi \leq \arg z \leq \pi$. [4]

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- [illegible]

[illegible]

[3]

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(a) Show that $a = \cos^{-1} \left(\sqrt[3]{\frac{\cos a + 2a \sin a}{12}} \right)$. [3]

[illegible]

- (b) Verify by calculation that a lies between 0.9 and 1. [2]

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- (c) Use an iterative formula based on the equation in part (a) to determine a correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

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$$\frac{dx}{dt} = kxe^{-0.1t},$$

(a) Solve the differential equation, obtaining a relation between x , t and k . [5]

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- (b) Given that $x = 40$ when $t = 10$, find the value of k and find the value approached by x as t becomes large. [3]

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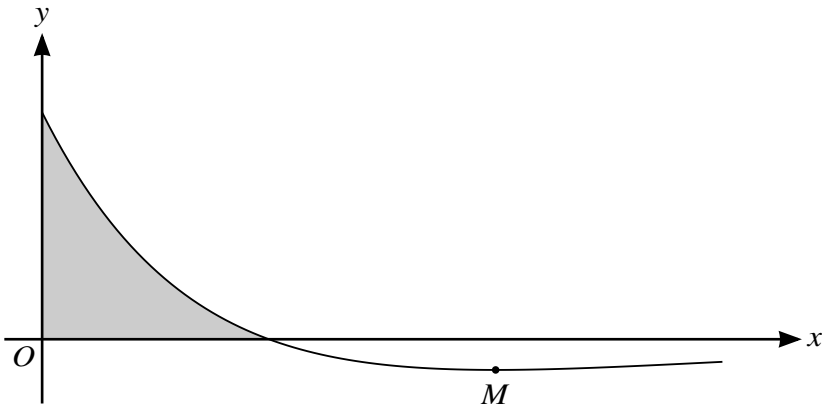
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The diagram shows part of the curve $y = (3 - x)e^{-\frac{1}{3}x}$ for $x \geq 0$, and its minimum point M .

- (a) Find the exact coordinates of M . [5]

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[illegible]

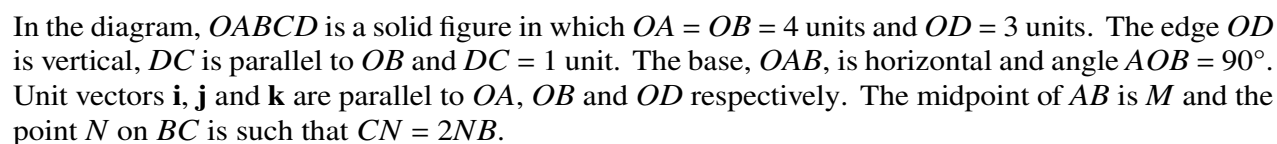
10 Let $f(x) = \frac{2x^2 + 7x + 8}{(1+x)(2+x)^2}$.

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

[5]

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- [illegible]

(b) Calculate the angle in degrees between the directions of $\overrightarrow{MD}$ and $\overrightarrow{ON}$. [3]

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(c) Show that the length of the perpendicular from M to ON is $\sqrt{\frac{22}{5}}$. [4]

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