

# Cambridge International AS & A Level

CANDIDATE  
NAME

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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]

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- 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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[7]

A series of horizontal dotted lines for handwriting practice.

HEAD

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

[4]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. In the bottom right corner, there is a small, partially visible circular logo. The logo has a blue border and contains the word "AHEAD" in white capital letters. Below the word "AHEAD", there is a red graphic element that appears to be a stylized letter or symbol. The rest of the page is completely blank and white.

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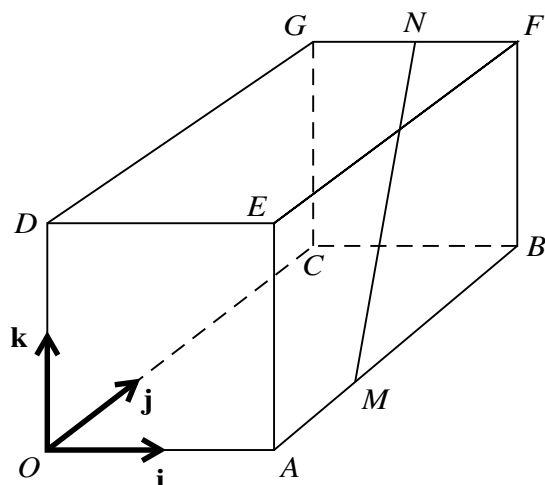
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**7** The equation of a curve is  $x^3 + 3xy^2 - y^3 = 5$ .

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

[illegible]

AHEAD



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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A series of horizontal dotted lines for writing.

A circular logo in the bottom right corner with the text "GO AHEAD" in a stylized font. The logo is partially cut off by the edge of the page.

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

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

[5]

[illegible]

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

Handwriting practice paper with 20 horizontal dotted lines.

- 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]

AHEAD



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

This image shows a full page of blank handwriting practice paper. It features multiple rows of horizontal lines. Each row consists of a solid top line, a dashed midline, and a solid bottom line, providing a guide for letter height and placement. The paper is white, and the lines are printed in a light gray or blue color. In the bottom right corner, there is a small, partially visible circular logo with the word "AHEAD" in a stylized font.

A large area of dotted lines for writing.

A circular logo in the bottom right corner. The outer ring contains the text "GO AHEAD" in white capital letters. Inside the circle, there is a red and blue design element.



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