

Cambridge International AS & A Level

CANDIDATE
NAME

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MATHEMATICS

9709/22

Paper 2 Pure Mathematics 2

February/March 2020

1 hour 15 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 50.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Blank pages are indicated.

- 1** Solve the equation $2 \sin(\theta + 30^\circ) + 5 \cos \theta = 2 \sin \theta$ for $0^\circ < \theta < 90^\circ$. [4]

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 (a) Find the quotient when $4x^3 + 17x^2 + 9x$ is divided by $x^2 + 5x + 6$, and show that the remainder is 18. [3]

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- (b) Hence solve the equation $4x^3 + 17x^2 + 9x - 18 = 0$. [3]

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3 It is given that $\int_a^{3a} \frac{2}{2x-5} dx = \ln \frac{7}{2}$.

Find the value of the positive constant a .

[6]

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of horizontal dotted 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.

4 A curve has equation

$$3x^2 - y^2 - 4 \ln(2y + 3) = 26.$$

Find the equation of the tangent to the curve at the point $(3, -1)$.

[6]

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.

- 5 (a) Sketch, on the same diagram, the graphs of $y = |x + 2k|$ and $y = |2x - 3k|$, where k is a positive constant.

Give, in terms of k , the coordinates of the points where each graph meets the axes. [3]

- (b) Find, in terms of k , the coordinates of each of the two points where the graphs intersect. [4]

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- (c) Find, in terms of k , the largest value of t satisfying the inequality

$$|2^t + 2k| \geq |2^{t+1} - 3k|. \quad [2]$$

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- 6** A curve has equation $y = x^3 e^{0.2x}$ where $x \geq 0$. At the point P on the curve, the gradient of the curve is 15.

(a) Show that the x -coordinate of P satisfies the equation $x = \sqrt{\frac{75e^{-0.2x}}{15+x}}$. [4]

[illegible]

- (b) Use the equation in part (a) to show by calculation that the x -coordinate of P lies between 1.7 and 1.8. [2]

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- (c) Use an iterative formula, based on the equation in part (a), to find the x -coordinate of P correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]

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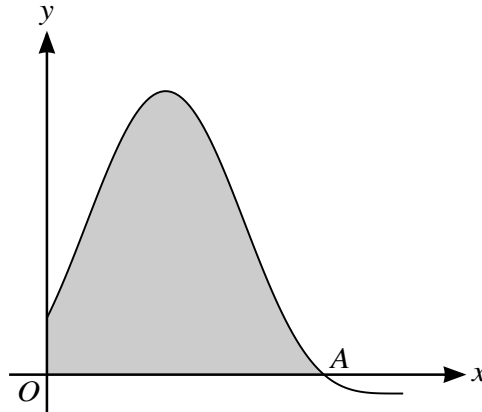
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The diagram shows part of the curve with equation

$$y = 4 \sin^2 x + 8 \sin x + 3,$$

where x is measured in radians. The curve crosses the x -axis at the point A and the shaded region is bounded by the curve and the lines $x = 0$ and $y = 0$.

- (a) Find the exact x -coordinate of A . [2]

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- (b) Find the exact gradient of the curve at A . [3]

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[5]

[illegible]

This image shows a full page of a worksheet designed for handwriting practice. It features 20 evenly spaced, horizontal dashed lines across the entire width of the page. The background is plain white, and there are no margins, text, or other markings present.

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