

Cambridge International AS & A Level

CANDIDATE
NAME

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CENTRE
NUMBER

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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]

[illegible]

- 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]

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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]

[illegible]

- 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]

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.

- (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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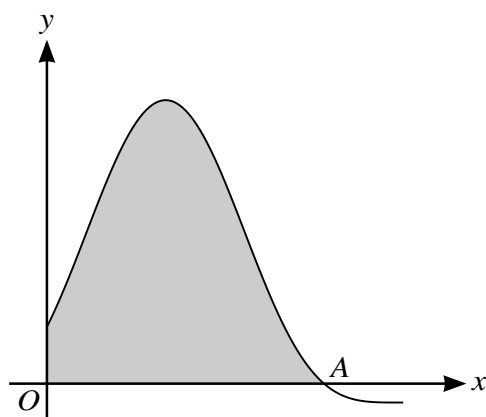
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The diagram shows part of the curve with equation

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

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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(c) Find the exact area of the shaded region.

[5]

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[illegible]

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