Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2987964 1

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.

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

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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 $\int_a^{3a} \frac{2}{2x-5}\,\mathrm{d}x = \ln\frac{7}{2}$.

Find the value of the positive constant a. [6]

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]

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

$$\left|2^t + 2k\right| \geqslant \left|2^{t+1} - 3k\right|. \qquad [2]$$

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6 A curve has equation $y = x^3 e^{0.2x}$ where $x \geqslant 0$. 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 $x = \sqrt{\dfrac{75e^{-0.2x}}{15 + x}}$. [4]

(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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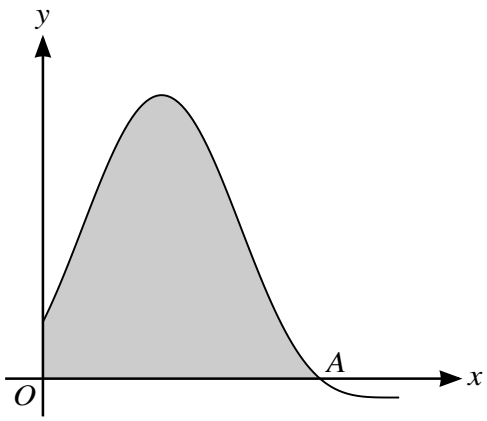
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The diagram shows part of the curve with equation

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

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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Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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