



## Cambridge International AS & A Level

CANDIDATE  
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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.



- 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]

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- 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]

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- (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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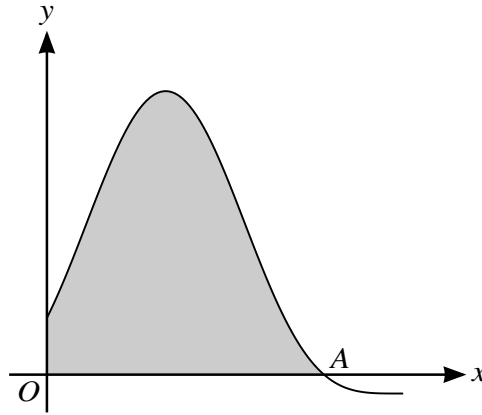
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The diagram shows part of the curve with equation

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

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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