



# Cambridge International AS & A Level

CANDIDATE  
NAME

--

CENTRE  
NUMBER

--	--	--	--	--

CANDIDATE  
NUMBER

--	--	--	--

\* 2 6 8 7 9 8 7 6 4 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.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- 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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6 A curve has equation  $y = x^3e^{0.2x}$  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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



- (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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

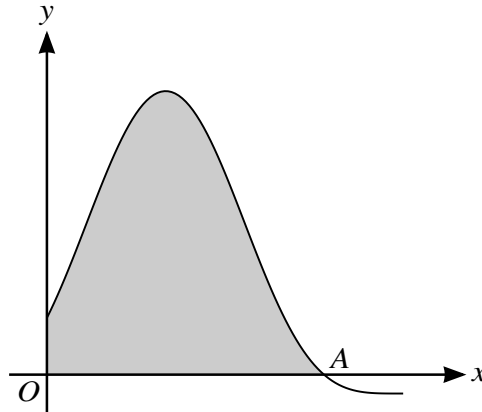
.....

.....

.....

.....

7



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]

.....

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

[5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cambridgeinternational.org](http://www.cambridgeinternational.org) after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.