



## Cambridge International AS & A Level

CANDIDATE  
NAME

--

CENTRE  
NUMBER

--	--	--	--	--

CANDIDATE  
NUMBER

--	--	--	--



**MATHEMATICS**

**9709/22**

Paper 2 Pure Mathematics 2

**October/November 2021**

**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.





2 (a) Sketch, on the same diagram, the graphs of  $y = x + 3$  and  $y = |2x - 1|$ . [2]

(b) Solve the equation  $x + 3 = |2x - 1|$ . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(c) Find the value of  $y$  such that  $5^{\frac{1}{2}y} + 3 = |2 \times 5^{\frac{1}{2}y} - 1|$ . Give your answer correct to 3 significant figures. [2]

.....

.....

.....

.....

.....

.....







6 (a) By sketching a suitable pair of graphs on the same diagram, show that the equation

$$\ln x = 2e^{-x}$$

has exactly one root.

[2]

(b) Verify by calculation that the root lies between 1.5 and 1.6.

[2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



- (c) Show that if a sequence of values given by the iterative formula

$$x_{n+1} = e^{2e^{-x_n}}$$

converges, then it converges to the root of the equation in part (a).

[1]

.....  
.....  
.....  
.....  
.....  
.....  
.....

- (d) Use the iterative formula in part (c) to determine the root correct to 3 significant figures. Give the result of each iteration to 5 significant figures.

[3]

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

7 (a) Prove that  $4 \sin x \sin(x + \frac{1}{6}\pi) \equiv \sqrt{3} - \sqrt{3} \cos 2x + \sin 2x$ . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) Find the exact value of  $\int_0^{\frac{5}{6}\pi} 4 \sin x \sin(x + \frac{1}{6}\pi) dx$ . [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(c) Find the smallest positive value of  $y$  satisfying the equation

$$4 \sin(2y) \sin\left(2y + \frac{1}{6}\pi\right) = \sqrt{3}.$$

Give your answer in an exact form.

[3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

