



# Cambridge International AS & A Level

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**MATHEMATICS**

**9709/21**

Paper 2 Pure Mathematics 2

**May/June 2022**

**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.

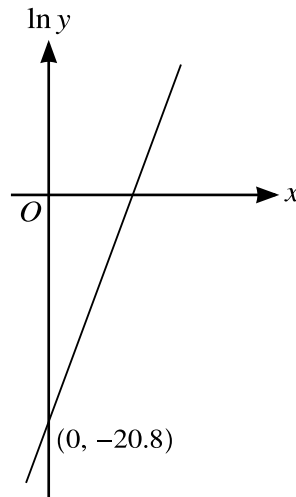
## INFORMATION

- 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.



1



The variables  $x$  and  $y$  satisfy the equation  $y = 4^{2x-a}$ , where  $a$  is an integer. As shown in the diagram, the graph of  $\ln y$  against  $x$  is a straight line passing through the point  $(0, -20.8)$ , where the second coordinate is given correct to 3 significant figures.

(a) Show that the gradient of the straight line is  $\ln 16$ . [2]

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(b) Determine the value of  $a$ . [2]

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2 (a) Express the equation  $7 \tan \theta + 4 \cot \theta - 13 \sec \theta = 0$  in terms of  $\sin \theta$  only. [3]

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(b) Hence solve the equation  $7 \tan \theta + 4 \cot \theta - 13 \sec \theta = 0$  for  $0^\circ < \theta < 360^\circ$ . [3]

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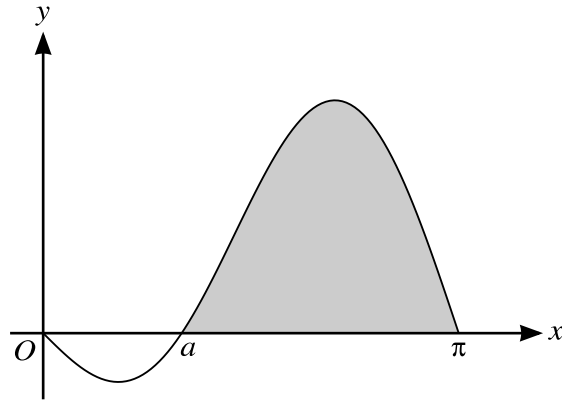
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The diagram shows the curve with equation  $y = 3 \sin x - 3 \sin 2x$  for  $0 \leq x \leq \pi$ . The curve meets the  $x$ -axis at the origin and at the points with  $x$ -coordinates  $a$  and  $\pi$ .

(a) Find the exact value of  $a$ . [3]

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(b) Find the area of the shaded region. [4]

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5 (a) By sketching the graphs of

$$y = |5 - 2x| \quad \text{and} \quad y = 3 \ln x$$

on the same diagram, show that the equation  $|5 - 2x| = 3 \ln x$  has exactly two roots. [3]

(b) Show that the value of the larger root satisfies the equation  $x = 2.5 + 1.5 \ln x$ . [1]

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(c) Show by calculation that the value of the larger root lies between 4.5 and 5.0. [2]

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(d) Use an iterative formula, based on the equation in part (b), to find the value of the larger root correct to 3 significant figures. Give the result of each iteration to 5 significant figures. [3]

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