Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

8149304845

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

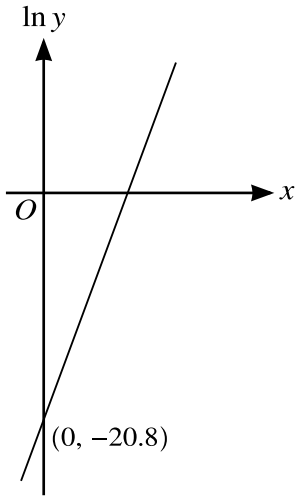
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction 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 $0° < \theta < 360°$. [3]

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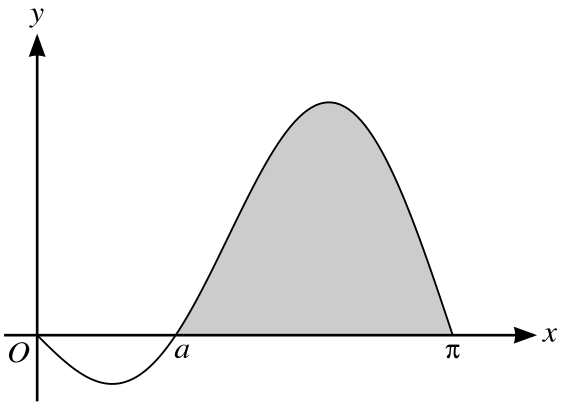

The diagram shows the curve with equation $y = 3\sin x - 3\sin 2x$ for $0 \leqslant x \leqslant \pi$. The curve meets the x-axis at the origin and at the points with x-coordinates a and π.

(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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4 A curve has equation $x^2y + 2y^3 = 48$.

Find the equation of the normal to the curve at the point (4, 2), giving your answer in the form $ax + by + c = 0$ where a, b and c are integers. [7]

5 **(a)** By sketching the graphs of

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

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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6 A curve has equation $y = \dfrac{9e^{2x} + 16}{e^x - 1}$.

(a) Show that the x-coordinate of any stationary point on the curve satisfies the equation

$$e^x(3e^x - 8)(3e^x + 2) = 0.$$ [4]

(b) Hence show that the curve has only one stationary point and find its exact coordinates. [4]

7 The polynomial $\mathrm{p}(x)$ is defined by

$$\mathrm{p}(x) = 2x^3 + 5x^2 + ax + 2a,$$

where a is an integer.

(a) Find, in terms of x and a, the quotient when $\mathrm{p}(x)$ is divided by $(x + 2)$, and show that the remainder is 4. [3]

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(b) It is given that $\displaystyle\int_{-1}^{1} \frac{\mathrm{p}(x)}{x+2}\,\mathrm{d}x = \frac{22}{3} + \ln b$, where b is an integer.

Find the values of a and b. [6]

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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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