



Cambridge International AS & A Level

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MATHEMATICS

9709/02

Paper 2 Pure Mathematics 2

For examination from 2020

SPECIMEN PAPER

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 **14** pages. Blank pages are indicated.

- 1 (a) The polynomial $2x^3 + ax^2 - ax - 12$, where a is a constant, is denoted by $p(x)$. It is given that $(x + 1)$ is a factor of $p(x)$.

Find the value of a .

[2]

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- (b) When a has this value, find the remainder when $p(x)$ is divided by $(x + 3)$.

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- 2 Solve the equation $3 \sin 2\theta \tan \theta = 2$ for $0^\circ < \theta < 180^\circ$. [4]

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3 It is given that a is a positive constant.

(a) (i) Sketch on a single diagram the graphs of $y = |2x - 3a|$ and $y = |2x + 4a|$. [2]

(ii) State the coordinates of each of the points where each graph meets an axis. [1]

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- 4 (a) Solve the equation $5^{2x} + 5^x = 12$, giving your answer correct to 3 significant figures. [4]

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(b) It is given that $\ln(y + 5) - \ln y = 2 \ln x$.

Express y in terms of x , in a form not involving logarithms.

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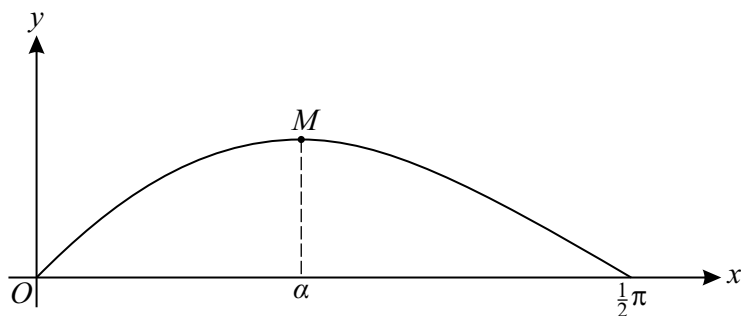
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The diagram shows the curve $y = \frac{\sin 2x}{x+2}$ for $0 \leq x \leq \frac{1}{2}\pi$. The x -coordinate of the maximum point M is denoted by α .

(a) Find $\frac{dy}{dx}$ and show that α satisfies the equation $\tan 2\alpha = 2\alpha + 4$. [4]

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(b) Show by calculation that α lies between 0.6 and 0.7.

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(c) Use the iterative formula $x_{n+1} = \frac{1}{2} \tan^{-1}(2x_n + 4)$ to find the value of α correct to 3 decimal places. Give the result of each iteration to 5 decimal places. [3]

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6 The parametric equations of a curve are

$$x = e^{2t}, \quad y = 4te^t.$$

(a) Show that $\frac{dy}{dx} = \frac{2(t+1)}{e^t}$. [4]

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- 7 (a) Show that $\tan^2 x + \cos^2 x \equiv \sec^2 x + \frac{1}{2} \cos 2x - \frac{1}{2}$ and hence find the exact value of

$$\int_0^{\frac{1}{4}\pi} (\tan^2 x + \cos^2 x) dx. \quad [7]$$

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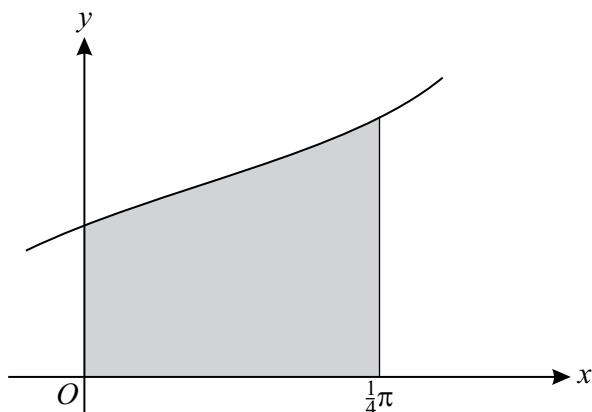
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(b)



The region enclosed by the curve $y = \tan x + \cos x$ and the lines $x = 0$, $x = \frac{1}{4}\pi$ and $y = 0$ is shown in the diagram.

Find the exact volume of the solid produced when this region is rotated completely about the x -axis. [4]

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Additional page

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