



Cambridge International AS & A Level

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MATHEMATICS

9709/23

Paper 2 Pure Mathematics 2

October/November 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 Given that

$$\ln(2x + 1) - \ln(x - 3) = 2,$$

find x in terms of e .

[4]

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2 The polynomial $p(x)$ is defined by

$$p(x) = x^3 + ax^2 + bx + 16,$$

where a and b are constants. It is given that $(x + 2)$ is a factor of $p(x)$ and that the remainder is 72 when $p(x)$ is divided by $(x - 2)$.

Find the values of a and b . [5]

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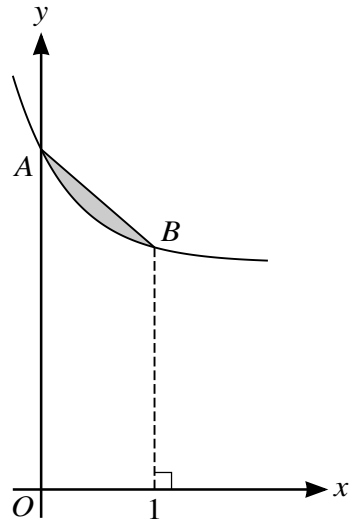
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The diagram shows the curve $y = 2 + e^{-2x}$. The curve crosses the y -axis at the point A , and the point B on the curve has x -coordinate 1. The shaded region is bounded by the curve and the line segment AB .

Find the exact area of the shaded region.

[5]

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- 4 (a) Solve the equation $|2x - 5| = |x + 6|$. [3]

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- (b) Hence find the value of y such that $|2^{1-y} - 5| = |2^{-y} + 6|$. Give your answer correct to 3 significant figures. [2]

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5 The sequence of values given by the iterative formula $x_{n+1} = \frac{6 + 8x_n}{8 + x_n^2}$ with initial value $x_1 = 2$ converges to α .

- (a) Use the iterative formula to find the value of α correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]

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- (b) State an equation satisfied by α and hence determine the exact value of α . [2]

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6 It is given that $3 \sin 2\theta = \cos \theta$ where θ is an angle such that $0^\circ < \theta < 90^\circ$.

(a) Find the exact value of $\sin \theta$. [2]

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(b) Find the exact value of $\sec \theta$. [2]

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(c) Find the exact value of $\cos 2\theta$. [2]

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7 A curve is defined by the parametric equations

$$x = 3t - 2 \sin t, \quad y = 5t + 4 \cos t,$$

where $0 \leq t \leq 2\pi$. At each of the points P and Q on the curve, the gradient of the curve is $\frac{5}{2}$.

(a) Show that the values of t at P and Q satisfy the equation $10 \cos t - 8 \sin t = 5$. [3]

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(b) Express $10 \cos t - 8 \sin t$ in the form $R \cos(t + \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$. Give the exact value of R and the value of α correct to 3 significant figures. [3]

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(c) Hence find the values of t at the points P and Q . [4]

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8 A curve has equation $y = f(x)$ where $f(x) = \frac{4x^3 + 8x - 4}{2x - 1}$.

- (a) Find an expression for $\frac{dy}{dx}$ and hence find the coordinates of each of the stationary points of the curve $y = f(x)$. [5]

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(b) Divide $4x^3 + 8x - 4$ by $(2x - 1)$, and hence find $\int f(x) dx$. [5]

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Additional Page

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