Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

* 0 0 8 3 4 8 4 9 8 *

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.

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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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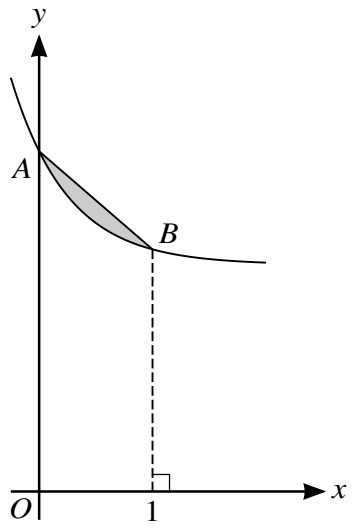
3



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 $\left|2^{1-y} - 5\right| = \left|2^{-y} + 6\right|$. Give your answer correct to 3 significant figures. [2]

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5 The sequence of values given by the iterative formula $x_{n+1} = \dfrac{6 + 8x_n}{8 + x_n^2}$ 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 $0° < \theta < 90°$.

(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

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

where $0 \leqslant t \leqslant 2\pi$. 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 $y = \mathrm{f}(x)$ where $\mathrm{f}(x) = \dfrac{4x^3 + 8x - 4}{2x - 1}$.

(a) Find an expression for $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ and hence find the coordinates of each of the stationary points of the curve $y = \mathrm{f}(x)$. [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

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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