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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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0221719570

MATHEMATICS **9709/23**

Paper 2 Pure Mathematics 2 **May/June 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 [ ].

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1 Given that $2^y = 9^{3x}$, use logarithms to show that $y = kx$ and find the value of k correct to 3 significant figures. [3]

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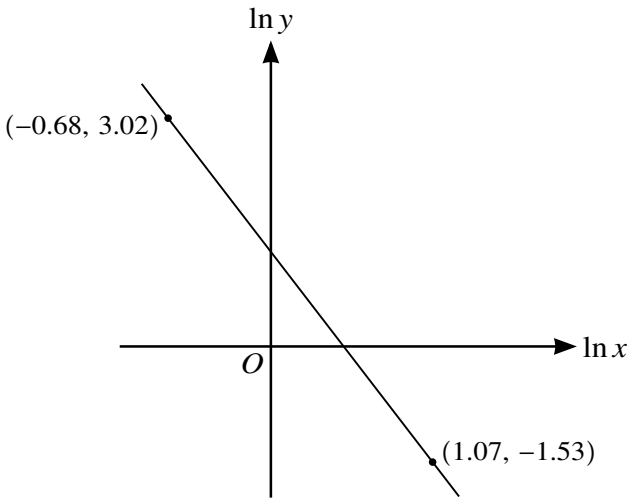
2 Find the exact coordinates of the stationary point on the curve with equation $y = 5xe^{\frac{1}{2}x}$. [5]

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3 The equation of a curve is $\cos 3x + 5 \sin y = 3$.

Find the gradient of the curve at the point $\left(\frac{1}{9}\pi, \frac{1}{6}\pi\right)$. [5]

4



The variables x and y satisfy the equation $y = Ax^{-2p}$, where A and p are constants. The graph of $\ln y$ against $\ln x$ is a straight line passing through the points $(-0.68, 3.02)$ and $(1.07, -1.53)$, as shown in the diagram.

Find the values of A and p. [5]

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5 **(a)** Sketch, on the same diagram, the graphs of $y = |2x - 3|$ and $y = 3x + 5$. [2]

(b) Solve the inequality $3x + 5 < |2x - 3|$. [3]

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

$$p(x) = 6x^3 + ax^2 - 4x - 3,$$

where a is a constant. It is given that $(x + 3)$ is a factor of $p(x)$.

(a) Find the value of a. [2]

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(b) Using this value of a, factorise $p(x)$ completely. [3]

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(c) Hence solve the equation $p(\text{cosec}\,\theta) = 0$ for $0° < \theta < 360°$. [3]

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7 It is given that $\int_0^a \left(\frac{4}{2x+1} + 8x \right) \mathrm{d}x = 10$, where a is a positive constant.

(a) Show that $a = \sqrt{2.5 - 0.5\ln(2a+1)}$. [4]

(b) Using the equation in part **(a)**, show by calculation that $1 < a < 2$. [2]

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(c) Use an iterative formula, based on the equation in part **(a)**, to find the value of a correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]

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8 **(a)** Show that $3 \sin 2\theta \cot \theta \equiv 6 \cos^2 \theta$. [2]

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(b) Solve the equation $3 \sin 2\theta \cot \theta = 5$ for $0 < \theta < \pi$. [3]

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(c) Find the exact value of $\int_{\frac{1}{4}\pi}^{\frac{1}{2}\pi} 3 \sin x \cot \frac{1}{2}x \, \mathrm{d}x$. [5]

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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