Cambridge Assessment International Education

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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 [ ].

This document has **16** pages. Blank pages are indicated.

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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]



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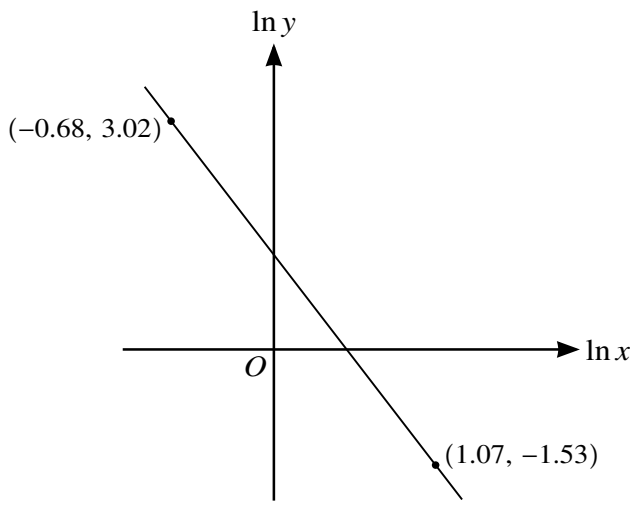
**4**




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 $p(\operatorname{cosec}\theta) = 0$ for $0° < \theta < 360°$. [3]



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

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



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**(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 $\int_{\frac{1}{4}\pi}^{\frac{1}{2}\pi} 3\sin x \cot \frac{1}{2}x \, dx$. [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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