Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

2196541905

MATHEMATICS **9709/21**

Paper 2 Pure Mathematics 2 **October/November 2022**

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. Any blank pages are indicated.

© UCLES 2022

BLANK PAGE

1 Solve the inequality $|2x - 5| > x$. [4]

2 Use logarithms to solve the equation $14e^{-2x} = 5^{x+1}$, giving your answer correct to 3 significant figures. [4]

3 It is given that $\sec\theta = \sqrt{17}$ where $0 < \theta < \frac{1}{2}\pi$.

Find the exact value of $\tan(\theta + \frac{1}{4}\pi)$. [4]

4 **(a)** By sketching a suitable pair of graphs on the same diagram, show that the equation

$$e^{-\frac{1}{2}x} = x^5$$

has exactly one real root. [2]

(b) Use the iterative formula $x_{n+1} = \sqrt[5]{e^{-\frac{1}{2}x_n}}$ to determine the root correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

5 A curve has equation $4e^{2x}y + y^2 = 21$.

Find the gradient of the curve at the point $(0, -7)$. [5]

6 The polynomial $\mathrm{p}(x)$ is defined by

$$\mathrm{p}(x) = 12x^3 - 9x^2 + 8x - 4.$$

(a) Find the quotient when $\mathrm{p}(x)$ is divided by $(4x - 3)$ and show that the remainder is 2. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) Hence find $\displaystyle\int_2^{12} \left(\frac{\mathrm{p}(x)}{4x - 3} - 3x^2 \right) \mathrm{d}x$, giving your answer in the form $a + \ln b$. [6]

.....

.....

.....

.....

.....

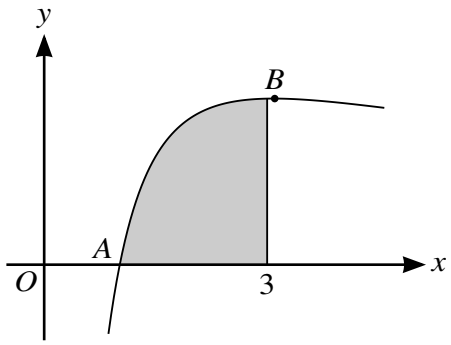
.....

.....

.....

© UCLES 2022

7



The diagram shows the curve with equation $y = \dfrac{2\ln x}{3x+1}$. The curve crosses the x-axis at the point A and has a maximum point B. The shaded region is bounded by the curve and the lines $x = 3$ and $y = 0$.

(a) Find the gradient of the curve at A. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) Show by calculation that the x-coordinate of B lies between 3.0 and 3.1. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(c) Use the trapezium rule with two intervals to find an approximation to the area of the shaded region. Give your answer correct to 2 decimal places. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

8 The expression $f(\theta)$ is defined by $f(\theta) = 12\sin\theta\cos\theta + 16\cos^2\theta$.

(a) Express $f(\theta)$ in the form $R\cos(2\theta - \alpha) + k$, where $R > 0$, $0 < \alpha < \frac{1}{2}\pi$ and k is a constant. State the values of R and k, and give the value of α correct to 4 significant figures. [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) Find the smallest positive value of θ satisfying the equation $f(\theta) = 17$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(c) Find $\int \mathrm{f}(\theta)\,\mathrm{d}\theta$. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

© UCLES 2022

BLANK PAGE

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.