



Cambridge International AS & A Level

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--



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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

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

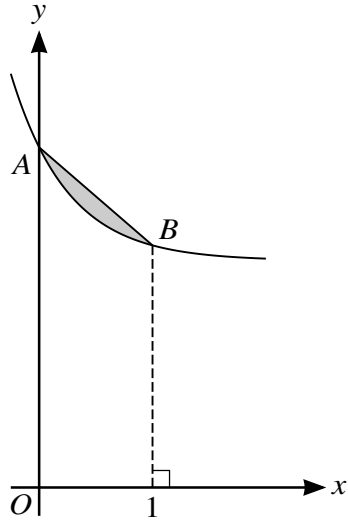
where a and b are constants. It is given that $(x + 2)$ is a factor of $p(x)$ and that the remainder is 72 when $p(x)$ is divided by $(x - 2)$.

Find the values of a and b .

[5]

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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]

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....
.....
.....
.....
.....
.....
.....
.....

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

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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 the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.