



Cambridge IGCSE™

CANDIDATE
NAME
CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

ADDITIONAL MATHEMATICS**0606/22**

Paper 2

October/November 2023**2 hours**

You must answer on the question paper.

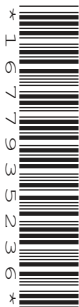
No additional materials are needed.

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.
- 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 80.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages. Any blank pages are indicated.

Mathematical Formulae**1. ALGEBRA***Quadratic Equation*

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \dots + \binom{n}{r}a^{n-r}b^r + \dots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series

$$u_n = a + (n-1)d$$

$$S_n = \frac{1}{2}n(a + l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series

$$u_n = ar^{n-1}$$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY*Identities*

$$\begin{aligned}\sin^2 A + \cos^2 A &= 1 \\ \sec^2 A &= 1 + \tan^2 A \\ \operatorname{cosec}^2 A &= 1 + \cot^2 A\end{aligned}$$

Formulae for $\triangle ABC$

$$\begin{aligned}\frac{a}{\sin A} &= \frac{b}{\sin B} = \frac{c}{\sin C} \\ a^2 &= b^2 + c^2 - 2bc \cos A \\ \Delta &= \frac{1}{2}bc \sin A\end{aligned}$$

3

- 1 (a)** A straight line passes through the points $(4, 23)$ and $(-8, 29)$. Find the point of intersection, P , of this line with the line $y = 2x + 5$. [5]

- (b)** Find the distance of P from the origin. [2]

4

- 2 Find the non-zero value of k for which the line $y = -2x - 6k - 1$ is a tangent to the curve $y = x(x + 2k)$.
[5]

5**3 DO NOT USE A CALCULATOR IN THIS QUESTION.**

A cylinder has base radius $(2 + \sqrt{3})$ m and volume $\pi(16 + 9\sqrt{3})\text{m}^3$. Find the exact value of its height, giving your answer in its simplest form. [4]

6**4** Solve the following equations.

(a) $\frac{(e^{x+1})^2}{\sqrt{e^x}} = 10$

[4]

(b) $2 \log_9 y - \log_9 (4y - 9) = \frac{1}{2}$

[5]

7

5 (a) Find the equation of the normal to the curve $y = x^3 - 7x^2 + 12x - 5$ at the point (1, 1). [5]

(b) Find the x -coordinates of the two points where the normal cuts the curve again. Give your answers in the form $x = a \pm \sqrt{b}$ where a and b are integers. [5]

8

6 Find the exact value of $\int_2^3 \frac{(x+2)^2}{x} dx$.

[6]

9

- 7** A particle is travelling in a straight line. Its displacement, s metres, from the origin at time t seconds is given by $s = 1.5e^{2t} + 2e^{-2t} - t$.

(a) Find expressions for the velocity, $v \text{ ms}^{-1}$, and acceleration, $a \text{ ms}^{-2}$, of the particle. [3]

(b) Find the time, T seconds, when the particle is at rest. [4]

(c) Find the acceleration of the particle at time T seconds. [2]

10

8 A curve has equation $y = x \sin 2x$.

(a) Find $\frac{dy}{dx}$. [2]

(b) Find the equation of the tangent to the curve at $x = \frac{\pi}{4}$. [3]

11

- (c) Use your answer to **part (a)** to find the exact value of $\int_0^{\frac{\pi}{6}} 2x \cos 2x dx$. [5]

12

- 9 (a)** An arithmetic progression has twelve terms. The sum of the first three terms is -36 and the sum of the last three terms is 72 . Find the first term and the common difference. [5]

13

- (b) The first three terms of a geometric progression are 1, 1.2 and 1.44. Find the smallest value of n such that the sum of the first n terms is greater than 500. [5]

14

10 (a) By writing $\cot x$ and $\tan x$ in terms of $\cos x$ and $\sin x$, show that

$$\frac{\sin x}{1 - \cot x} + \frac{\cos x}{1 - \tan x} = \sin x + \cos x. \quad [5]$$

15

(b) Solve the equation $9 \cot x + 3 \operatorname{cosec} x = \tan x$, for $0^\circ < x < 360^\circ$.

[5]

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.