



Cambridge IGCSE™

CANDIDATE
NAME

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--



ADDITIONAL MATHEMATICS

0606/23

Paper 2

May/June 2022

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 $\triangle ABC$

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

1 Solve the equation $4|7x-3|-5=9$. [3]

2 **DO NOT USE A CALCULATOR IN THIS QUESTION.**

Variables x and y are related by the equation $y = kx^2$. When $x = 1 + \sqrt{2}$, $y = 1 - \sqrt{2}$. Find the value of k , giving your answer in the form $a + b\sqrt{c}$, where a , b and c are integers. [4]

4

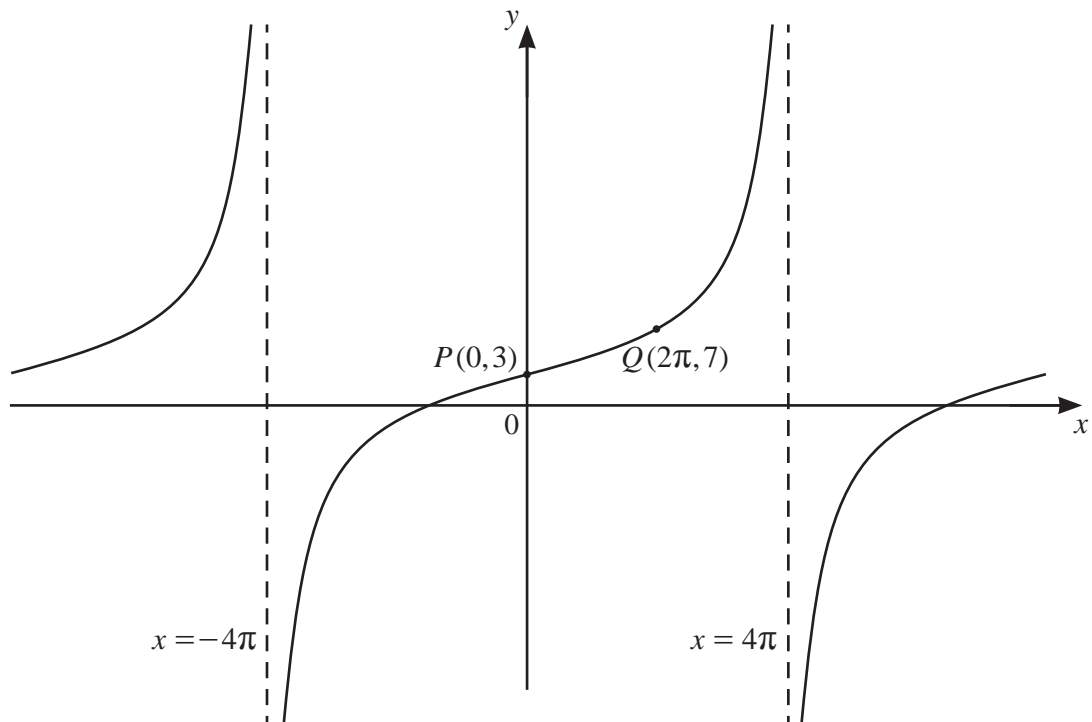
- 3 The points A , B and C have coordinates $(2, 6)$, $(6, 1)$ and (p, q) respectively. Given that B is the mid-point of AC , find the equation of the line that passes through C and is perpendicular to AB . Give your answer in the form $ax + by = c$, where a , b and c are integers. [5]

- 4 (a) Find the range of values of x satisfying the inequality $(5x - 1)(6 - x) < 0$. [2]

- (b) Show that the equation $(2k + 1)x^2 - 4kx + 2k - 1 = 0$, where $k \neq -\frac{1}{2}$, has distinct, real roots. [3]

5

5



The diagram shows part of the graph of $y = a \tan bx + c$. The graph has vertical asymptotes at $x = -4\pi$ and $x = 4\pi$ and passes through the points P and Q .

(a) Write down the period of $a \tan bx + c$. [1]

(b) Find the values of a , b and c . [4]

6

6 The polynomial $p(x)$ is such that $p(x) = 6x^3 + ax^2 - 52x + b$, where a and b are integers. It is given that $p(x)$ is divisible by $2x - 3$ and that $p'(1) = 4$.

(a) Find the values of a and b . [5]

DO NOT USE A CALCULATOR IN THIS PART OF THE QUESTION.

(b) Using your values of a and b , factorise $p(x)$ fully. [3]

7

7 (a) (i) Write down the set of values of x for which $\lg(5x-3)$ exists. [1]

(ii) Solve the equation $\lg(5x-3) = 1$. [1]

(b) It is given that $\log_y x = 4 + \frac{1}{2}\log_y 64 + \log_y 162$, where $y > 0$. Find an expression for y in terms of x . Simplify your answer. [5]

8

8 (a) Differentiate $y = 2xe^{4x}$ with respect to x . [2]

(b) Hence find $\int xe^{4x} dx$. [4]

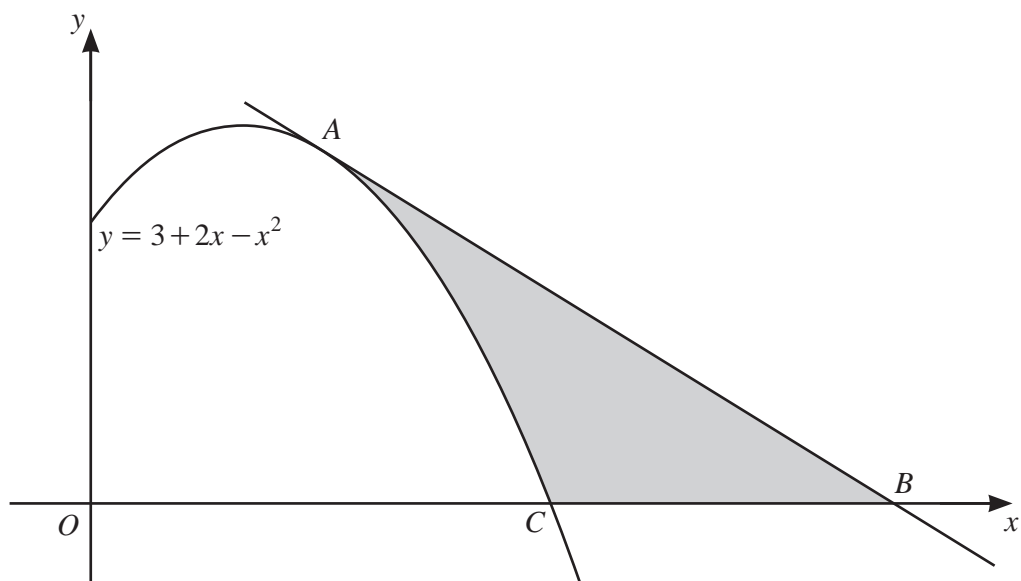
9

9 (a) Find the unit vector in the direction of $40\mathbf{i} - 9\mathbf{j}$. [2]

(b) The position vectors of points P and Q relative to an origin O are \mathbf{p} and \mathbf{q} respectively. The point R lies on the line PQ and is between P and Q such that $\frac{PR}{PQ} = k$.

(i) Write down the set of all possible values of k . [1]

(ii) Given that the position vector of R relative to O is $\lambda\mathbf{p} + \mu\mathbf{q}$ show that $\lambda + \mu = 1$. [3]



The diagram shows part of the curve $y = 3 + 2x - x^2$. The point A lies on the curve and has an x -coordinate of 1.5. The tangent to the curve at A meets the x -axis at B . The curve meets the x -axis at C . Find the area of the shaded region. [10]

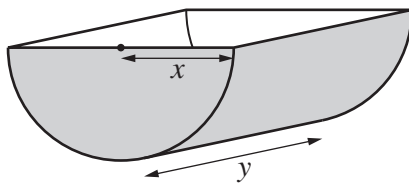
Continuation of working space for Question 10.

- 11 (a)** The sum of the first 20 terms of an arithmetic progression is 1100. The sum of the first 70 terms is 14 350. Find the 12th term. [6]

- (b) The first three terms of a geometric progression are $x+6$, $x-9$, $\frac{1}{2}(x+1)$. Show that x satisfies the equation $x^2 - 43x + 156 = 0$. Hence show that a sum to infinity exists for each possible value of x . [7]

14

12 In this question all lengths are in centimetres.



A container is a half-cylinder, open as shown. It has length y and uniform cross-section of radius x . The volume of the container is 25 000. Given that x and y can vary and that the outer surface area, S , of the container has a minimum value, find this value. [8]

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.