



Cambridge IGCSE™

CANDIDATE
NAME



CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

ADDITIONAL MATHEMATICS

0606/21

Paper 2

October/November 2024

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.



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 Show that $\tan \theta + \cot \theta$ can be written as $\sec \theta \operatorname{cosec} \theta$.

[3]





- 2 (a) Given that $y = \tan x - x$, find $\frac{dy}{dx}$. Write your answer in terms of $\tan x$.

[2]

- (b) Hence find $\int_0^{\frac{\pi}{4}} \tan^2 x dx$. Give your answer in exact form.

[2]





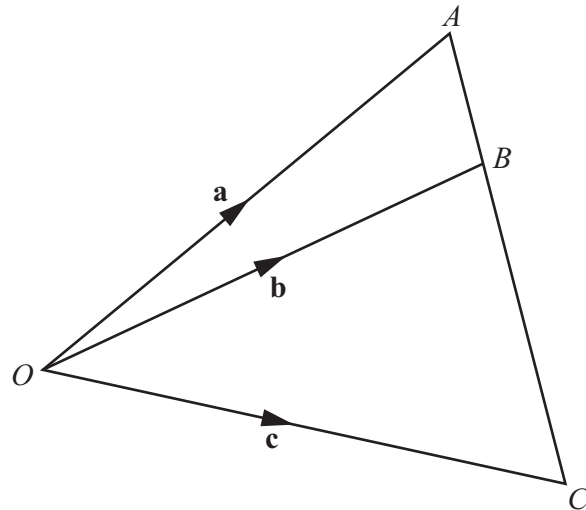
3 (a) Solve the equation $8^{\frac{1}{x}} - 2 \times 8^{-\frac{1}{x}} = 1$.

[4]

(b) It is given that $(a - \sqrt{3})^2 = b + (3 - b)\sqrt{3}$, where a and b are integers. Find the possible values of a and b .

[6]





The diagram shows the triangle OAC . The point B lies on AC such that $AB:BC = p:q$, where p and q are constants ($p \neq -q$).

$$\overrightarrow{OA} = \mathbf{a}, \overrightarrow{OB} = \mathbf{b} \text{ and } \overrightarrow{OC} = \mathbf{c}.$$

Show that $\mathbf{b} = \frac{q\mathbf{a} + p\mathbf{c}}{q + p}$.

[5]



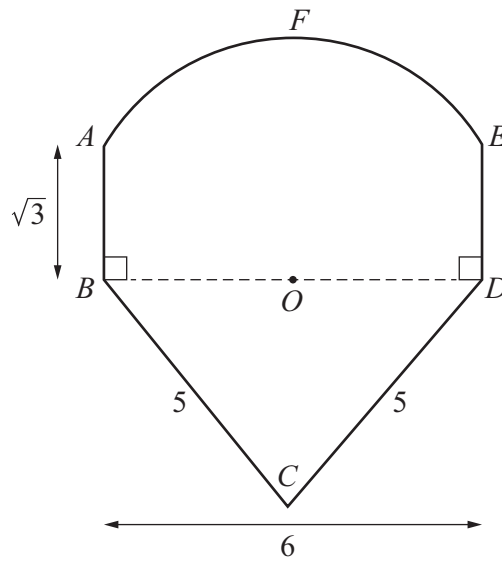


- 5 Given that $\log_a(p+1) + \frac{1}{\log_p a} - \log_a(p+2) + \log_a 5 = \log_a 12$, find the value of p . [5]





6 In this question all lengths are in metres.



The diagram shows a shape $ABCDEF$.
 AB , BD and DE are three sides of a rectangle.
 O is the mid-point of BD .
 AFE is an arc of a circle whose centre is O .
 $AB = \sqrt{3}$, $BC = CD = 5$ and $BD = 6$.

(a) Find the exact value of the perimeter of the shape, giving your answer in terms of π .

[5]





- (b) Find the exact value of the area of the shape, giving your answer in terms of π . [3]





- 7 A curve has equation $y = 2x \cos x$. The normal to the curve at $(\pi, -2\pi)$ meets the x -axis and y -axis at points P and Q . Find the exact area of triangle POQ . [7]

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN





- 8 A particle moves in a straight line so that its displacement from a fixed point O at time t seconds is x metres, where $x = t^3 + t^2 - t + 8$ and $t \geq 0$.

(a) Find the time when the particle changes direction. [3]

(b) Show that the particle is moving towards O when $t = 0$. [3]

(c) Find the total distance travelled by the particle during the first 2 seconds of its motion. [4]





9 A curve has equation $y = x^2 - 8x + c$, where c is a constant.

(a) Find the value of c in each of the following cases.

(i) The curve crosses the x -axis at $x = 2$.

[1]

(ii) The minimum value of y is 3.

[3]

(b) Find the range of values of c for which y is always greater than 0.

[2]





- 10 (a) A class contains 7 girls and 8 boys. A group of 6 is selected from the class. The group must contain at least 3 girls and at least 2 boys. Find the number of different groups that can be selected. [3]

- (b) A 5-character code is to be formed from the following characters.

Letters A B C D E F

Numbers 1 2 3

No character may be used more than once in any code. The characters may be arranged in any order.

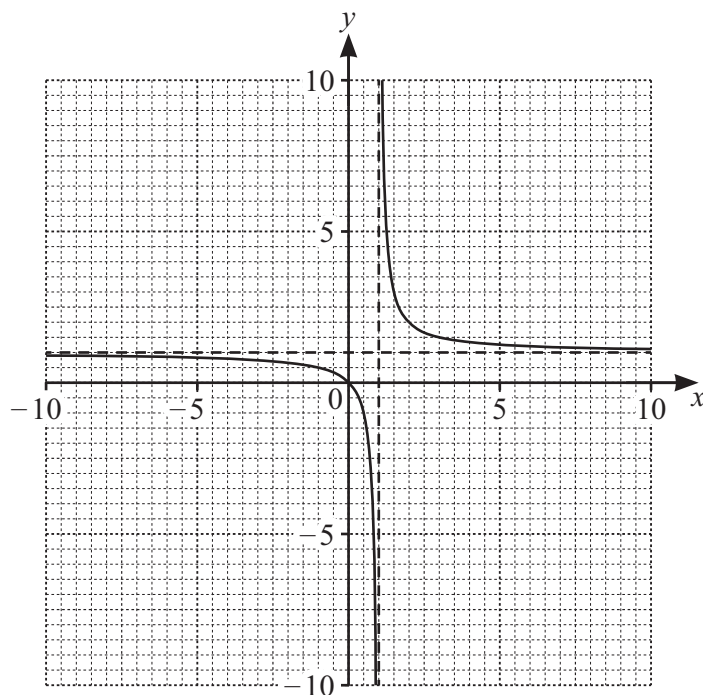
Find the number of different codes that can be formed using 4 letters and 1 number. [3]





- 11 (a) $f(x) = \frac{x}{x-1}$ for $-10 \leq x \leq 10, x \neq 1$.

The diagram shows the graph of $y = f(x)$.



- (i) Use the diagram to explain why f is a function.

[1]

- (ii) Find $ff(x)$, giving your answer in its simplest form.

[2]





(iii) Using your answer to **part (ii)** state the relationship between the functions f and f^{-1} . [1]

(iv) Explain how the diagram shows the relationship between f and f^{-1} . [1]

(b) A function g is defined by $g(x) = \frac{x}{x-1}$ for $x \geq 2$. Find the range of g . [1]

(c) A function h is defined by $h(x) = \frac{2x}{3x+1}$ for the largest possible domain. State the domain of h . [1]

Question 12 is printed on the next page.





- 12 Two arithmetic progressions, A and B , each have 100 terms. Their terms are denoted by $a_1, a_2, a_3, a_4, \dots, a_{100}$ and $b_1, b_2, b_3, b_4, \dots, b_{100}$ respectively.

It is given that $a_1 = b_{100} = 1$ and $a_{100} = b_1 = 298$.

- (a) Find n such that $a_n - b_n = 45$.

[6]

- (b) Find the smallest m such that $a_m > 2b_m$.

[3]

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.

