Cambridge Assessment International Education

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 [ ].

© UCLES 2024

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

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

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

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

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2024

1 Show that $\tan\theta + \cot\theta$ can be written as $\sec\theta \operatorname{cosec}\theta$. [3]

View solution

© UCLES 2024

2 **(a)** Given that $y = \tan x - x$, find $\frac{\mathrm{d}y}{\mathrm{d}x}$. Write your answer in terms of $\tan x$. [2]

View solution

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

View solution

© UCLES 2024

3 **(a)** Solve the equation $8^{\frac{1}{x}} - 2 \times 8^{-\frac{1}{x}} = 1$. [4]

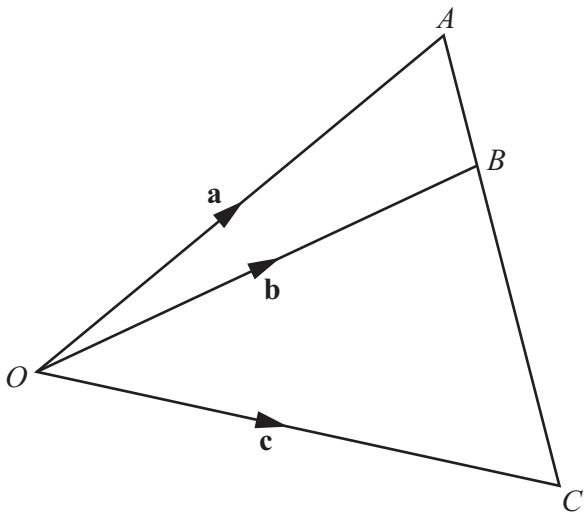
View solution

(b) It is given that $\left(a - \sqrt{3}\right)^2 = b + \left(3 - b\right)\sqrt{3}$, where a and b are integers. Find the possible values of a and b. [6]

View solution

4

View solution



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

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

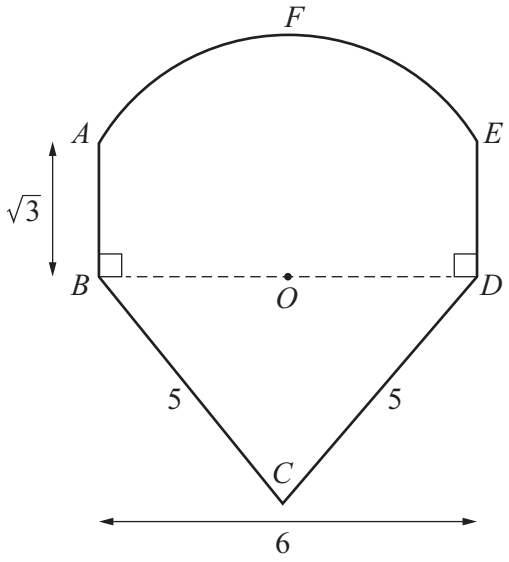
Show that $\mathbf{b} = \dfrac{q\mathbf{a} + p\mathbf{c}}{q + p}$. [5]

© UCLES 2024

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

View solution

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]

View solution

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

View solution

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]

View solution

© UCLES 2024

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 $t \geqslant 0$.

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

View solution

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

View solution

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

View solution

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

View solution

(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]

View solution

(b) Find the range of values of c for which y is always greater than 0. [2]

View solution

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]

View solution

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

View solution

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.

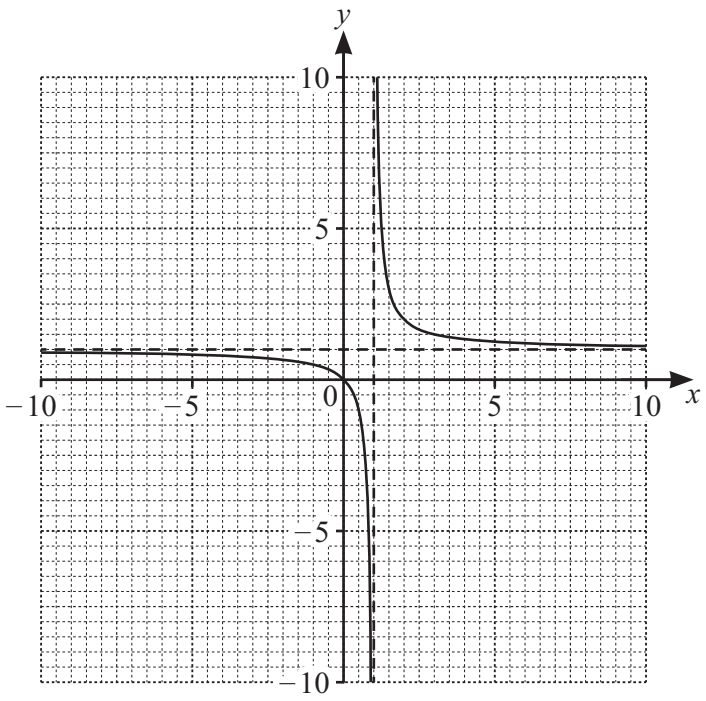
Find the number of different codes that can be formed using 4 letters and 1 number. [3]

© UCLES 2024

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

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

View solution



(i) Use the diagram to explain why f is a function. [1]

(ii) Find $ff(x)$, giving your answer in its simplest form. [2]

View solution

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

View solution

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

View solution

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

View solution

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

View solution

Question 12 is printed on the next page.

© UCLES 2024

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

View solution

(b) Find the smallest m such that $a_m > 2b_m$. [3]

View solution

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.

© UCLES 2024