



# Cambridge IGCSE™

CANDIDATE  
NAME



CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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**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.




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  $8^{\frac{1}{x}} - 2 \times 8^{-\frac{1}{x}} = 1$ .

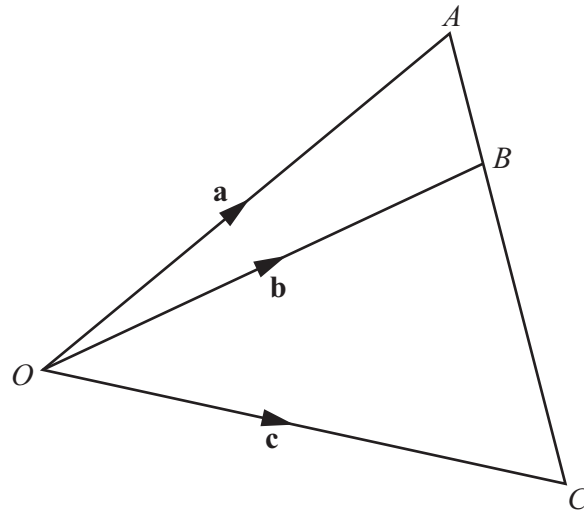
[4]



- (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]

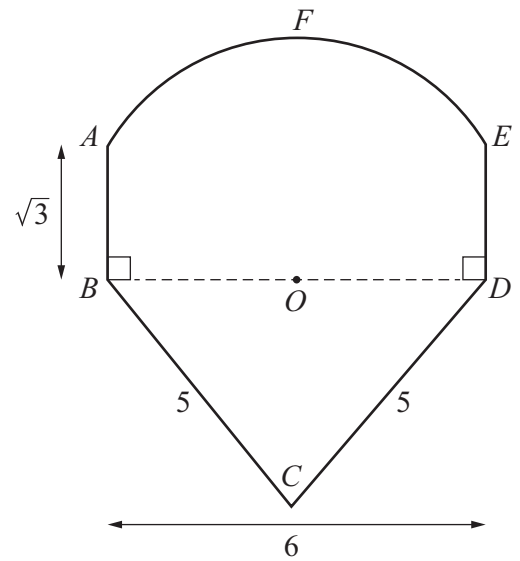




6 In this question all lengths are in metres.



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  $\pi$ . [5]

(b) Find the exact value of the area of the shape, giving your answer in terms of  $\pi$ . [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]







- 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]

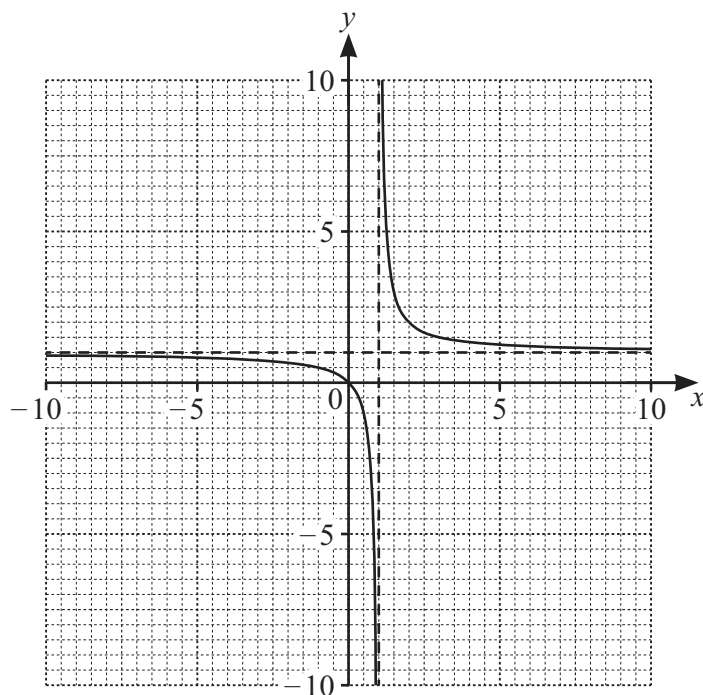




11 (a)  $f(x) = \frac{x}{x-1}$  for  $-10 \leq x \leq 10, x \neq 1$ .



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]

