



# Cambridge IGCSE™

CANDIDATE NAME



CENTRE NUMBER

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**ADDITIONAL MATHEMATICS**

**0606/23**

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

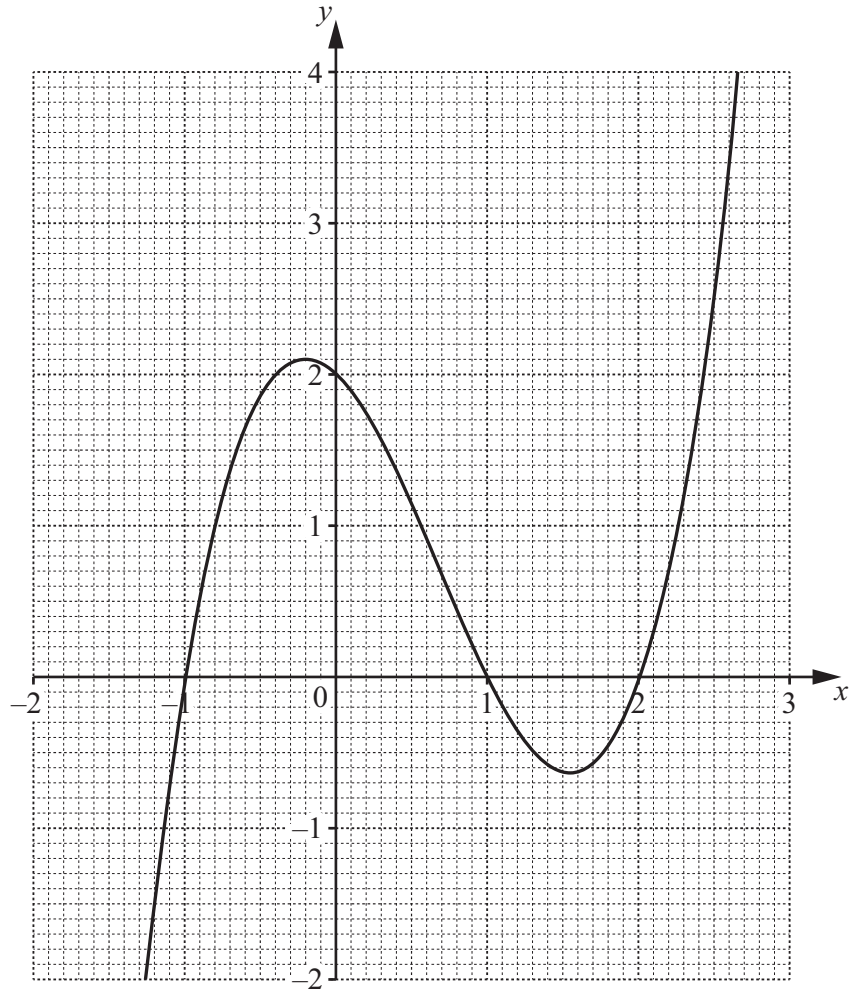
- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

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





1



The diagram shows the graph of  $y = (x+1)(x-1)(x-2)$ . Use the graph to solve the inequality  $(x+1)(x-1)(x-2) < 1$ . [3]





2 The function  $f$  is defined by  $f(x) = 1 - 4x - x^2$  for all real values of  $x$ .

**(a)** Write  $f(x)$  in the form  $a - (x + b)^2$ , where  $a$  and  $b$  are constants. [2]

**(b)** Find the range of  $f$ . [1]

The function  $g$  is defined by  $g(x) = 1 - 4x - x^2$  for  $x \geq k$ , where  $k$  is a constant.

**(c)** State the least possible value of  $k$  such that  $g$  has an inverse. [1]

**(d)** Using your value of  $k$ , find  $g^{-1}(x)$ , stating its domain and range. [5]

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3 (a) Show that  $(2 \tan \theta + \sec \theta)(2 \tan \theta - \sec \theta) = 3 \tan^2 \theta - 1$ .

[2]



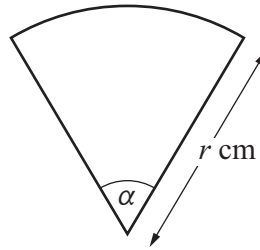
(b) Hence solve the equation  $(2 \tan \theta + \sec \theta)(2 \tan \theta - \sec \theta) = 1$  for  $0^\circ \leq \theta \leq 180^\circ$ .

[4]





- 4 The diagram shows a design for a logo. The logo is a sector of a circle, radius  $r$  cm, with angle  $\alpha$  radians.



The area of the logo is  $9 \text{ cm}^2$ .

- (a) Show that the perimeter,  $P$  cm, of the logo is given by

$$P = 2r + \frac{18}{r}. \quad [3]$$

- (b) Given that  $r$  can vary, find the stationary value of  $P$  and determine its nature. [5]





- 5 The tangent to the curve  $y = \frac{\sqrt{x+1}}{x}$  at the point where  $x = 3$  meets the line  $y = x - 16$  at the point  $A$ . Find the coordinates of  $A$ . [8]





6 (a) Find  $\int \frac{1}{\sqrt{3x+2}} dx$ .

[2]



(b) Find, in terms of  $a$ ,  $\int_{0.5}^a e^{(1-2x)} dx$ .

[3]

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7 (a) In the expansion of  $(x + x^2)^8$  in ascending powers of  $x$ , the 3rd and 6th terms are equal.



Find the value of  $x$ .

[3]

(b) In the expansion of  $(x + \frac{2}{x})^n$  in decreasing powers of  $x$ , the 6th term is a constant.

(i) Find the value of the positive integer  $n$ .

[2]

(ii) Find the value of the 6th term.

[2]



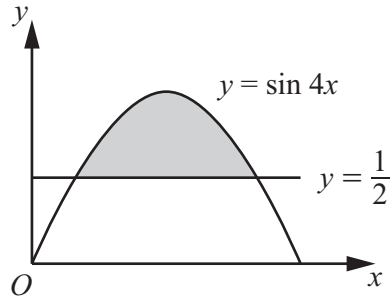


- 8 (a) Solve the equation  $\sin 4x = \frac{1}{2}$  for  $0 \leq x \leq \frac{\pi}{4}$ , giving your answers in terms of  $\pi$ .

[2]



(b)



The diagram shows parts of the graphs of  $y = \sin 4x$  and  $y = \frac{1}{2}$ .

Find the exact area of the shaded region enclosed by the curve and the line.

[5]





9 DO NOT USE A CALCULATOR IN THIS QUESTION.



Write  $\frac{16 + 11\sqrt{10}}{2 + \sqrt{10}} + 1$  in the form  $p + q\sqrt{10}$ , where  $p$  and  $q$  are integers.

[4]

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- 10 (a) Suzma is training for a marathon. In the first week she runs 10 km. Then each week she runs a distance that is 10% greater than the week before.

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The total distance that Suzma has run by the end of  $n$  whole weeks is more than 200 km. Find the smallest possible value of  $n$ . [4]

- (b) A geometric progression has 1st term  $a$  and common ratio  $r$ , where  $a \neq 0$  and  $r \neq 1$ . The 1st, 2nd and 3rd terms of the geometric progression are the 1st, 3rd and 7th terms of an arithmetic progression. Find the value of  $r$ . [4]





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**11 (a)** There are 3 girls and 2 boys standing in a straight line. Find the number of possible orders in each of the following cases.



**(i)** No girls are next to each other. [2]

**(ii)** The 2 boys are not next to each other. [2]

**(b)** 12 people, including Anjie and Bubay, are divided into 3 groups of 4 people. Anjie and Bubay must not be in the same group.

Find the number of ways in which the 3 groups can be selected. [2]





12 A particle moves in a straight line. Its velocity,  $v \text{ ms}^{-1}$ , at time  $t$  seconds is given by



$$v = \cos t - \sin t.$$

(a) Find the acceleration,  $a \text{ ms}^{-2}$ , when  $t = \frac{\pi}{3}$ . [2]

The displacement of the particle from a fixed point  $O$  at time  $t$  is  $s$  metres. The particle passes through  $O$  when  $t = 0$ .

(b) Find the displacement at the time when the particle first changes direction after passing through  $O$ . [6]

(c) Find an expression for  $a$  in terms of  $s$ . [1]





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