



# Cambridge IGCSE™

CANDIDATE  
NAME

CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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**ADDITIONAL MATHEMATICS**

**0606/13**

Paper 1

**May/June 2024**

**2 hours**

You must answer on the question paper.

No additional materials are needed.

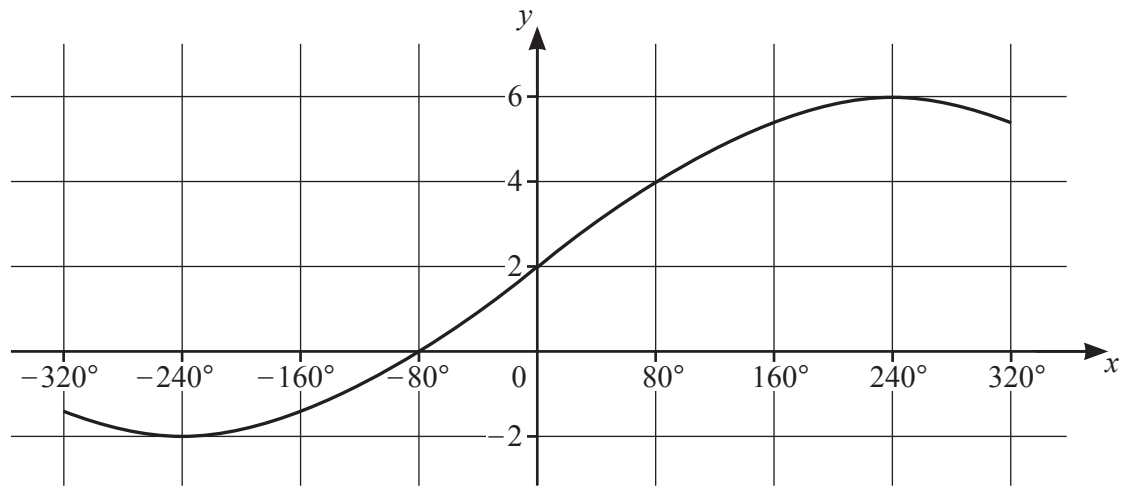
## INSTRUCTIONS

- 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.

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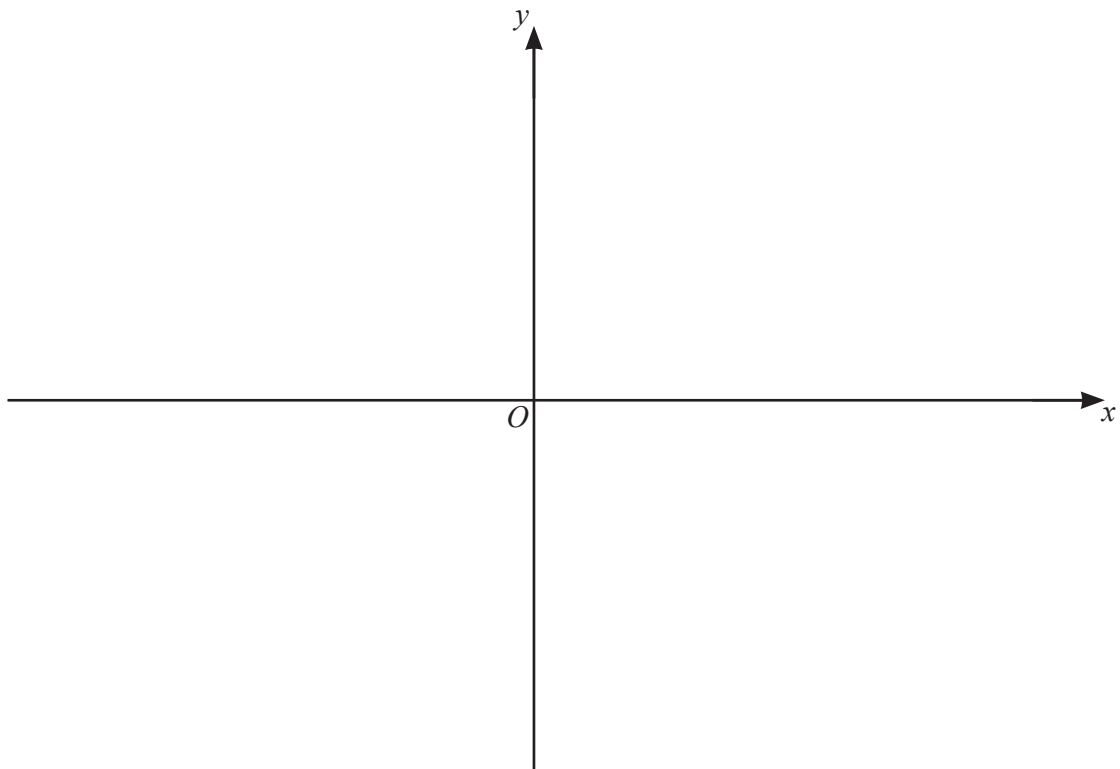
The diagram shows the graph of  $y = a \sin bx + c$ , for  $-320^\circ \leq x \leq 320^\circ$ , where  $a$ ,  $b$  and  $c$  are constants. Find the values of  $a$ ,  $b$  and  $c$ . [3]

2 Solve the equation  $3(2^{2x+1}) - 11(2^x) + 3 = 0$ , giving your answers correct to 2 decimal places. [4]  
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- 3 (a) Find the coordinates of the stationary points on the curve  $y = (2x + 1)^2(x - 3)$ . [4]



- (b) On the axes, sketch the graph of  $y = (2x + 1)^2(x - 3)$ , stating the intercepts with the axes. [3]



- (c) Write down the values of  $k$  for which the equation  $(2x + 1)^2(x - 3) = k$  has exactly one solution. [2]

4 Find  $\int_0^2 (1 + e^{2x})^2 dx$ , giving your answer in exact form.

[5]

5 When  $e^{2y}$  is plotted against  $x^3$ , a straight line graph that passes through the points (2, 5) and (6.4, 7.2) is obtained.



(a) Find  $y$  in terms of  $x$ .

[4]

(b) Find the values of  $x$  for which  $y$  exists.

[2]

6 It is given that  $y = \frac{\ln(2x^2 + 1)}{x + 2}$ ,  $x \neq -2$ .



(a) Find  $\frac{dy}{dx}$ . [3]

(b) Given that  $x$  increases from 1 to  $1 + h$ , where  $h$  is small, find the approximate corresponding change in  $y$ . [2]

(c) When  $x = 1$ , the rate of change in  $y$  is 3 units per second. Find the corresponding rate of change in  $x$ . [2]

- 7 (a) A 6-digit number is to be formed using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. The 6-digit number cannot start with 0. Each digit can be used at most once in any 6-digit number. Find how many of these 6-digit numbers are divisible by 5. [3]

- (b) The number of combinations of  $(n + 1)$  objects taken 13 at a time is equal to 16 times the number of combinations of  $n$  objects taken 12 at a time. Find the value of  $n$ . [3]

- 8 The line  $L$  is the normal to the curve  $y = 3(5x+6)^{\frac{1}{2}}$  at the point where  $x = 2$ . The point  $(-2, k)$ , where  $k$  is a constant, lies on  $L$ . Find the exact value of  $k$ . [7]



9 In this question, all lengths are in metres, and time,  $t$ , is in seconds.



A particle  $P$  moves in a straight line such that,  $t$  seconds after leaving a fixed point  $O$ , its displacement,  $s$ , is given by  $s = 4t - 4 \cos 2t + 4$ .

(a) Find the velocity,  $v$ , of  $P$  at time  $t$ .

[2]

(b) On the axes, sketch the velocity–time graph for  $P$  for  $0 \leq t \leq \pi$ , stating the intercepts with the axes in exact form.

[5]



(c) Find the acceleration of  $P$  at time  $t$ .

[1]

(d) Find the times when the acceleration of  $P$  is zero for  $0 \leq t \leq \pi$ . Give your answers in terms of  $\pi$ .  
[2]

- 10 (a) In an arithmetic progression, the first term is  $a$  and the common difference is  $d$ . The sum of the first three terms of this arithmetic progression is 42. The product of the first three terms of this arithmetic progression is  $-6720$ .



(i) Show that  $a(a+2d) = -480$ . [3]

(ii) Hence, given that  $a$  is positive, find the values of  $a$  and  $d$ . [4]

- (b) In a geometric progression, the 3rd term is  $\frac{e^{4x}}{4}$  and the 10th term is  $\frac{e^{11x}}{512}$ . Find the first term and the common ratio. [5]

11 Solve the following simultaneous equations, giving your answers in exact form.

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$$8 \log_3 x + 12 \log_{81} y = 5$$

$$4 \log_9 x + 3 \log_3 y = 2$$

[6]

- 12 Solve the equation  $\sec\left(3\theta - \frac{\pi}{2}\right) = 2$  for  $-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$ . Give your answers in exact form. [5]

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