



# Cambridge IGCSE™

CANDIDATE  
NAME

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NUMBER

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**ADDITIONAL MATHEMATICS**

**0606/23**

Paper 2

**October/November 2023**

**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 functions  $f$  and  $g$  are defined as follows, for all real values of  $x$ .



$$f(x) = 2 \sin x + 3 \cos x$$

$$g(x) = e^{3x} - 1$$

(a) Find  $fg(0)$ . [2]

(b) Find  $gg(x)$ . [1]

(c) Solve the equation  $g^{-1}(x) = \frac{1}{3} \ln 5$ . [3]

- 2 Find the values of  $k$  for which the curve  $y = x^2 + kx + (4k - 15)$  is completely above the  $x$ -axis. [4]



3 (a) Solve the following simultaneous equations.



$$3 \log_2 x + 2 \log_2 y = 24$$

$$5 \log_2 x - 3 \log_2 y = 2$$

[5]

(b) Solve the equation  $\frac{2^{t+4}}{2^{1-2t}} = 512$ .

[4]

4 Find the exact value of  $\int_3^5 \frac{(x-1)^2}{x^3} dx$ .



[6]

5 The curved surface area of a cylinder with radius  $r$  and height  $h$  is  $2\pi rh$ .



A closed cylinder has radius  $r$  cm and volume  $1000 \text{ cm}^3$ .

(a) Show that the total surface area of the cylinder is  $2\pi r^2 + \frac{2000}{r} \text{ cm}^2$ . [3]

(b) Find the value of  $r$  which makes this area a minimum. You should show that your value of  $r$  gives a minimum for this area. [5]

6 A particle travels in a straight line. Its displacement,  $s$  metres, from the origin, at time  $t$  seconds, where  $t > 2$ , is given by  $s = \ln(4t^2 - 5) - t$ .

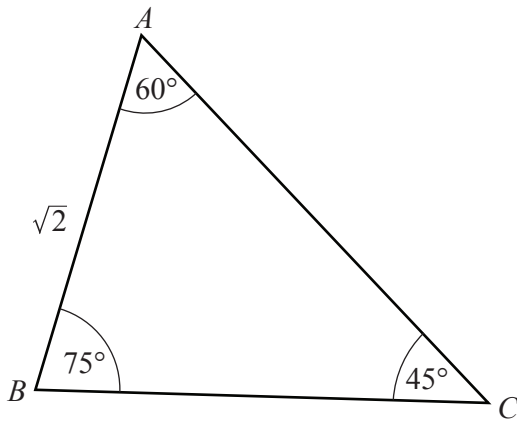


(a) Find expressions for the velocity,  $v \text{ ms}^{-1}$ , and acceleration,  $a \text{ ms}^{-2}$ , of the particle. [4]

(b) Find the time when the particle is at rest. [3]

(c) Find the acceleration at this time. [2]

## 7 DO NOT USE A CALCULATOR IN THIS QUESTION.



You may use the following trigonometrical ratios.

$$\sin 60^\circ = \frac{\sqrt{3}}{2}, \quad \sin 45^\circ = \frac{\sqrt{2}}{2}$$

$$\cos 60^\circ = \frac{1}{2}, \quad \cos 45^\circ = \frac{\sqrt{2}}{2}$$

$$\tan 60^\circ = \sqrt{3}, \quad \tan 45^\circ = 1$$

- (a) Given that the area of triangle  $ABC$  is  $\frac{3 + \sqrt{3}}{4}$ , show that  $\sin 75^\circ = \frac{\sqrt{6} + \sqrt{2}}{4}$ . [5]

- (b) Hence find the exact length of  $AC$ . [2]

8 (a) Show that  $\frac{\sin x}{\tan x - 1} - \frac{\cos x}{\tan x + 1} = \frac{\cos x}{\sin^2 x - \cos^2 x}$ . [5]



(b) Hence solve the equation  $\frac{\sin x}{\tan x - 1} - \frac{\cos x}{\tan x + 1} = 1$  for  $0^\circ < x < 360^\circ$ . [5]

9 A curve has equation  $y = xe^{2x}$ .



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

[2]

(b) Find the equation of the normal to the curve at  $x = 1$ .

[4]

(c) Use your answer to **part (a)** to find the exact value of  $\int_0^2 2xe^{2x} dx$ . [5]

- 10 (a) In an arithmetic progression the 5th term is 11. The 7th term is three times the 2nd term.  
Find the 1st term and the common difference.

[4]

(b) A different arithmetic progression (AP) and a geometric progression (GP) have the following properties.

- The 1st terms of the AP and GP are both 3.
- The 2nd term of the AP is the same as the 3rd term of the GP.
- The 6th term of the AP is the same as the 5th term of the GP.
- The common ratio of the GP is greater than 1.

Find the common difference of the AP and the common ratio of the GP.

[6]