



# Cambridge IGCSE™

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## ADDITIONAL MATHEMATICS

0606/22

Paper 2

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.



## 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*

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

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*

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

#### *Formulae for $\Delta ABC$*

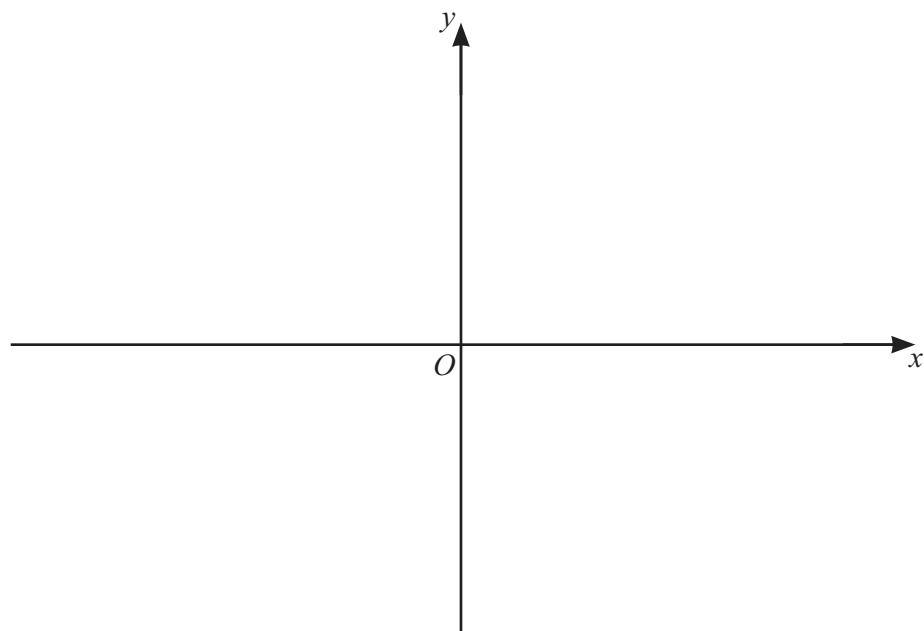
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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



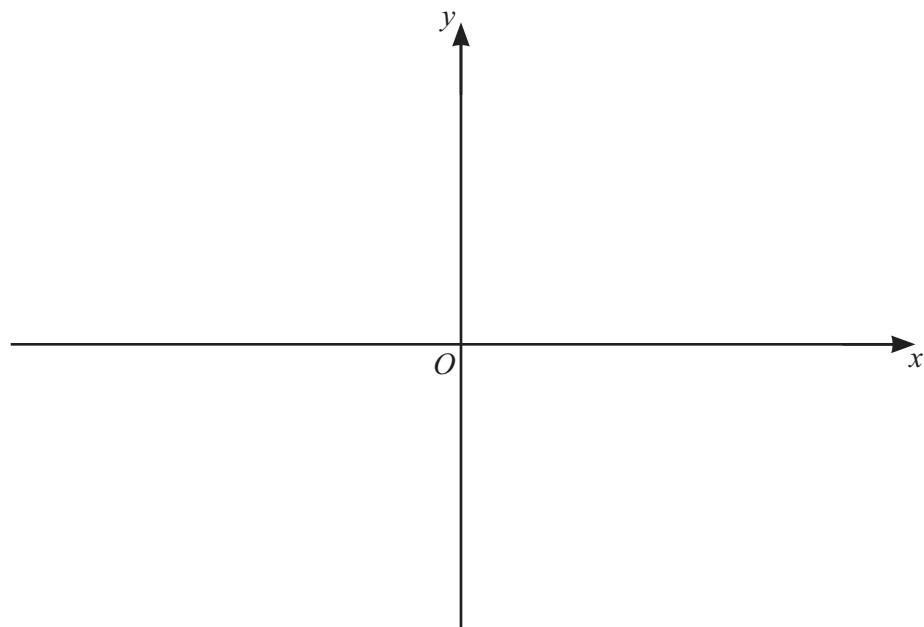
1 (a) On the axes, sketch the graph of  $y = (2x-5)(x+3)(1-x)$ , stating the intercepts with the coordinate axes. [3]



(b) Hence

(i) solve the inequality  $(2x-5)(x+3)(1-x) \leq 0$  [2]

(ii) on the axes below, sketch the graph of  $y = |(2x-5)(x+3)(1-x)|$ . [1]





2 (a) Evaluate  $\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \cos \frac{x}{4} dx$ . You must show all your working.

(b) Find  $\int \left( \frac{1}{4x-3} + \frac{1}{x^3} \right) dx$ . [3]





3 (a) Determine whether the equation  $\frac{(4x+1)(3x+2)}{5x-3} = x+1$  has two distinct real roots, two equal roots or no real roots. [4]

(b) Solve the equation  $\frac{12}{\sqrt[3]{x}} - \sqrt[3]{x} = 4$ . [4]





4 The polynomial  $p$  is such that  $p(x) = 6x^3 + x^2 - 12x + 5$ .

(a) Find the remainder when  $p(x)$  is divided by  $x - 2$ .

[1]

(b) (i) Show that  $2x - 1$  is a factor of  $p(x)$ .

[1]

(ii) Hence write  $p(x)$  as a product of linear factors.

[3]

(iii) Hence solve the equation  $6 \sin^3 \theta + \sin^2 \theta - 12 \sin \theta + 5 = 0$  for  $0^\circ \leq \theta \leq 90^\circ$ .

[2]





5 A curve has equation  $y = 5e^{2x-1} + e$ . The tangent to the curve at the point where  $x = 1$  cuts the  $x$ -axis at the point  $P$ .

Find the equation of the tangent in the form  $y = mx + c$ , where  $m$  and  $c$  are exact values, and hence find the  $x$ -coordinate of  $P$ . [6]





6 (a) Show that  $\sin^3 x \left( \frac{\cosec x}{\cot x} \right)$  can be written as  $\sin^2 x \tan x$ .

(b) Solve the equation  $\cos^2 x \tan x - \frac{1}{2} \tan x = 0$  for  $-\pi < x < \pi$ .





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7 Find the number of different ways the 9 letters of the word POLYMATHS can be arranged when

(a) the O and A are **not** next to each other

[2]

(b) the letters MATHS are together in this order.

[2]





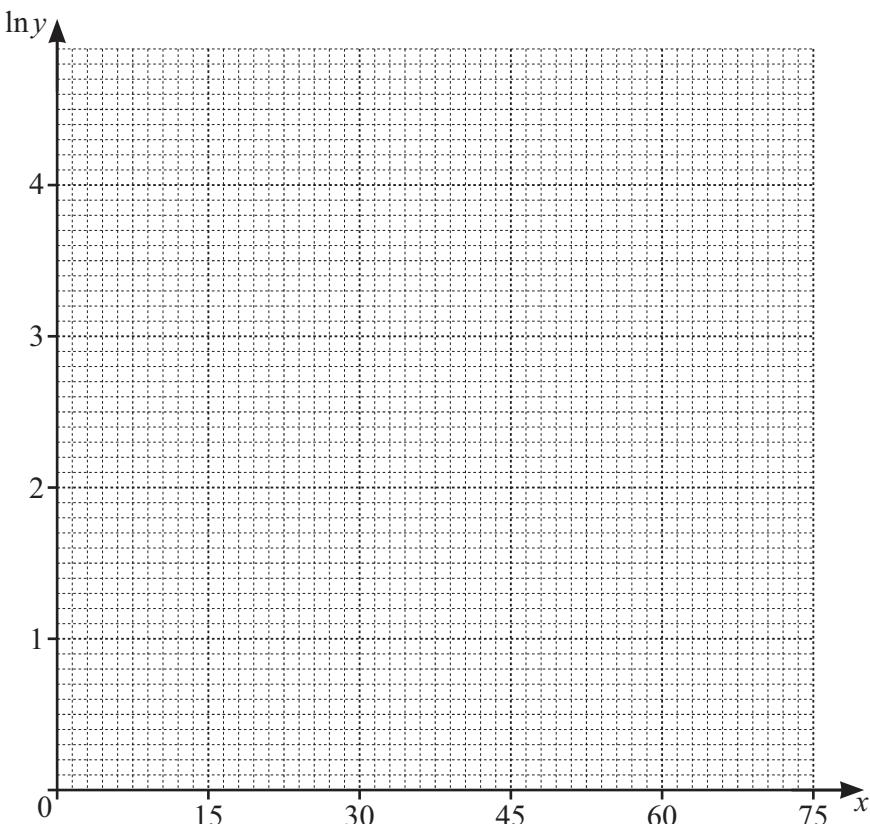
8 An experiment was carried out and values of  $y$  for certain values of  $x$  were recorded. The table shows the values recorded.

$x$	15	30	45	60	75
$y$	10	13	22	35	50

The relationship between  $y$  and  $x$  is modelled by  $y = Ae^{kx}$ , where  $A$  and  $k$  are constants.

(a) Draw a straight line graph for  $\ln y$  against  $x$ .

[2]

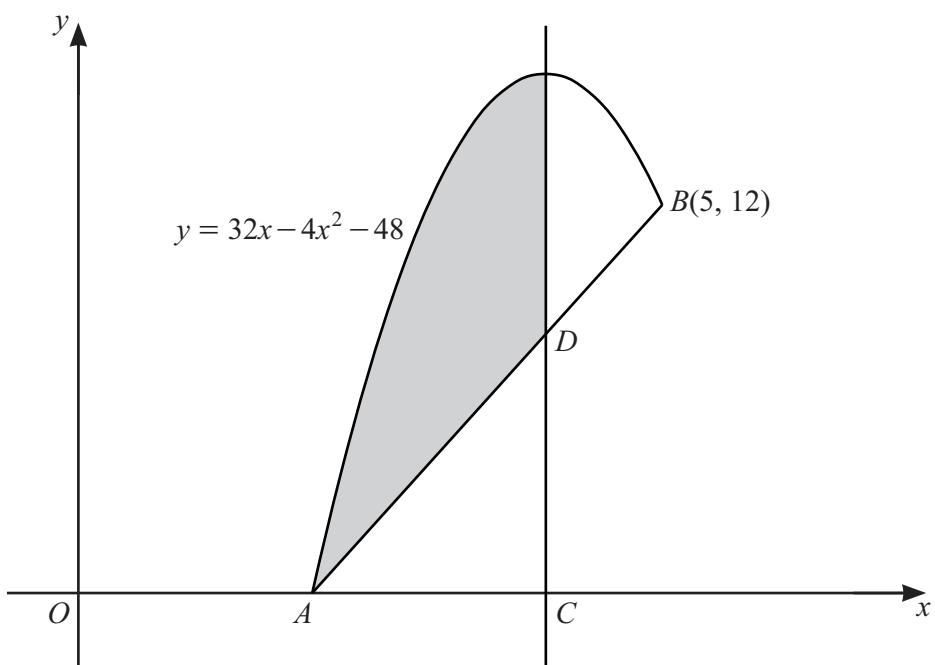




(b) Find the equation of the line in **part (a)** and hence find the values of  $A$  and  $k$ . Give each value correct to 1 significant figure. [5]

(c) Find the value of  $x$  for which  $y = 17$ . [2]





[9]





Continuation of working space for Question 9.

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10 The functions  $f$  and  $fg$  are defined by

$$f(x) = e^{x^2+3} \quad \text{for } x < 0$$

$$fg(x) = e^{2x} \quad \text{for } x > \frac{3}{2}.$$

(a) Explain why  $f^{-1}$  exists.

[1]

(b) Find an expression for  $f^{-1}(x)$  and state the domain and range of  $f^{-1}$ .

[5]

(c) Hence find and simplify an expression for  $g(x)$ .

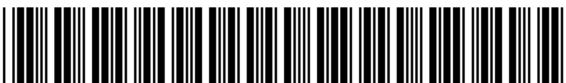
[2]





11 In the binomial expansion of  $\left(2 + \frac{x}{2}\right)^n$ , the first three terms in increasing powers of  $x$  are  $b + abx + \frac{9}{8}abx^2$ . Find the values of the constants  $n$ ,  $a$  and  $b$ .

[8]



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