



# Cambridge O Level

CANDIDATE NAME



CENTRE NUMBER

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## ADDITIONAL MATHEMATICS

4037/11

Paper 1 Non-calculator

May/June 2025

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.
- Calculators must **not** be used in this paper.
- You must show all necessary working clearly.

### 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.



### List of formulas

Equation of a circle with centre  $(a, b)$  and radius  $r$ .

$$(x - a)^2 + (y - b)^2 = r^2$$

Curved surface area,  $A$ , of cone of radius  $r$ , sloping edge  $l$ .

$$A = \pi r l$$

Surface area,  $A$ , of sphere of radius  $r$ .

$$A = 4\pi r^2$$

Volume,  $V$ , of pyramid or cone, base area  $A$ , height  $h$ .

$$V = \frac{1}{3}Ah$$

Volume,  $V$ , of sphere of radius  $r$ .

$$V = \frac{4}{3}\pi r^3$$

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

$$u_n = ar^{n-1}$$

$$S_n = \frac{a(1 - r^n)}{1 - r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1 - r} \quad (|r| < 1)$$

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulas for  $\triangle ABC$

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

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

$$\Delta = \frac{1}{2} ab \sin C$$





Calculators must **not** be used in this paper.

1 (a) Given that  $\vec{PQ} = \begin{pmatrix} -3 \\ 7 \end{pmatrix}$  and  $4\vec{PR} = \begin{pmatrix} -2 \\ 8 \end{pmatrix}$ , find  $\vec{RQ}$ . [2]

(b) The vectors  $\mathbf{a}$ ,  $\mathbf{b}$  and  $\mathbf{c}$  are such that  $\mathbf{a} = \alpha\mathbf{i} + 6\mathbf{j}$ ,  $\mathbf{b} = 4\mathbf{i} + \beta\mathbf{j}$  and  $\mathbf{c} = (2\alpha + 5\beta)\mathbf{i} + 20\mathbf{j}$ , where  $\alpha$  and  $\beta$  are scalars.

Given that  $\mathbf{c} = 3\mathbf{a} - 2\mathbf{b}$ , find the values of  $\alpha$  and  $\beta$ . [3]





2 Solve the inequality  $(3 - x)(5x + 8) \geq 9 - 3x$ .

[4]

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3 Point  $A$  has coordinates  $(3, -1)$ .

A circle has equation  $(x - 4)^2 + (y + 3)^2 = 5$ .

(a) Show that  $A$  lies on the circumference of the circle.

[1]

(b) Given that  $AB$  is a diameter of the circle, find the coordinates of  $B$ .

[2]

(c) Find the equation of the tangent to the circle at  $A$ .

[3]



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4 (a) Solve the equation  $x^{\frac{1}{3}} - x^{\frac{1}{6}} = 2$ .

[4]

(b) Solve the simultaneous equations

$$\begin{aligned} \lg(x + 2y) &= 0 \\ x^2 + 4xy + y &= 1. \end{aligned}$$

[5]



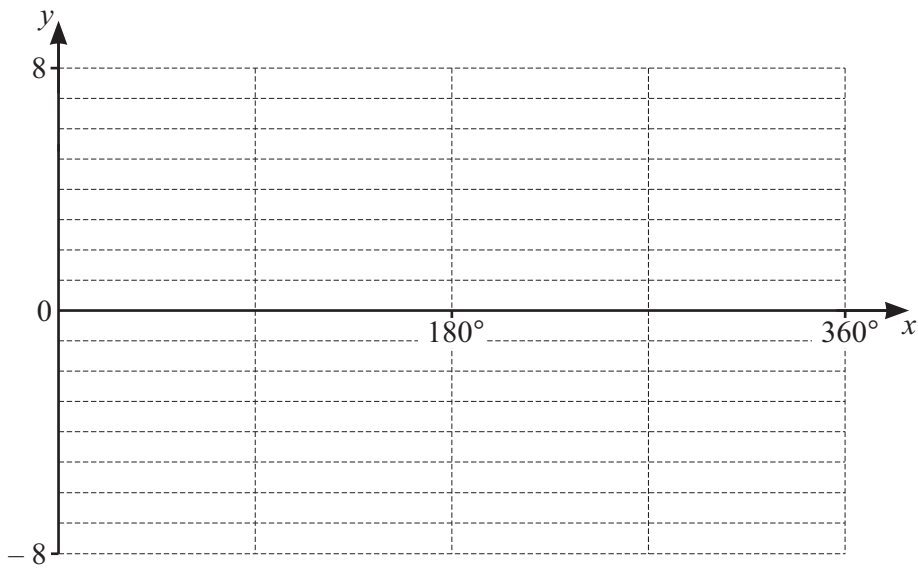


5 (a) Solve the equation  $5|2x - 1| + 8 = 23$ .

[3]

(b) On the axes, sketch the graph of  $y = 5\sin x - 2$  for  $0^\circ \leq x \leq 360^\circ$ .

[2]





6 A curve has equation  $y = \left(\frac{x^2 - 1}{x^2 + 1}\right)^4$ .

(a) Show that  $\frac{dy}{dx}$  can be written as  $\frac{Ax(x^2 - 1)^3}{(x^2 + 1)^5}$ , where  $A$  is a positive integer to be found. [5]







(b) (i) Show that the curve has stationary points where  $x = -1$ ,  $x = 0$  and  $x = 1$ .

[1]

(ii) Use the first derivative test to determine which two stationary points have the same nature and state whether they are maximum or minimum points.

[2]



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7 **Solutions to this question by accurate drawing will not be accepted.**

Find the  $x$ -coordinates of the points where the curve  $y = (2x - 9)(x^2 + 5) + 42$  cuts the  $x$ -axis. [6]

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8 (a) Write down the set of values of  $x$  for which  $\log_5(12x-4)$  exists.

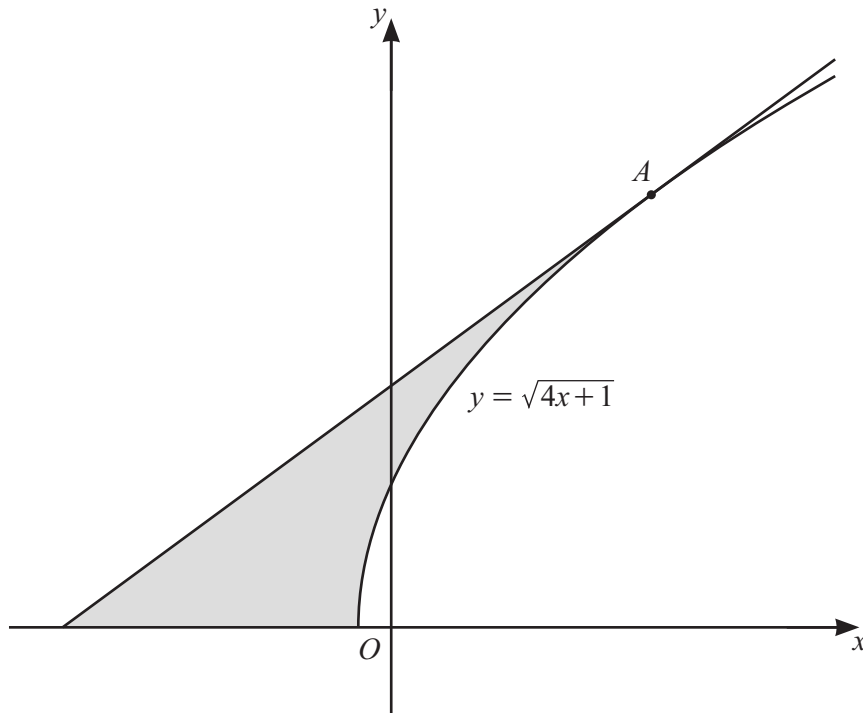
[1]

(b) Solve the equation  $\log_5(12x-4) = \frac{6}{\log_x 125} + 1$ .

[6]



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The point  $A$  with  $x$ -coordinate 2 lies on the curve  $y = \sqrt{4x + 1}$ .  
The diagram shows part of this curve and the tangent to the curve at  $A$ .

Find the area of the shaded region enclosed by the curve, the tangent and the  $x$ -axis.

[10]





Continuation of working space for Question 9.

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10 (a) Given that  $0 \leq \theta < \frac{\pi}{2}$ , show that  $\frac{\sin \theta}{\sqrt{\operatorname{cosec}^2 \theta - 1}} + \frac{1}{\sqrt{1 + \tan^2 \theta}}$  can be written as  $\sec \theta$ . [4]

(b) Given that  $\sec x = \alpha$ , where  $\frac{3\pi}{2} < x \leq 2\pi$ , find  $\sin x$  in terms of  $\alpha$ . [3]

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11 An arithmetic progression has common difference  $d$ .  
The 3rd term of this progression is 10.

(a) Write down expressions for the 1st term and the 2nd term of this progression.  
Give your answers in terms of  $d$  only.

[2]

(b) When each of the first 3 terms is squared, the sum of these squares is 140 .  
There are two possible values for  $d$ .

Using your answer to part (a), find the sum of the first 200 terms of the progression with the smaller value of  $d$ .

[7]

Question 12 is printed on the next page.





12 In this question  $n \geq 6$ .

Use an algebraic method to show that  ${}^n C_5 - {}^{n-1} C_5$  can be written as  ${}^{n-1} C_4$ .

[4]

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