



# Cambridge O Level

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## ADDITIONAL MATHEMATICS

4037/22

Paper 2

May/June 2026

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. Do **not** use correction fluid or tape.
- Do **not** write on any bar codes.
- You should use a scientific calculator where appropriate.
- You must show all necessary working clearly.
- 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.
- For  $\pi$ , use either your calculator value or 3.142.

### 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

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

$$\text{where } n \text{ is a positive integer and } \binom{n}{r} = \frac{n!}{(n-r)!r!}$$

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  $\triangle ABC$ 

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

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

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



1 The point  $A$  is the minimum point on the curve  $y = x^2 - 6x + 10$ .

(a) Using the method of completing the square, find the coordinates of  $A$ .

[2]

(b) The point  $B$  has coordinates  $(6, 7)$ .  
The curve cuts the  $y$ -axis at the point  $C$ .

Find the equation of the line through  $B$  parallel to the line  $AC$ .

[2]

- 2 Show that there is no real value of  $k$  for which the equation
- $$(k-2)x^2 + (2k+3)x + 3 = 0$$
- has two equal roots.

[3]

- 3 (a) Differentiate  $y = \sqrt{x+1} + \cos(5x+3)$  with respect to  $x$ .

[3]

- (b) Find  $\int \sec^2 \frac{x}{3} dx$ .

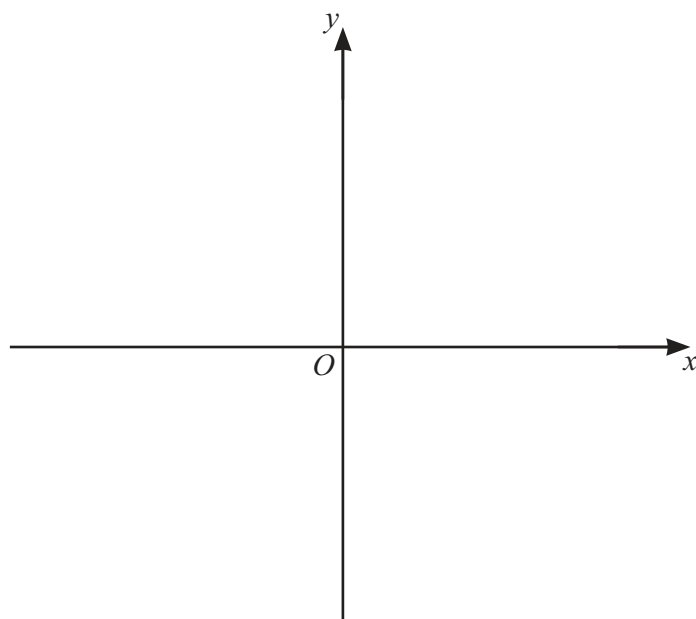
[3]





- 4 (a) On the axes, sketch the graph of  $y = |x^2 - 5|$ .  
State the intercepts with the coordinate axes.

[3]



- (b) It is given that  $f(x) = ax + b$  where  $a$  and  $b$  are non-zero integers.  
The solutions of the equation  $|f(x)| = 4$  are  $x = 2.5$  and  $x = -1.5$ .

Find the possible expressions for  $f(x)$ .

[4]



- 5 (a) In this question, 6-digit numbers do not start with 0.

Find how many 6-digit numbers have 6 different digits and are divisible by 2.

[3]

- (b) A committee of 10 people is to be selected from 9 students and 7 teachers.

Find the number of different committees that can be selected if the committee must have at least 4 students and at least 4 teachers.

[3]



- 6 In this question,  $a$ ,  $b$  and  $c$  are integers.

When the expansion of  $(a+x)^4(1+ax)^5$  is written in ascending powers of  $x$ , the first three terms are  $16+bx+cx^2$ .

Find all the possible values of  $a$ ,  $b$  and  $c$ .

[8]

- 7 In this question,  $\mathbf{i}$  is a unit vector due east and  $\mathbf{j}$  is a unit vector due north. Distances are measured in kilometres and time is measured in hours.

Point  $P$  has position vector  $2\mathbf{i} + 5\mathbf{j}$  relative to an origin  $O$ .

At 13 00, boat  $A$  sails from point  $P$  with velocity vector  $8\mathbf{i} + 8\mathbf{j}$ .

- (a) Find the position vector of  $A$  at the end of 2 hours of sailing. [1]

- (b) Write down the position vector of  $A$  at the end of  $t$  hours of sailing. [1]

- (c) Point  $Q$  has position vector  $20\mathbf{i} + 8\mathbf{j}$  relative to the origin  $O$ .  
At 15 00, boat  $B$  sails from point  $Q$  on a bearing of  $300^\circ$  with a constant speed of  $5\sqrt{3}$ .

Find the position vector of  $B$  at 17 00. [3]



(d) Find the distance between the two boats at 17 00.

[3]



8 The function  $f$  is defined, for  $x \geq -1$ , by  $f(x) = 1 + 2^x$ .

(a) Find the range of  $f$ .

[1]

(b) (i) Write down the domain of  $f^{-1}$ .

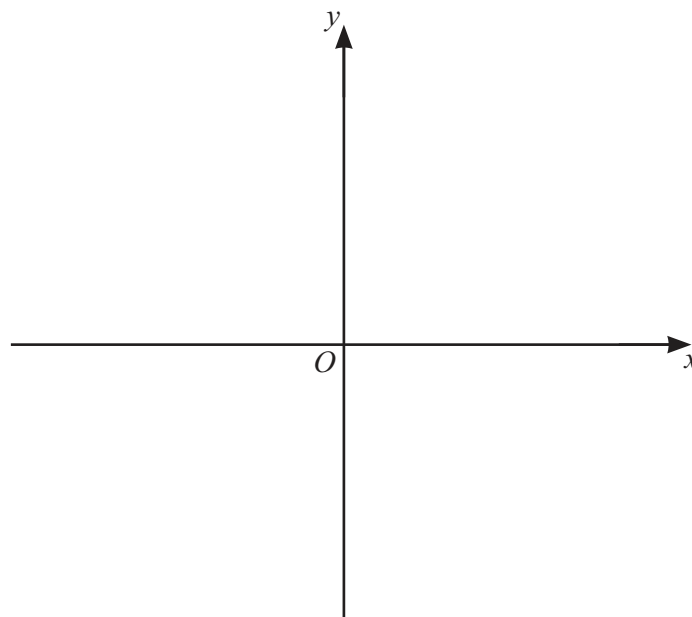
[1]

(ii) Find an expression for  $f^{-1}(x)$ .

[2]

(iii) On the axes, sketch the graph of  $y = f(x)$  and hence the graph of  $y = f^{-1}(x)$ .  
State any intercepts with the coordinate axes.

[4]



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

(i) Explain why  $g$  exists.

[1]

(ii) Find an expression for  $g'(x)$ .

[1]

(iii) It is given that  $g(3) = 126$ .

Find the value of  $k$ .

[2]



- 9 A particle  $P$  moves in a straight line such that  $t$  seconds after passing through a fixed point  $O$ , its displacement from  $O$ ,  $s$  metres, is given by  $s = e^{4t} - 10e^{2t} + 9$ .

(a) The velocity of  $P$  is  $v \text{ ms}^{-1}$ .

Find the value of  $t$  for which  $v$  has a stationary value.

[5]

(b) Find the acceleration of  $P$  when  $t = \ln 2$ .

[2]



10 Solve the equation  $\tan(3x+1) = 5 \sin(3x+1)$  for  $-\frac{\pi}{3} < x < \frac{\pi}{3}$ .

[6]



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

A circle  $C_1$  has centre  $(3, 5)$ .

The point  $P(1, 4)$  lies on circle  $C_1$ .

A circle  $C_2$  has centre  $(12, 8)$ .

The line with equation  $y = 19 - 3x$  is the common chord of circles  $C_1$  and  $C_2$ .

Find the radius of circle  $C_2$ .

[9]





Continuation of working space for Question 11.

Question 12 is on the back page.



- 12 A sphere has volume  $V \text{ cm}^3$  and radius  $r \text{ cm}$ .

Given that  $r$  varies with time  $t$ , find  $V$  at the instant when  $\frac{dV}{dt} = 9\frac{dr}{dt}$ . [4]

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