



## Cambridge O Level

CANDIDATE  
NAME

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## ADDITIONAL MATHEMATICS

4037/11

## Paper 1 Non-calculator

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.
- 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  $\triangle ABC$ 

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

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

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





1 Solve the equation  $|5x + 4| = |3x - 2|$ .

[3]



2 A circle has equation  $(x-3)^2 + (y-4)^2 = 20$ .

(a) Write down the coordinates of the centre of the circle.

[1]

(b) Write down the radius of the circle.

[1]

(c) The line  $AB$  is a diameter of this circle.  
The point  $A$  has coordinates  $(-1, 6)$ .

Find the coordinates of the point  $B$ .

[2]



- 3 Show that  $(3 + 5 \cot \theta)^2 + (3 - 5 \cot \theta)^2 - 50 \operatorname{cosec}^2 \theta$ , where  $0 < \theta < \frac{\pi}{2}$ , can be simplified to a constant. [4]

- 4 Given that  $\int_0^a \frac{1}{3x+2} dx = \ln 4$ , find the value of the constant  $a$ .

[5]



- 5 The polynomial  $p$  is such that  $p(x) = ax^3 + 4x^2 - ax - 28$ , where  $a$  is a positive constant.

It is given that  $p(a) = 0$ .

- (a) Find the value of  $a$ .

[4]

- (b) Using your value of  $a$ , find  $p(x)$  as a product of a linear factor and a quadratic factor.

[2]

- (c) Hence show that the equation  $p(x) = 0$  has exactly one root.

[2]





- 6 The function  $f$  is such that  $f(x) = 3x^2 + 8x$  for  $x \geq k$ , where  $k$  is a constant. It is given that  $f^{-1}$  exists.  $k$  has the least possible value for which  $f^{-1}$  exists.

(a) Find the value of  $k$ .

[2]

(b) Find the range of  $f$ .

[2]

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

[3]



(d) The function  $g$  is such that  $g(x) = 3^x$  for  $x > -6$ .

(i) Write down the domain of  $gf$ .

[1]

(ii) Solve the equation  $gf(x) = 27$ .

[4]



7 A curve has equation  $y = \frac{4 + e^{2x}}{2 + e^x}$ .

(a) Show that, when  $\frac{dy}{dx} = 0$ ,  $e^{2x} + 4e^x - 4 = 0$ .

[5]



- (b) Hence find the  $x$ -coordinate of the stationary point on the curve.  
Give your answer in the form  $\ln(a\sqrt{b} + c)$ , where  $a$ ,  $b$  and  $c$  are integers.

[4]

8 (a) Write down the value of  $\lg(10000)$ .

[1]

(b) Solve the equation  $\log_2(\log_3 x) = 2$ .

[3]

(c) Solve the equation  $\log_x 5 = \log_5 x^4$ .

[4]



- 9 (a) A geometric progression has common ratio  $r$  and first term  $a$ , where  $a \neq 0$ .  
The 4th term is  $-8$  times the 7th term.

(i) Find the value of  $r$ .

[2]

- (ii) The sum of the first 5 terms of this progression is  $\frac{99}{32}$ .

Find the value of  $a$ .

[2]

- (b) The first three terms of a different geometric progression are  $\cos \theta \sin \theta$ ,  $\cos \theta \sin^3 \theta$  and  $\cos \theta \sin^5 \theta$ , for  $0 < \theta < \frac{\pi}{2}$ .

Show that the sum to infinity of this progression is  $\tan \theta$ .

[4]





- 10 A curve has equation  $y = f(x)$ , where  $f''(x) = (2x + 10)^{-\frac{1}{2}} - 2x$ .

The curve has a stationary point at  $\left(3, \frac{64}{3}\right)$ .

Find the equation of the curve.

[8]





- 11 A triangle  $OAB$  is such that  $\vec{OA} = \mathbf{a}$  and  $\vec{OB} = \mathbf{b}$ .

The point  $X$  lies on  $OA$  such that  $\vec{OA} = 3\vec{OX}$ .

The point  $Y$  lies on  $XB$  such that  $\vec{XB} = 5\vec{XY}$ .

The point  $Z$  lies on  $OB$  such that  $\vec{OB} = m\vec{OZ}$ , where  $m$  is a scalar.

$\vec{OX} = n\vec{ZY}$ , where  $n$  is a scalar.

Use a vector method to find the values of  $m$  and  $n$ .

[8]

Question 12 is on the back page.





12 Find the value of  $n$  such that  ${}^{n+3}C_6 = 12 \times {}^{n+2}C_5$ .

[3]

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