Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0123456789

ADDITIONAL MATHEMATICS **4037/01**

Paper 1 Non-calculator **For examination from 2025**

SPECIMEN PAPER **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

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

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

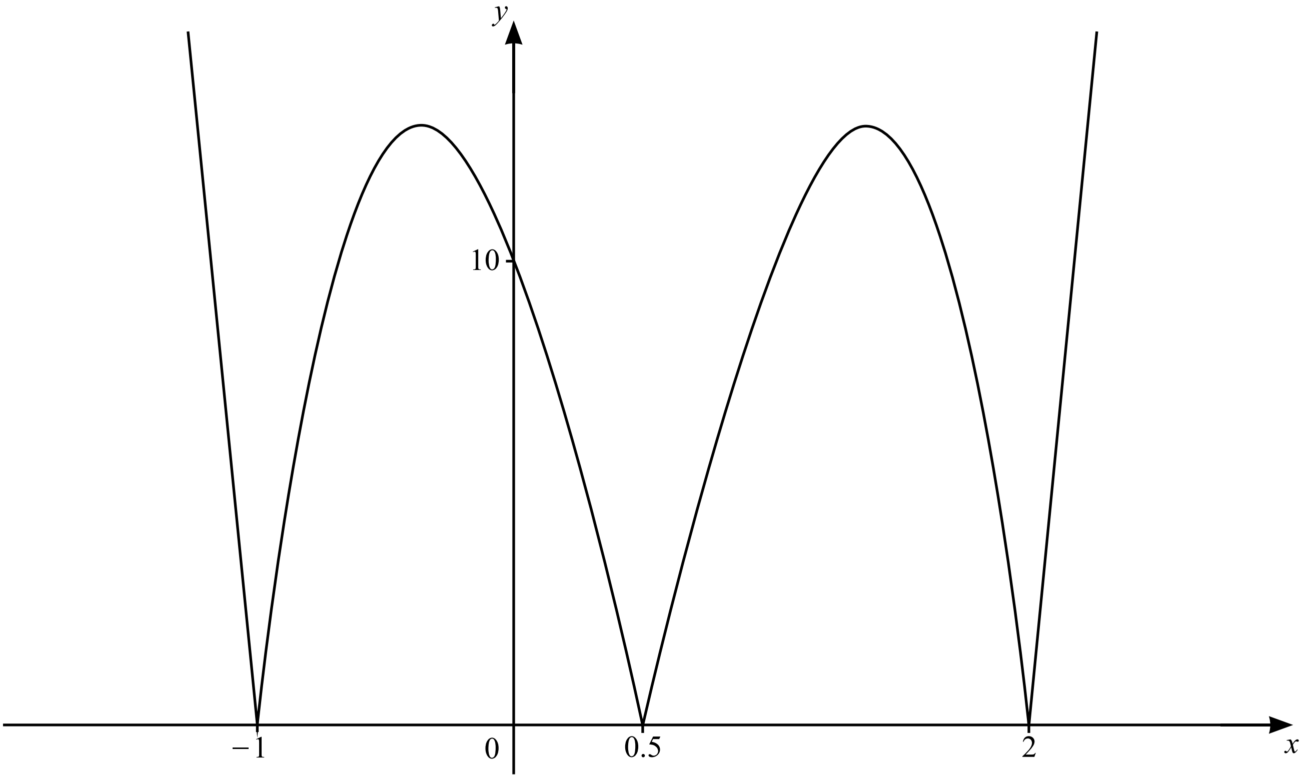
$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulas for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$\Delta = \frac{1}{2}ab\sin C$$

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

1



The diagram shows the graph of $y = |f(x)|$, where $f(x)$ is a cubic function.

Find the possible expressions for $f(x)$ in factorised form. [3]

2 The polynomial $p(x) = 6x^3 + ax^2 + bx + 2$, where a and b are integers, has a factor of $x - 2$.

(a) Given that $p(1) = -2p(0)$, find the values of a and b. [4]

(b) Using your values of a and b,

(i) find the remainder when $p(x)$ is divided by $2x - 1$ [2]

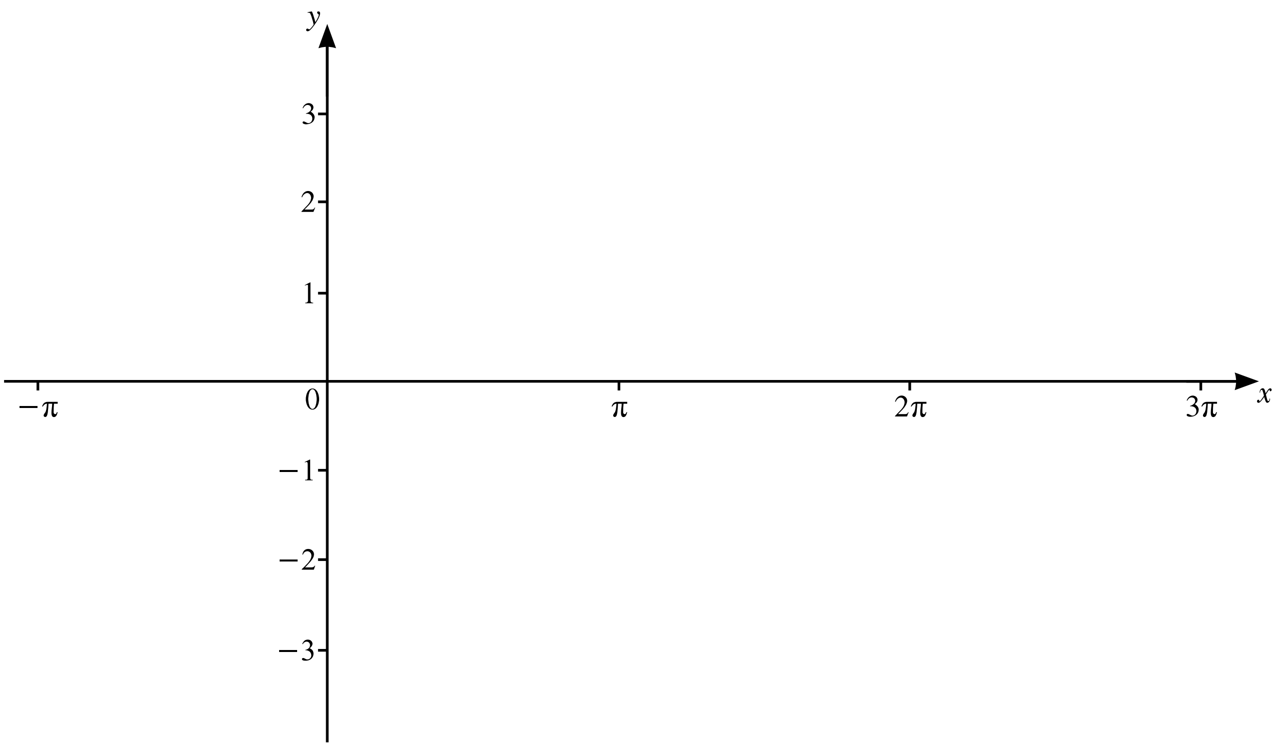
(ii) factorise $p(x)$. [2]

3 In this question, all angles are in radians.

(a) Write down the amplitude of $2\cos\frac{x}{3} - 1$. [1]

(b) Write down the period of $2\cos\frac{x}{3} - 1$. [1]

(c) On the axes below, sketch the graph of $y = 2\cos\frac{x}{3} - 1$ for $-\pi \leqslant x \leqslant 3\pi$. [3]



4 The parallelogram $OABC$ is such that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$. The point D lies on OC such that $OD : DC = 1 : 2$. The point E lies on AC such that $AE : EC = 2 : 1$.

Show that $\overrightarrow{OB} = k\overrightarrow{DE}$, where k is an integer to be found. [5]

5 **(a)** Given that $\log_a p + \log_a 5 - \log_a 4 = \log_a 20$, find the value of p. [2]

(b) Solve the equation $3^{2x+1} + 8(3^x) - 3 = 0$. [3]

(c) Solve the equation $4\log_y 2 + \log_2 y = 4$. [3]

6 **(a)** $f(x) = 3e^{2x} + 1$ for $x \in \mathbb{R}$

$g(x) = x + 1$ for $x \in \mathbb{R}$

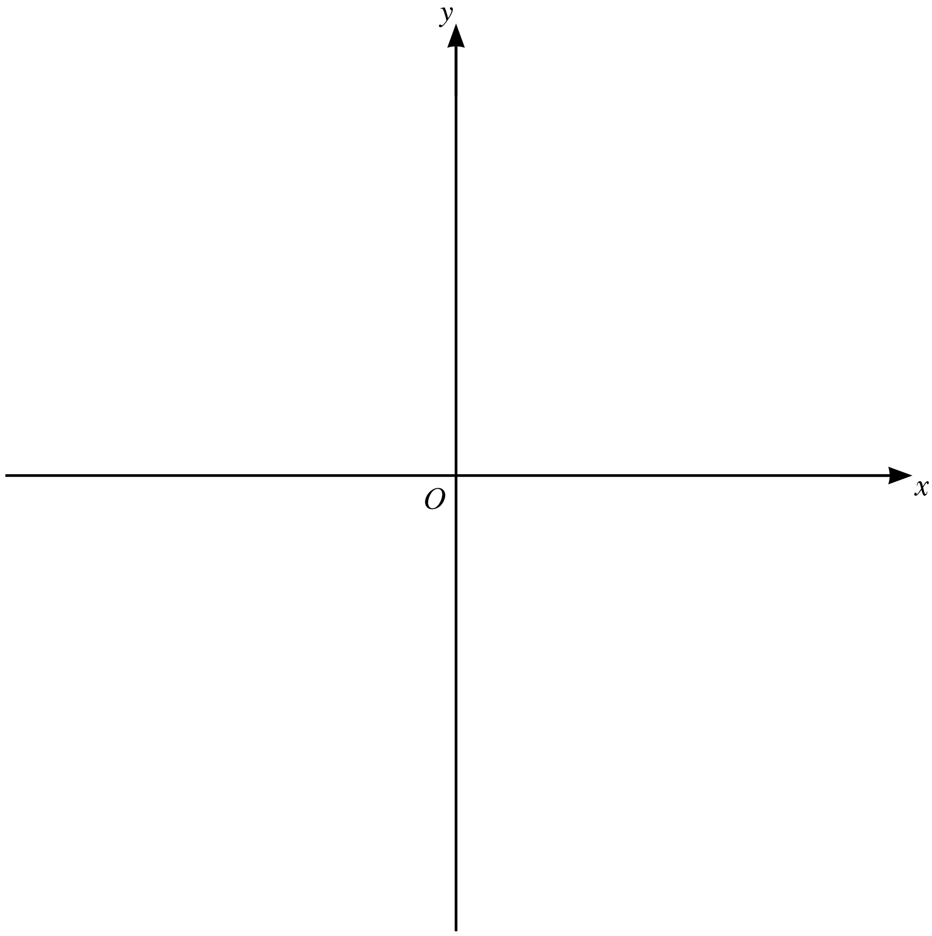
(i) Write down the range of f and the range of g. [2]

(ii) Find $g^2(0)$. [1]

(iii) Hence find $fg^2(0)$. [2]

(iv) On the axes below, sketch the graphs of $y = \mathrm{f}(x)$ and $y = \mathrm{f}^{-1}(x)$.

State the intercepts with the coordinate axes and the equations of any asymptotes. [4]



(b) It is given that $\mathrm{h}(x) = a + \dfrac{b}{x^2}$, where a and b are constants.

(i) Explain why $-2 \leqslant x \leqslant 2$ is not a suitable domain for $\mathrm{h}(x)$. [1]

(ii) Given that $\mathrm{h}(1) = 4$ and $\mathrm{h}'(1) = 16$, find the values of a and b. [2]

7 **(a)** In an arithmetic progression, the 5th term is equal to $\frac{1}{3}$ of the 16th term. The sum of the 5th term and the 16th term is equal to 33.

Find the sum of the first 10 terms of this progression. [6]

(b) In a geometric progression, the sum of the first two terms is equal to 16. The sum to infinity is equal to 25.

Find the possible values of the first term. [6]

8 **(a)** Given that $\int_1^a \left(\frac{2}{2x+3} + \frac{3}{3x-1} - \frac{1}{x} \right) dx = \ln 2.4$, where $a > 1$, find the value of a. [7]

(b) **(i)** Find $\frac{\mathrm{d}}{\mathrm{d}x}(6\sin^3 kx)$, where k is a constant. [2]

(ii) Hence find $\int(\sin^2 2x\cos 2x)\,\mathrm{d}x$. [2]

[Turn over

9 In this question, the units are metres and seconds.

A particle P is travelling in a straight line. Its acceleration, a, away from a fixed point O, at time t, is given by $a = (3t+2)^{-\frac{1}{3}}$, where $t \geqslant 0$.

When $t = 2$, P is travelling with a velocity of 8 and has a displacement of -4.8 from O.

(a) Find an expression for the velocity of P at time t. [3]

(b) Explain why P is never at rest. [1]

(c) Find the displacement of P from O when $t = \frac{25}{3}$. [4]

Question 10 is printed on the next page.

10 A circle has a centre $(2, -4)$ and radius 3.
The line $y = 2x - 3$ intersects the circle at points A and B.
The perpendicular bisector of line AB intersects the circle at points X and Y.

Find the area of kite $AXBY$. [8]