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**

PRACTICE 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. $A = \pi rl$

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

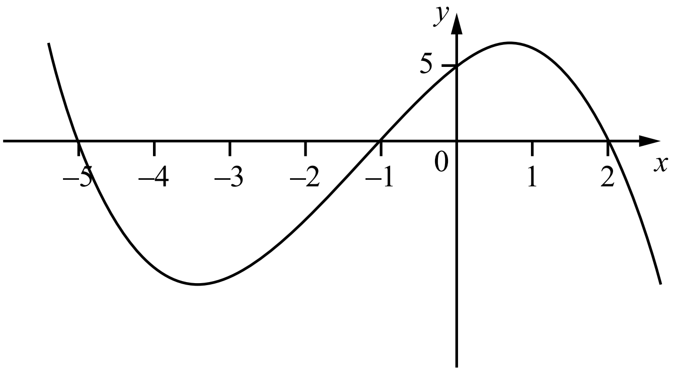
$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

1 The curve $y = 2x^2 + k + 4$ intersects the straight line $y = (k + 4)x$ at two distinct points.
Find the possible values of k. [4]

2



The diagram shows the graph of $y = \mathrm{f}(x)$, where $\mathrm{f}(x)$ is a cubic polynomial.

(a) Find $\mathrm{f}(x)$ giving your answer as a product of linear factors. [3]

(b) Write down the values of x such that $\mathrm{f}(x) < 0$. [2]

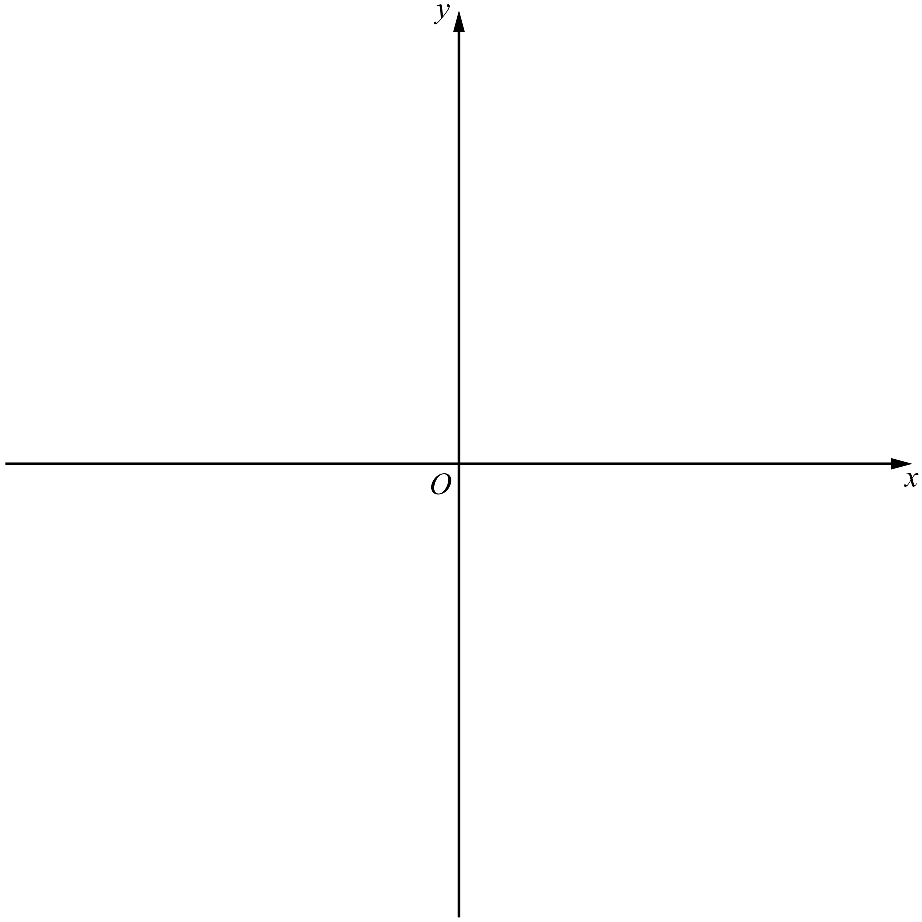
3 Solve the inequality $|5x + 4| \leqslant |2x - 3|$. [4]

4 The function f is defined as $f(x) = x^2 + 2x - 3$ for $x \geqslant -1$.

(a) Given that the minimum value of $x^2 + 2x - 3$ occurs when $x = -1$ explain why $f(x)$ has an inverse. [1]

(b) On the axes below, sketch the graph of $y = f(x)$ and the graph of $y = f^{-1}(x)$.

Label each graph and state the intercepts on the coordinate axes. [4]



5 **(a)** Show that $\dfrac{\sin x \tan x}{1 - \cos x}$ can be written as $1 + \sec x$. [4]

(b) Hence show that $\dfrac{\mathrm{d}}{\mathrm{d}x}\left(\dfrac{\sin x \tan x}{1 - \cos x}\right)$ can be written as $\tan x \sec x$. [2]

6 Solve the following simultaneous equations.

$$\log_3(x + y) = 2$$
$$2\log_3(x + 1) = \log_3(y + 2)$$

[6]

7 When y^3 is plotted against $\ln x$, a straight-line graph is obtained.
The straight line passes through the points (1, 5) and (6, 15).

(a) Find y in terms of x. [4]

(b) Given that $y > -1$, find the corresponding values of x. [2]

8 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 value of a and of b. [4]

(b) Using your values of a and b,

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

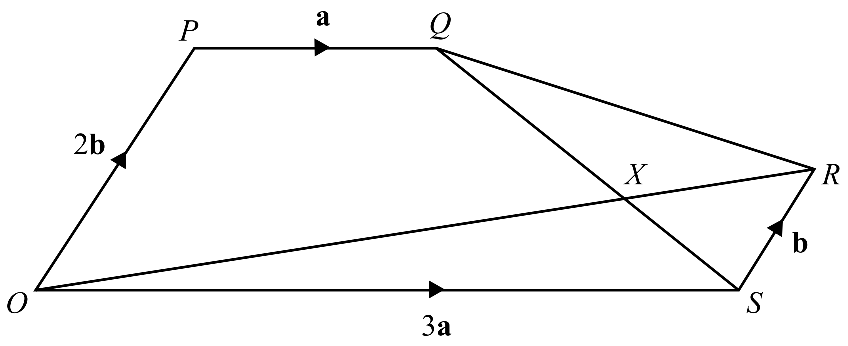
(ii) factorise $p(x)$. [2]

9 **(a)** Find the equation of the tangent to the curve $y = x^3 - 6x^2 + 3x + 10$ at the point where $x = 1$. Give your answer in the form $y = mx + c$. [4]

(b) Find the coordinates of the point where this tangent meets the curve again. [5]

10 Find the exact value of $\displaystyle\int_2^4 \frac{(x+1)^2}{x^2}\,\mathrm{d}x$. [6]

11



In the diagram $\overrightarrow{OP} = 2\mathbf{b}$, $\overrightarrow{OS} = 3\mathbf{a}$, $\overrightarrow{SR} = \mathbf{b}$ and $\overrightarrow{PQ} = \mathbf{a}$.
The lines OR and QS intersect at the point X.

(a) Find $\overrightarrow{OQ}$ in terms of **a** and **b**. [1]

(b) Find $\overrightarrow{QS}$ in terms of **a** and **b**. [1]

(c) Given that $\overrightarrow{QX} = \mu\overrightarrow{QS}$, find $\overrightarrow{OX}$ in terms of **a**, **b** and μ. [1]

(d) Given that $\overrightarrow{OX} = \lambda\overrightarrow{OR}$, find $\overrightarrow{OX}$ in terms of **a**, **b** and λ. [1]

(e) Find the values of λ and μ. [3]

12 Circle C_1 has equation $x^2 + y^2 - 2x + 6y = 0$.
The point A lies on the circumference of the circle and has coordinates (2, 0).

(a) Find the equation of the tangent to the circle at A. [5]

The circle C_1 is reflected in the tangent at A to form the circle C_2.

(b) Find the equation of C_2. [5]

Question 13 is printed on the next page.

13 It is given that $2 + \cos\theta = x$ for $1 < x < 3$ and $2\operatorname{cosec}\theta = y$ for $y > 2$.
Find y in terms of x. [4]