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 B **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.

 [Turn over

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

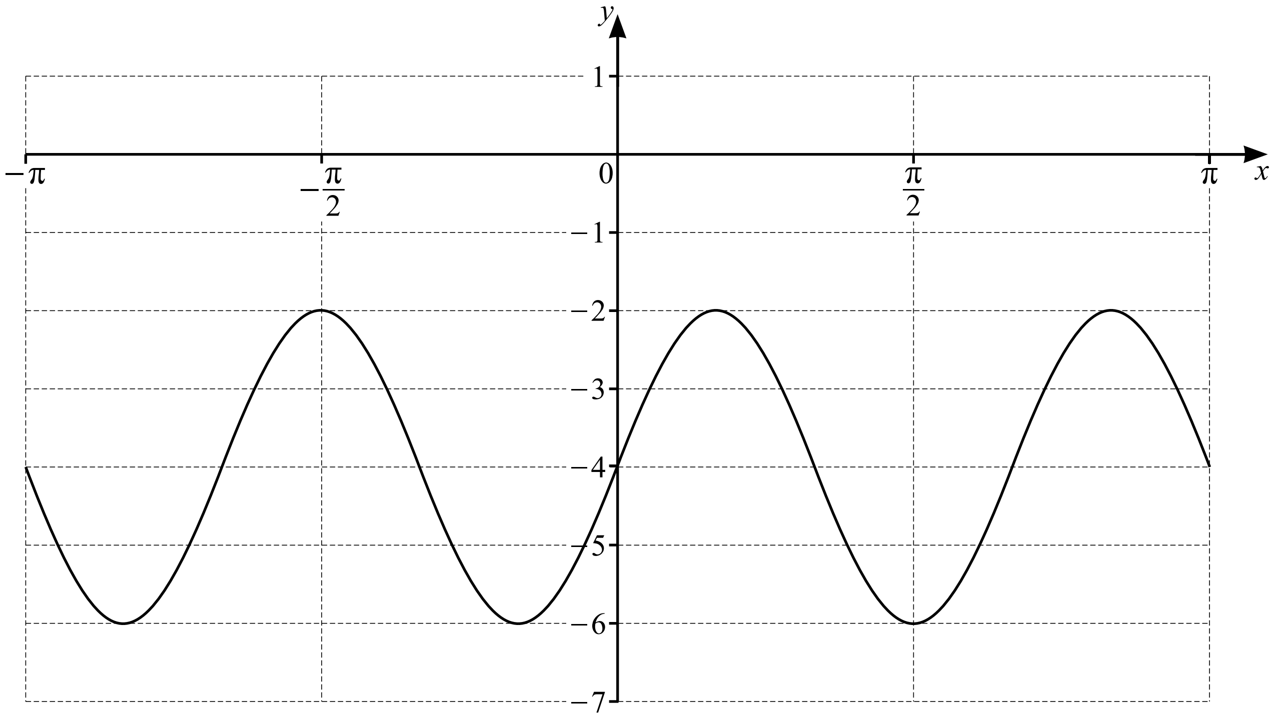
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

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

1



The diagram shows the graph of $y = a\sin bx + c$, where a, b and c are integers.

Find the values of a, b and c. [3]

2 The solutions of the equation $|5x + 2| = |3x - 4|$ are $x = a$ and $x = b$ where $a > b$.

Find the value of $|2a - 3| - |b - 1|$. [5]

3 Find the values of k such that the line $y = 9kx + 1$ does not meet the curve $y = kx^2 + 3x(2k + 1) + 4$. [5]

4 It is given that $\cot\theta = -2\sqrt{6}$ for $\pi < \theta < 2\pi$.

(a) Find the value of $\sin\theta$. [3]

(b) Find the value of $\cos\theta$, giving your answer in surd form. [2]

5 Solve the following simultaneous equations.

$$3y - 2x + 2 = 0$$
$$xy = \frac{1}{2}$$

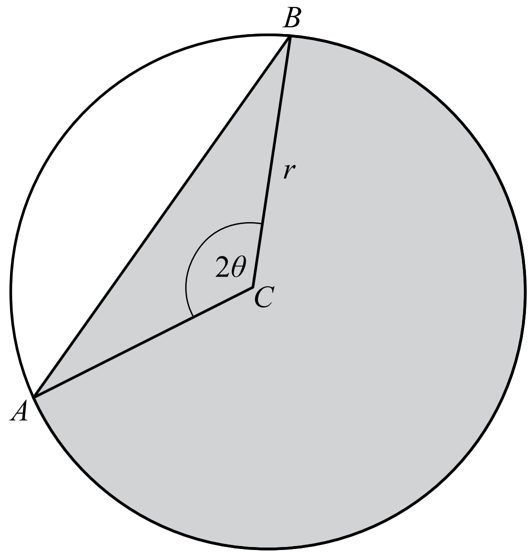
[3]

6 Points P, Q and R have coordinates $P\,(-4, -8)$, $Q\,(2, 4)$ and $R\,(10, 0)$.

(a) Show that the line PQ is perpendicular to the line QR. [2]

(b) Hence find the equation of the circle which passes through P, Q and R. [5]

7 In this question, all lengths are in centimetres and all angles are in radians.



The diagram shows the circle with centre C and radius r.
The points A and B lie on the circumference of the circle such that angle ACB is 2θ radians, where $\theta < \frac{\pi}{2}$.

(a) Find, in terms of r and θ, the perimeter of the shaded region. [3]

(b) Find, in terms of r and θ, the area of the shaded region. [3]

8

$$\sin\frac{\pi}{3} = \frac{\sqrt{3}}{2} \qquad \cos\frac{\pi}{3} = \frac{1}{2} \qquad \tan\frac{\pi}{3} = \sqrt{3}$$

It is given that $y = \tan x \sin 3x$.

(a) Find the exact value of $\frac{dy}{dx}$ when $x = \frac{\pi}{3}$. [4]

(b) It is given that x is increasing at the rate of 3 units per second.

Find the corresponding rate of change in y when $x = \frac{\pi}{3}$.
Give your answer in its simplest surd form. [2]

(c) Find the approximate change in y as x increases from $\frac{\pi}{3}$ to $\frac{\pi}{3} + h$ where h is small. [1]

9 **(a)** Show that $\dfrac{1}{2x+1}-\dfrac{1}{(2x+1)^2}+\dfrac{4}{4x-1}=\dfrac{24x^2+14x+4}{(2x+1)^2(4x-1)}$. [2]

(b) Hence find $\displaystyle\int_{\frac{1}{2}}^{1}\frac{24x^2+14x+4}{(2x+1)^2(4x-1)}\,\mathrm{d}x$.

Give your answer in the form $\dfrac{1}{2}\ln p+q$ where p and q are rational numbers. [7]

10 A particle P is initially at the point with position vector $\begin{pmatrix} 30 \\ 10 \end{pmatrix}$ and moves with a constant speed of $10\,\text{m s}^{-1}$ in the same direction as $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$.

(a) Find the position vector of P at time t seconds. [3]

As P starts moving, a particle Q starts to move such that its position vector at time t seconds is given by $\begin{pmatrix} -80 \\ -90 \end{pmatrix} + t\begin{pmatrix} 5 \\ 12 \end{pmatrix}$.

(b) Find the speed of Q. [1]

(c) Find the distance between P and Q when $t = 10$.

Give your answer in its simplest surd form. [3]

11 Given that $40 \times {}^{n}C_{5} = 2(n-1) \times {}^{n+1}C_{6}$, find the value of n. [3]

12 Solve the equation $3 + \log_3 x = 10\log_x 3$, giving your answers as powers of 3. [4]

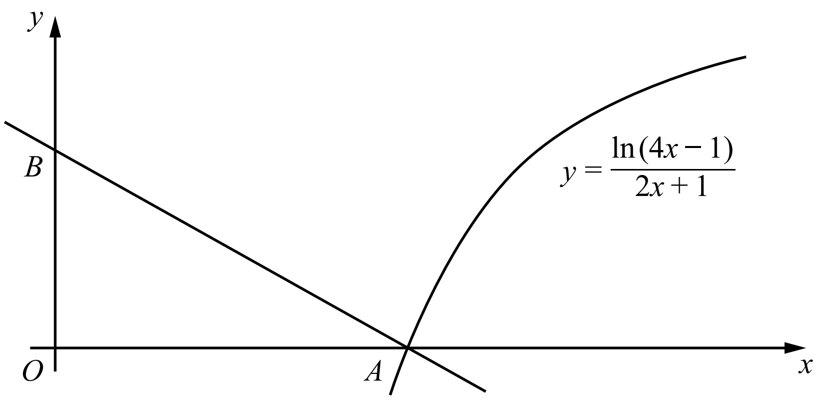
13 A curve is such that $\dfrac{d^2y}{dx^2} = 6e^{3x} + 4x$.

The curve has a gradient of 5 at the point $\left(0, \dfrac{5}{3}\right)$.

Find the equation of the curve. [7]

Question 14 is printed on the next page.

14



The diagram shows part of the curve $y = \dfrac{\ln(4x-1)}{2x+1}$ and the normal to the curve at the point A.
The curve crosses the x-axis at A.
The normal to the curve at A meets the y-axis at the point B.

Find the equation of this normal and hence the coordinates of B. [9]