Cambridge Assessment International Education

# Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*0123456789*

**ADDITIONAL MATHEMATICS** **4037/02**

Paper 2 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.
- 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. Any blank pages are indicated.

**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 $\Delta ABC$

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

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

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

1 **Solutions to this question by accurate drawing will NOT be accepted.**

A circle has centre (3, 2) and radius 17.
A different circle has centre (15, – 4) and radius 29.

**(a)** Show that the circles have two points of intersection. [2]

**(b)** The points of intersection are (–5, 17) and (–13.8, –0.6).

Using this information, or otherwise, find the equation of the common chord. [2]

2 For variables $x$ and $y$, plotting $\lg y$ against $x^4$ gives a straight line which passes through the points (2, 5) and (6, 7).

**(a)** Find the value of $\lg y$ when $x^4 = 0$. [2]

**(b)** It is given that $y$ can be written in the form $Ab^{Cx^4}$ where $A$, $b$ and $C$ are constants.

Find the values of $A$, $b$ and $C$. [3]

**3** In the expression $12x^3 + ax^2 - 12x + b$ , $a$ and $b$ are integers.
The expression has:

- a factor $x - 2$ and
- a remainder of $-15$ when divided by $x + 1$.

Find the other linear factors of this expression. [8]

**4** The seven digits 1, 2, 3, 4, 5, 7 and 9 are used to make a 4-digit number.
In these 4-digit numbers, all the digits are different.

**(a)** Find how many such 4-digit numbers can be made that are even and less than 4000. [3]

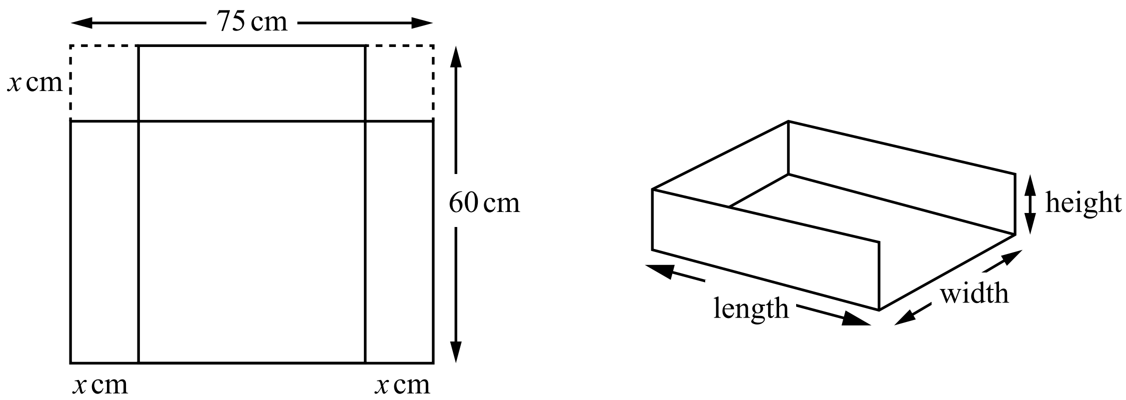
**(b)** Find how many such 4-digit numbers can be made that are between 2000 and 7000 and have a final digit which is prime. [3]

**5** The first four terms, in ascending powers of $x$, in the expansion of $(2 + ax)^7$ can be written as

$$128 + bx + cx^2 - 15\,120x^3.$$

Find the values of $a$, $b$ and $c$. [6]

**6**




A rectangular sheet of metal measures 75 cm by 60 cm.
A storage tray is made by cutting out squares of side $x$ cm from two corners of the sheet and folding the remainder of the sheet, as shown.
A cuboid has the same length, width and height as the tray.

**(a)** Show that the volume of the cuboid, $V$ cm$^3$, is given by $V = ax^3 + bx^2 + cx$, where $a$, $b$ and $c$ are integers to be found. [3]

**(b)** Given that $x$ can vary, find the value of $x$ for which $V$ has a stationary value. [3]

**7** **(a)** Show that $\dfrac{\cos x}{1-\sin x}+\dfrac{\cos x}{1+\sin x}$ can be written as $2\sec x$. [4]

**(b)** **(i)** Solve the equation $5\cos x - 4\sin x = 0$ for $-180° \leqslant x \leqslant 180°$. [3]

**(ii)** Solve the equation $10\sin^2 2x - 9 = 3\cos 2x$ for $0 \leqslant x \leqslant \pi$. [5]

**8** $\mathrm{f}(x) = x^2 + 2x + 5 \quad \text{for } x \geqslant 0$

$\mathrm{g}(x) = \dfrac{5x}{x+2} \quad \text{for } x \geqslant 0$

**(a)** **(i)** Explain why the function $\mathrm{f}^{-1}$ can be formed. [2]

**(ii)** Find and simplify an expression for $\mathrm{f}^{-1}(x)$. [4]

**(b)** **(i)** Explain why the function gf can be formed. [2]

**(ii)** Solve the equation $\mathrm{gf}(x) = 4$. [4]

**9** **(a)** A geometric progression has first term 3 and common ratio 1.25.

Find the sum of twelve terms of the progression, starting with the twentieth term.
Give your answer to the nearest integer. [4]

**(b)** An arithmetic progression has first term 5 and common difference 3.
The sum of the first $5n$ terms is 23 times the sum of the first $n$ terms.

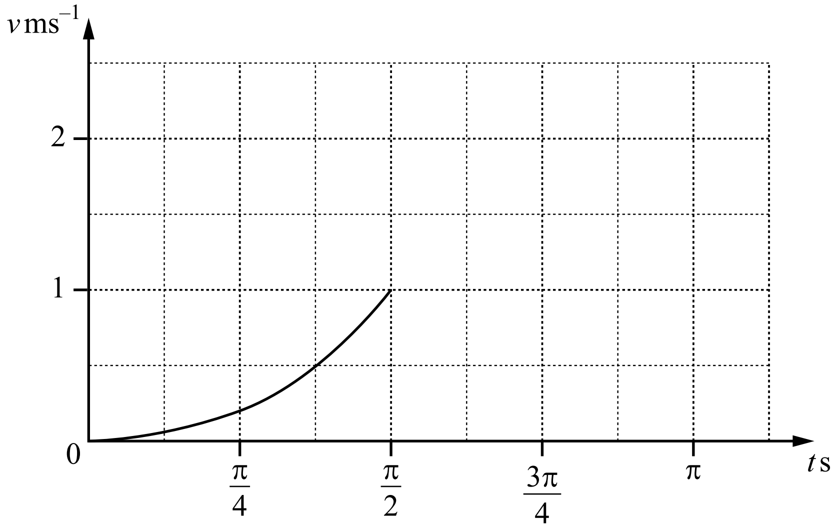
Find the value of the positive integer $n$. [4]

**10** **(a)** A particle $P$ travels in a straight line so that $t$ seconds after leaving a fixed point $O$ its velocity, $v\,\text{ms}^{-1}$, is given by

$$v = \sec^2\left(\frac{t}{2}\right) - 1 \quad \text{for } 0 \leqslant t \leqslant \frac{\pi}{2},$$

$$v = \frac{2}{\pi}(\pi - t) \qquad \text{for } t > \frac{\pi}{2}.$$

**(i)** Complete the velocity–time graph for the first $\pi$ seconds of the motion of particle $P$. [1]




**(ii)** Find the distance, in metres, travelled by $P$ in the first $\pi$ seconds of its motion.
You must show all your working. [5]

**(b)** A particle $Q$ travels in a straight line from a fixed point $O$.

At time $t$ seconds, its displacement from $O$, $s$ metres, is given by $s = \dfrac{4 - e^{2t} - 3e^{-2t}}{2}$ .

**(i)** Find the value of $t$ when $Q$ is at instantaneous rest.
Give your answer correct to 4 significant figures. [4]

**(ii)** Find the distance travelled by $Q$ in the first 0.5 seconds. [3]

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