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Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5616316166

ADDITIONAL MATHEMATICS **4037/23**

Paper 2 **October/November 2025**

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 π, 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.

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

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

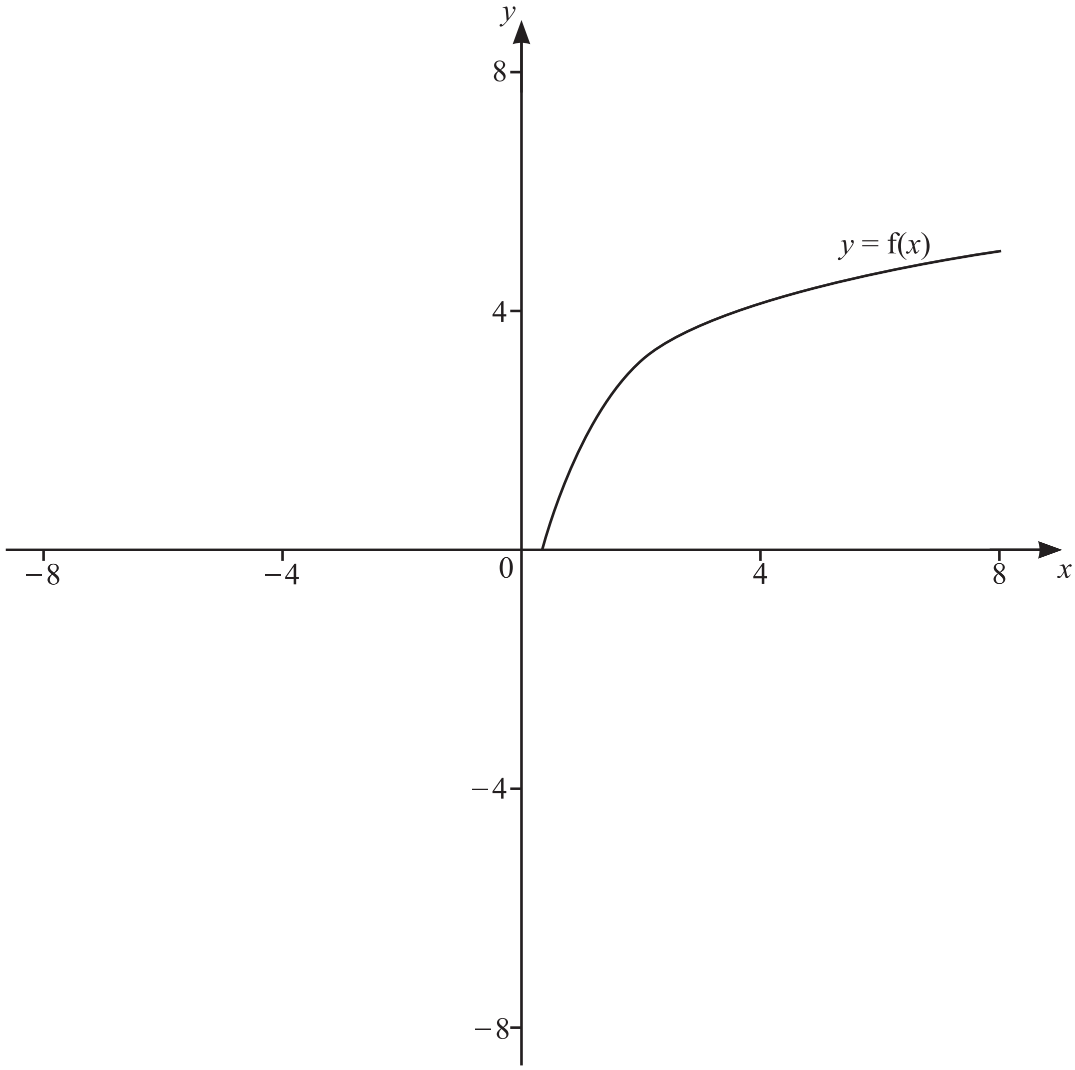
$a^2=b^2+c^2-2bc\cos A$

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

1 It is given that $p(x) = ax^3 - 7x^2 - bx + 9$, where a and b are constants.
$x - 3$ is a factor of $p(x)$.
When $p(x)$ is divided by $x + 2$ the remainder is -35.

Find the values of a and b. [5]

2 (a) (i)



The diagram shows the graph of $y = \mathrm{f}(x)$.

On the same diagram sketch the graph of $y = \mathrm{f}^{-1}(x)$. [1]

(ii) Describe the relationship between the graph of $\mathrm{f}(x)$ and the graph of $\mathrm{f}^{-1}(x)$. [1]

(b) A function g is defined by $g(x) = e^{\sqrt{x-2}}$ for $x \geqslant 2$.

(i) Find an expression for $g^{-1}(x)$. [3]

(ii) Write down the range of g^{-1}. [1]

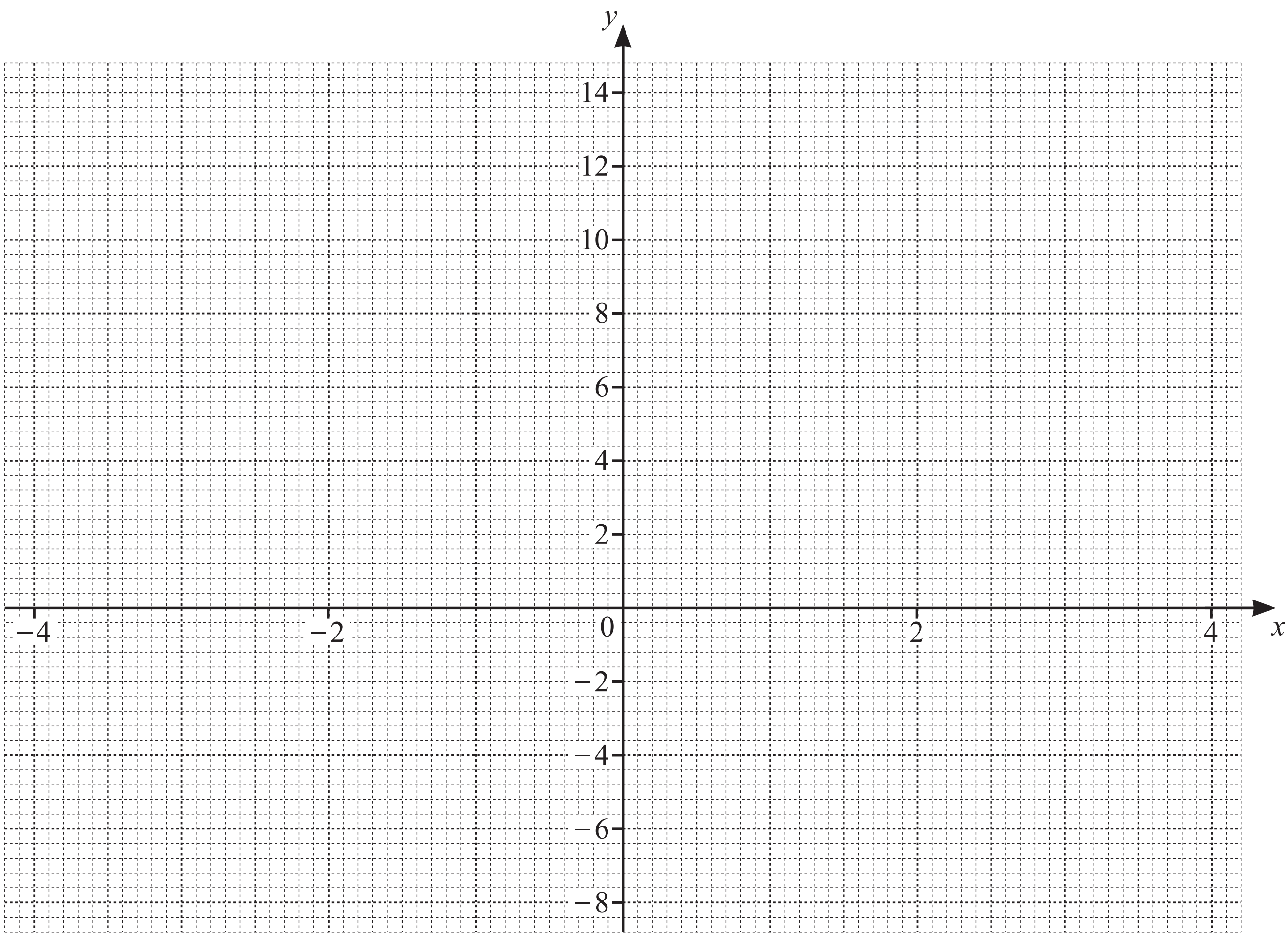
(iii) A function h is defined by $h(x) = \frac{1}{x^2} + 2$ for $x > 0$.

Find an expression for $gh(x)$ in its simplest form. [2]

3 **(a)** **(i)** Write $x^2 - x - 6$ in the form $(x+a)^2 + b$ where a and b are constants. [2]

(ii) Hence write down the coordinates of the stationary point on the curve $y = x^2 - x - 6$. [2]

(b) On the axes, draw the graph of $y = |x^2 - x - 6|$ for $-4 \leqslant x \leqslant 4$. [3]



(c) Use your graph to solve the inequality $|x^2 - x - 6| < 4$. [2]

4 **(a)** Integrate the following with respect to x.

(i) e^{5x-2} [2]

(ii) $\dfrac{1}{4-3x}$ where $x < \dfrac{4}{3}$ [2]

(b) Show that $\displaystyle\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \sec^2\left(\frac{1}{2}x\right)dx = 2\left(1-\frac{\sqrt{3}}{3}\right)$. [3]

5 Six different digits are chosen from the nine digits 1, 2, 3, 4, 5, 6, 7, 8, 9.
These digits are used to form a 6-digit number.
Find how many 6-digit numbers can be formed in the following cases.

(a) There are no restrictions. [1]

(b) The number is greater than 700 000. [2]

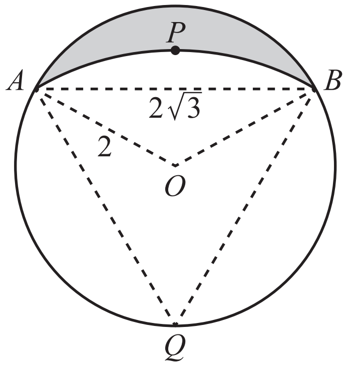
(c) The number is greater than 750 000. [3]

6 The line $y = 3x + 4$ meets the curve $y = 2x^2 + 8x + 1$ at two points A and B.

Find the equation of the perpendicular bisector of AB, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [9]

7 Solve the equation $\sec^2 3x + \tan 3x - 3 = 0$ for $0° \leqslant x \leqslant 120°$. [6]

8 In this question the units are metres.



The diagram shows a circle, centre O and radius 2.
The chord AB has length $2\sqrt{3}$.
The point Q lies on the circle such that $AQ = BQ$.
The arc APB is part of a circle, centre Q.

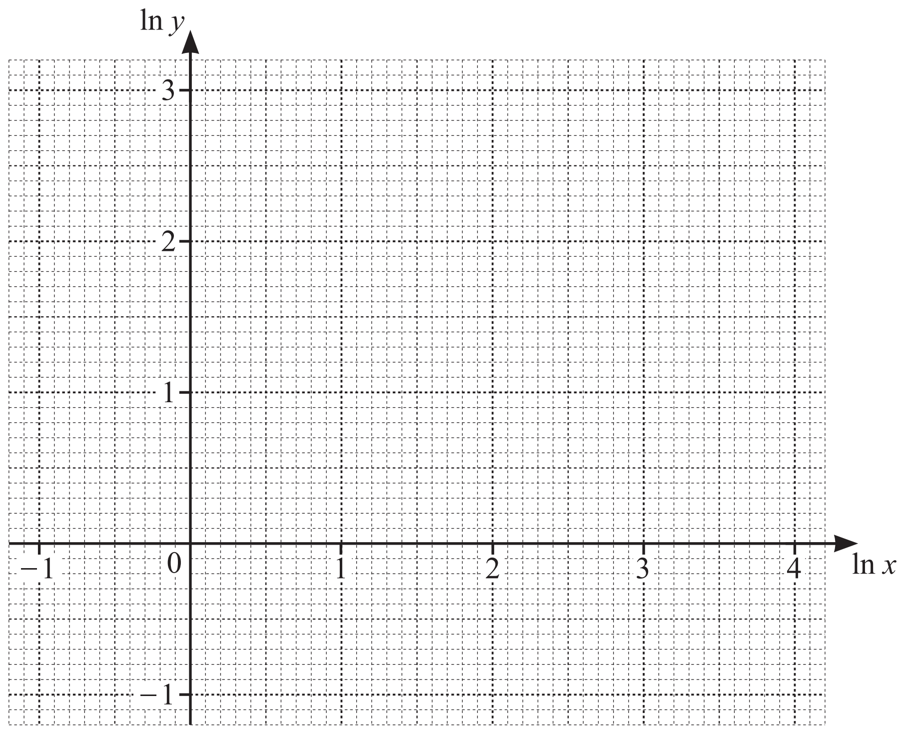
(a) Find the exact value of angle AQB in radians. [2]

(b) Hence find the area of the shaded region. Give your answer in terms of π. [6]

9 Two variables, x and y, are related by an equation of the form $y = Ax^b$, where A and b are constants. The following pairs of values of x and y are given.

x	0.61	4.48	12.18	33.1
y	1.65	4.47	7.39	12.17

(a) On the axes below, use these values to draw the straight-line graph of $\ln y$ against $\ln x$. [2]



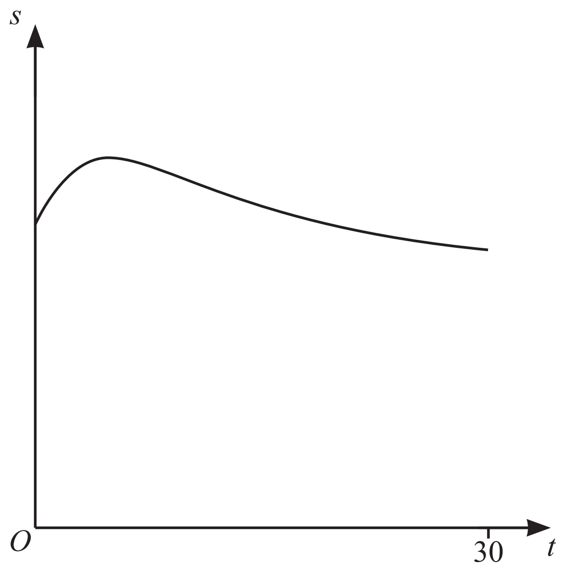
(b) Use your graph to find the values of A and b. [4]

10 In this question the units are metres and seconds.

A particle moves along a straight line through a point A.

Its displacement, s, from A at time t is given by $s = \dfrac{10t + 100}{\sqrt{2t^2 + 100}}$.

The diagram shows the displacement–time graph for the first 30 seconds of the motion.



(a) Find the value of t when s is a maximum. [6]

(b) The particle passes through its starting point again at time $t = T$.

(i) Find the total distance travelled by the particle during the first T seconds of its motion. [2]

(ii) Use algebra to find T. [3]

Question 11 is printed on the next page.

11 A circle has equation $x^2 + y^2 - 25 = 0$.
A second circle has the same radius as the first circle, and the coordinates of its centre are both positive.
The two circles intersect at the points A and B.
The line AB has length 6 and is parallel to the line $y = -x$.

Find the equation of the second circle in the form $x^2 + y^2 + ax + by + c = 0$, where a, b and c are constants. [5]