Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 Non-calculator **May/June 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.
- 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.

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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

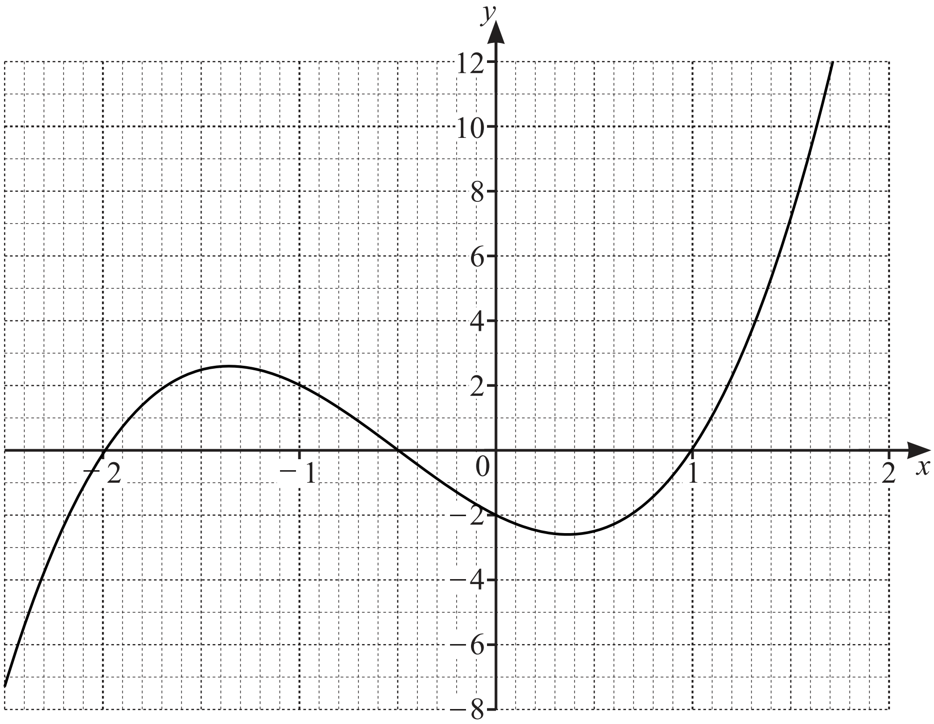
$$\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$$

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

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

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

1 (a)



The diagram shows the graph of $y = (2x + a)(x + b)(x + c)$ where a, b and c are integers.

Find values for a, b and c. [2]

(b) Use the graph to find the values of x for which $y \geqslant 2$. [3]

2 Find the values of k for which the equation $x^2 + 4kx + k + 3 = 0$ has two equal roots. [4]

3 The polynomial p is such that $p(x) = x^3 + Ax + 30$, where A is a constant.
When $p(x)$ is divided by $x + 2$ the remainder is 84.

Write $p(x)$ as a product of linear factors. [5]

4 Solve the equation $\dfrac{2}{\log_x 10} - \lg(x+4) = \lg 2$ for $x > 0$. [5]

5 **Solutions by accurate drawing will not be accepted.**

A circle, C, has equation $(x-5)^2+(y-12)^2=100$.

(a) Find the equation of the tangent to C at the point (11, 4).
Give your answer in the form $ax+by=c$, where a, b and c are integers. [4]

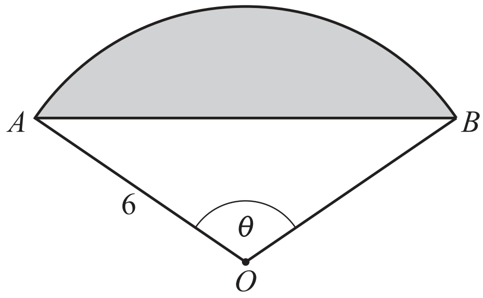
(b) Show that C and the circle with equation $x^2+y^2=4$ do not intersect. [2]

6 Find the x-coordinates of the points of intersection of the following curves.

$$y = 4\ln x \quad \text{and} \quad y = 5 - \frac{3}{\ln\left(x^2\right)}$$

Give your answers in exact form. [5]

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



The diagram shows a sector of a circle with centre O and radius 6.

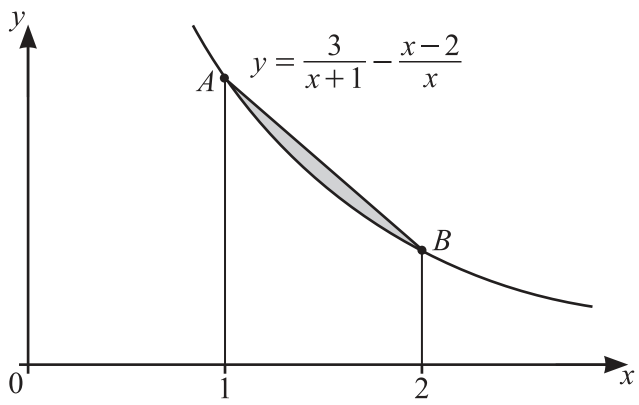
(a) It is given that the area of triangle AOB is $9\,\text{cm}^2$.

Find the value of $\sin\theta$. [2]

(b) It is also given that the exact area of the shaded segment is $(15\pi - 9)\,\text{cm}^2$.

Find the exact length of the arc AB. [4]

8



The diagram shows part of the curve $y = \frac{3}{x+1} - \frac{x-2}{x}$.

The points A and B lie on the curve such that the x-coordinate of A is 1 and the x-coordinate of B is 2.

(a) Find the y-coordinates of A and B. [1]

(b) Show that the area of the shaded region enclosed by the line AB and the curve is $\frac{a}{4} - \ln\frac{b}{2}$, where a and b are integers to be found. [7]

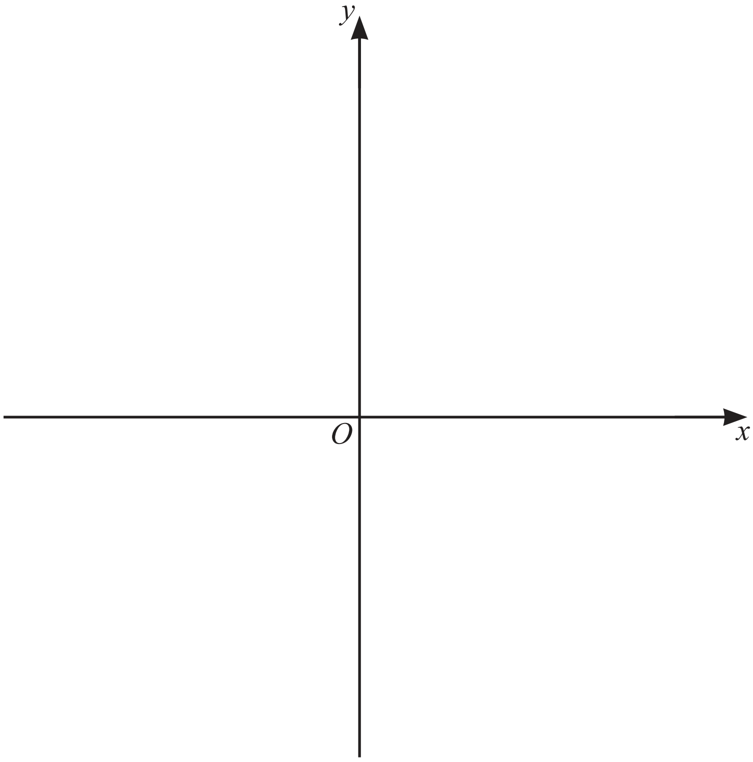
9 The function f is defined by $f(x) = -2x^2 + 9x - 10$ for $0 \leqslant x \leqslant 3$.

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

(ii) Hence determine whether or not f^{-1} exists. [2]

(b) The function g is defined by $g(x) = 3\ln(5 - 2x)$ for $0 \leqslant x < 2.5$.

(i) On the axes, sketch the graph of $y = g(x)$.
State the exact values of the intercepts with the coordinate axes and the equation of any asymptote. [3]



(ii) Find an expression for $g^{-1}(x)$. [2]

(iii) Find the domain and range of g^{-1}.
Give each of your answers in exact form. [2]

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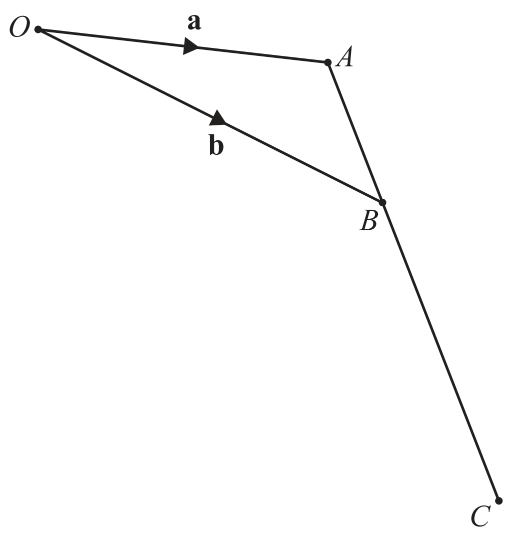


The diagram shows four points, O, A, B and C.

A, B and C lie in a straight line and are such that $\dfrac{AB}{AC} = \dfrac{1}{3}$.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

(a) Find $\overrightarrow{OC}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.
Simplify your answer. [3]

(b) The line OA is extended to the point D such that $OA : AD = 2 : 7$.
Point E lies on CD such that $\overrightarrow{OE} = \lambda\mathbf{b}$.

Find the value of λ. [5]

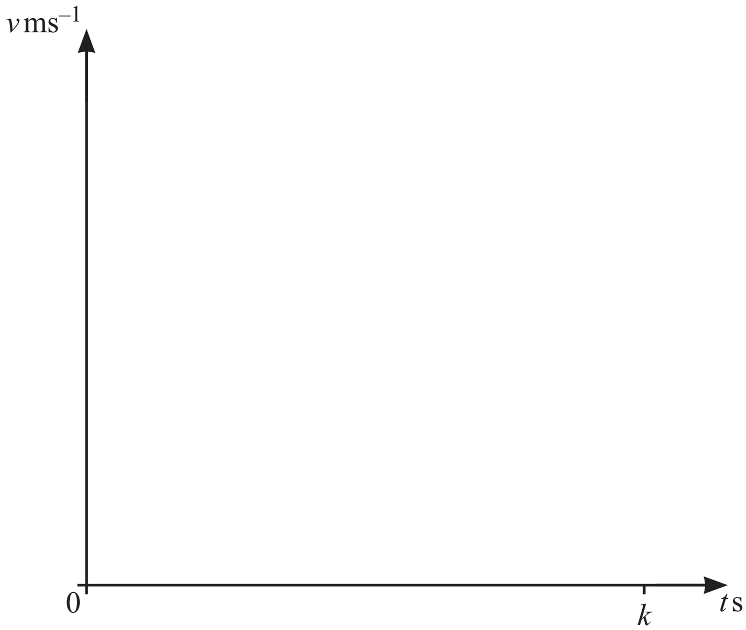
11 A particle P moves in a straight line and passes through a fixed point O.
At time t seconds, its displacement from O, s metres, is given by

$$s = t + 6t^2 - t^3 \qquad \text{for } 0 \leqslant t \leqslant 3$$

$$s = 12t - \frac{1}{3}t^2 - 3 \qquad \text{for } 3 \leqslant t \leqslant k \qquad \text{where } k \text{ is a constant.}$$

It is given that, for $3 \leqslant t \leqslant k$, the velocity of P is positive and its acceleration is negative.

(a) The maximum velocity of P occurs when $t = 2$.
On the axes below, sketch a velocity–time graph for the first k seconds of the motion of P. [4]



(b) The total distance travelled by P for $0 \leqslant t \leqslant k$ is 57 metres.

Given that when $t = 3$ the distance and displacement of P from O are equal, find the value of k. [6]

Question 12 is printed on the next page.

12 The normal to the curve $y = \frac{4}{x^2} + ax + 7$ at the point where $x = 2$ has equation $x + 4y = b$.

Find the values of a and b. [6]