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Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5133670553

ADDITIONAL MATHEMATICS **0606/21**

Paper 2 **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.
- 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.

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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

$$\sin^2A+\cos^2A=1$$
$$\sec^2A=1+\tan^2A$$
$$\operatorname{cosec}^2A=1+\cot^2A$$

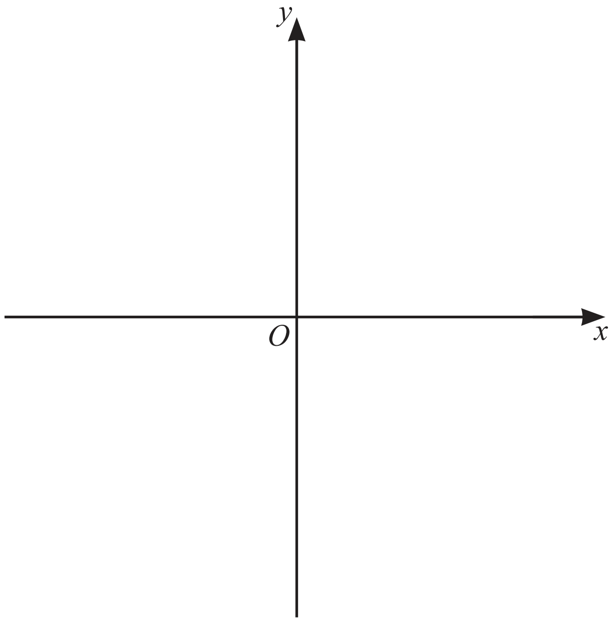
Formulas for ΔABC

$$\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$$
$$a^2=b^2+c^2-2bc\cos A$$
$$\Delta=\frac{1}{2}ab\sin C$$

1 A curve has equation $y = x^2 + 2x - 3$.

(a) Use the method of completing the square to find the coordinates of the stationary point on the curve. [3]

(b) On the axes, sketch the curve, stating the intercepts with the coordinate axes. [2]



2 In this question, k is a constant.
It is given that $2x^2 + (3k-2)x + k = 0$ has roots that are real and distinct.

Find the set of possible values of k. [5]

3 A sports club has the following members.

5 runners, 4 swimmers, 3 gymnasts

(a) These members stand in a straight line.

Find the number of ways that this can be done when all the runners stand together, all the swimmers stand together and all the gymnasts stand together. [2]

(b) Four of these members are selected for an event.

Find the number of ways that this can be done when at least one runner, at least one swimmer and at least one gymnast must be selected. [3]

4 The coordinates of points A, B, C and D are as follows.

$$A(-4,3) \quad B(6,-9) \quad C(15,10) \quad D(14,-1)$$

The line L has equation $y = 11x - 75$.
The perpendicular bisector of the line AB meets L at the point E.

Find the area of triangle CDE. [7]

5 Given that $y = x^2 \tan\frac{x}{2}$, use calculus to find the approximate change in y as x increases from $\frac{\pi}{3}$ to $\frac{\pi}{3} + h$, where h is small. [4]

6 **(a)** Using an appropriate quadratic factorisation, find the first three terms in the binomial expansion of $(9x^2+12x+4)^5$, in ascending powers of x.
You must simplify your coefficients. [4]

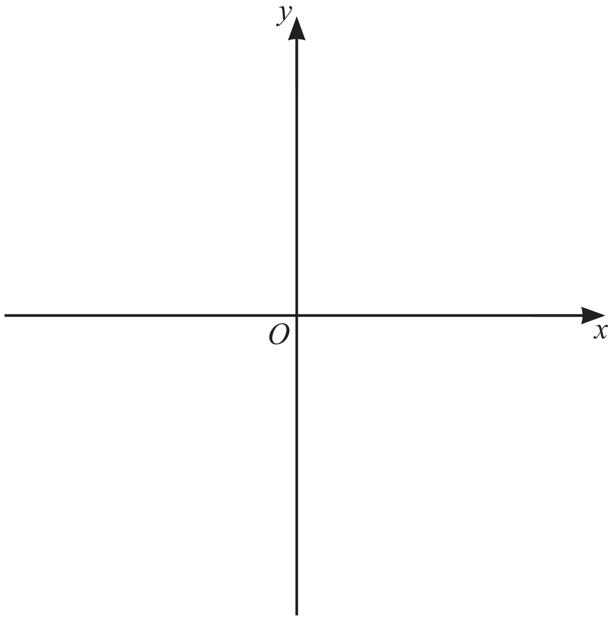
(b) Find the term independent of x in the expansion of $\left(\frac{6}{x^2}+\frac{x^4}{2}\right)^{12}$. [2]

7 **(a)** The function f is defined by $\mathrm{f}(x) = 2\mathrm{e}^{-x} + 3$ for $x \in \mathbb{R}$.

On the axes, sketch the graph of $y = \mathrm{f}(x)$ and hence, on the same axes, sketch the graph of $y = \mathrm{f}^{-1}(x)$.

Show clearly

- the positions of any points where your graphs meet the coordinate axes
- the positions of any asymptotes. [4]



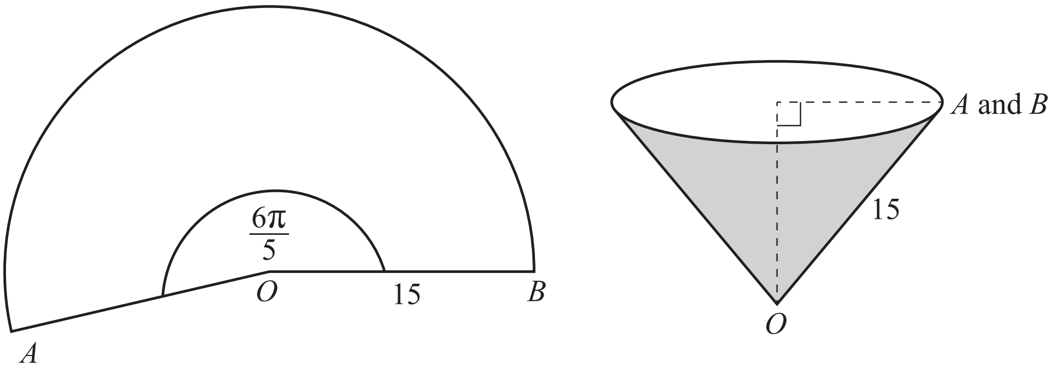
(b) The function g is defined by $g(x) = 2 - \dfrac{3}{e^x + 2}$ for $x \geqslant 0$.

Given that g^{-1} exists, find an expression for $g^{-1}(x)$ and state its domain. [4]

8 (a) Solve the equation $(2-3\cot x)\cos x = 0$ for $0 < x \leqslant \frac{\pi}{2}$. [3]

(b) Solve the equation $2\operatorname{cosec}(2\theta+1)-12\sin(2\theta+1)=5$, where θ is in radians and $-1 \leqslant \theta \leqslant 2$. [6]

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



The diagram shows a sector AOB of a circle, centre O, radius 15.
Angle $AOB = \frac{6\pi}{5}$.
The sector is made into a cone with points A and B touching, as shown.

(a) Find the curved surface area of the cone. [2]

The top of the cone is a horizontal circle.

(b) Find the circumference of the circular top. [2]

(c) Hence find the radius of the circular top and the perpendicular height of the cone. [2]

(d) Water is poured into the cone.
When the depth of the water in the cone is h, the radius of the circular top of the water is r.

(i) Find an expression for r in terms of h. [1]

(ii) The water is poured into the cone at a constant rate of $27\,\text{cm}^3$ per second.

Find the rate at which the depth of the water is rising when the depth of the water is 4. [5]

10 A particle P moves in a straight line.
t seconds after passing a fixed point, O, the acceleration of P, $a\,\text{ms}^{-2}$, is given by

$$a = t^2 - 2 \qquad \text{for } 0 \leqslant t \leqslant 4$$
$$a = 19 - 5e^{8-2t} \qquad \text{for } 4 \leqslant t \leqslant 10.$$

When $t = 3$, the velocity of P is $-\frac{1}{3}\,\text{ms}^{-1}$ and its displacement from O is $-\frac{1}{4}\,\text{m}$.

(a) **(i)** Find the velocity of P when $t = 4$. [3]

(ii) Find the displacement of P from O when $t = 4$. [3]

(b) Find the displacement of P from O when $t = 10$. [5]

Question 11 is printed on the next page.

11 A geometric progression has first term a and common ratio r, where $r > 0$.
The sum of the 2nd and 3rd terms of the progression is 168.
The sum of the 4th and 5th terms of the progression is 94.5.

(a) Find the 6th term of the progression. [7]

(b) Find the sum to infinity of the progression. [1]