Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0123456789

ADDITIONAL MATHEMATICS **4037/02**

Paper 2 **For examination from 2025**

SPECIMEN PAPER **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. 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 ΔABC

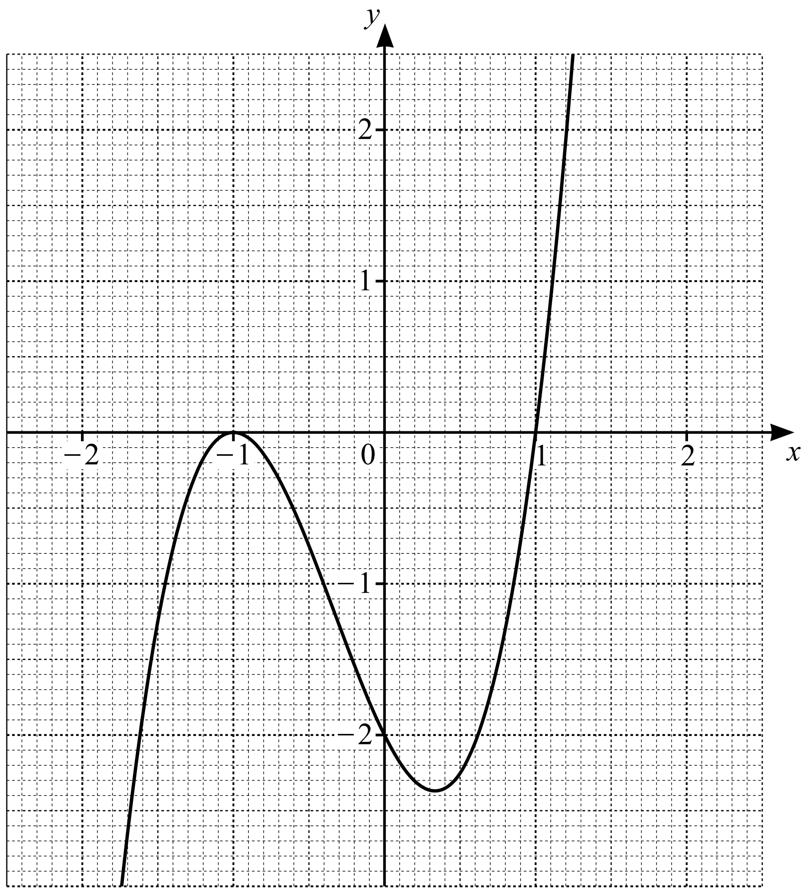
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

1 **(a)** Solve the equation $5|5x-7|-1=14$. [3]

(b)



The diagram shows the graph of $y=\mathrm{f}(x)$, where $\mathrm{f}(x)=2(x+1)^2(x-1)$.

Use the graph to solve the inequality $\mathrm{f}(x)\leqslant -1$. [3]

2 For variables x and y, plotting $\ln y$ against $\ln x$ gives a straight-line graph passing through the points (6, 5) and (8, 9).

Show that $y = e^p x^q$ where p and q are integers to be found. [4]

3 Find the values of the constant k for which the equation $(2k - 1)x^2 + 6x + k + 1 = 0$ has real roots. [5]

4 A photographer takes 12 different photographs. There are 3 photographs of sunsets, 4 of oceans and 5 of mountains.

(a) The photographs are arranged in a line on a wall.

(i) Find the number of possible arrangements if the first photograph is of a sunset and the last photograph is of an ocean. [2]

(ii) Find the number of possible arrangements if all the photographs of mountains are next to each other. [2]

(b) Three of the photographs are selected for a competition.

(i) Find the number of different possible selections if no photograph of a sunset is chosen. [2]

(ii) Find the number of different possible selections if one photograph of each type (sunset, ocean, mountain) is chosen. [2]

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

6 A curve has equation $y = \ln(5 - 3x)$ where $x < \frac{5}{3}$. The normal to the curve at the point where $x = -5$, cuts the x-axis, at the point P.

Find the equation of the normal and the x-coordinate of P. [7]

7 **Solutions to this question by accurate drawing will not be accepted.**

A circle has equation $x^2 + y^2 - 16x - 10y + 73 = 0$.

(a) **(i)** Find the coordinates of the centre of the circle and the length of the radius. [3]

(ii) Hence show that the point (10, 6.5) lies inside the circle. [2]

(b) A different circle has equation $(x - 10)^2 + (y - 6.5)^2 = 2.25$.

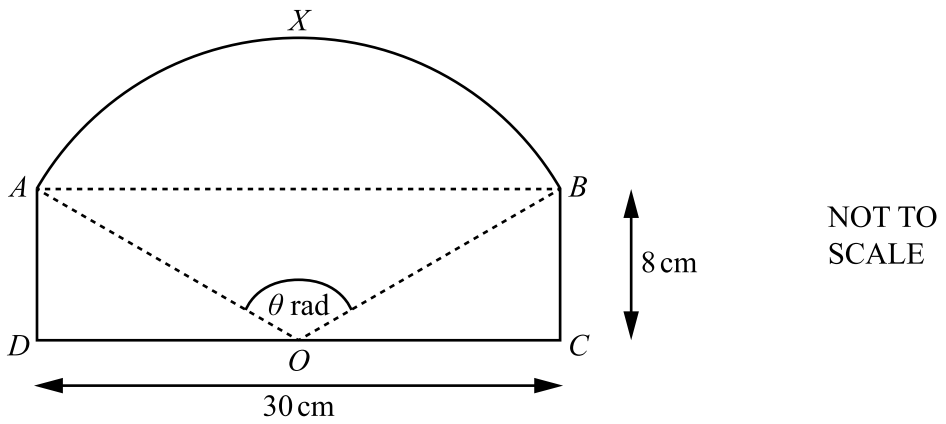
Show that the two circles touch. You are not required to find the coordinates of the common point. [1]

8 **(a)** **(i)** Show that $\dfrac{\cos^2 2x}{1 + \sin 2x} = 1 - \sin 2x$. [2]

(ii) Hence solve the equation for $\dfrac{3\cos^2 2x}{1 + \sin 2x} = 1$ for $0° \leqslant x \leqslant 90°$. [4]

(b) Solve the equation $\cot\left(y - \dfrac{\pi}{2}\right) = \sqrt{3}$, where y is in radians and $0 \leqslant y \leqslant \pi$. [3]

9



The diagram shows a rectangle $ABCD$ and an arc AXB of a circle with centre at O, the midpoint of DC. The length of BC is 8 cm and the length of DC is 30 cm. Angle AOB is θ radians.

(a) Find the perimeter of the shape $ADOCBX$. [5]

(b) Find the area of the shape $ADOCBX$. [2]

10 (a) In the expansion of $\left(2k - \frac{x}{k}\right)^5$, where k is a constant, the coefficient of x^2 is 160.

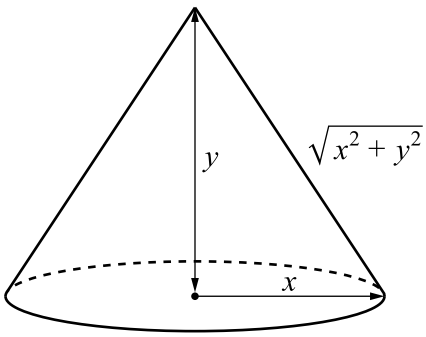
Find the value of k. [3]

(b) (i) Find the first 3 terms in the expansion of $(1 + 3x)^6$, in ascending powers of x.
Simplify the coefficient of each term. [2]

(ii) When the expansion of $(1 + 3x)^6(a + x)^2$ is written in ascending powers of x, the first three terms are $4 + 68x + bx^2$, where a and b are constants.

Find the value of a and the value of b. [3]

11 In this question, all lengths are in centimetres.



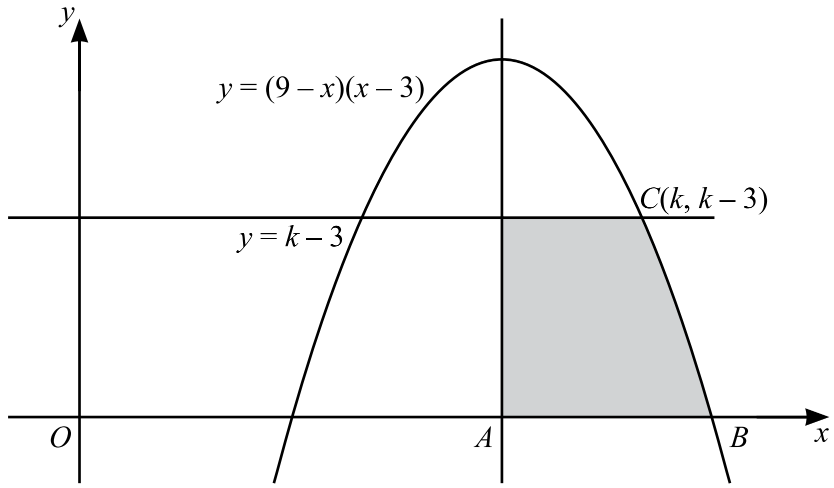
NOT TO SCALE

The diagram shows a cone of base radius x, height y and sloping edge $\sqrt{x^2 + y^2}$. The volume of the cone is $10\pi\,\text{cm}^3$.

(a) Show that the curved surface area, S, of the cone is given by $S = \dfrac{\pi\sqrt{x^6 + 900}}{x}$. [3]

(b) Given that x can vary and that S has a minimum value, find the value of x for which S is a minimum. [5]

12



The diagram shows part of the curve $y = (9 - x)(x - 3)$ and the line $y = k - 3$, where $k > 3$.
The line through the maximum point of the curve, parallel to the y-axis, meets the x-axis at A.
The curve meets the x-axis at B, and the line $y = k - 3$ meets the curve at the point $C(k, k - 3)$.

Find the area of the shaded region. [9]

Continuation of working space for Question 12.

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