



Cambridge O Level

CANDIDATE
NAME
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ADDITIONAL MATHEMATICS

4037/22

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.



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 .

$$A = \pi r l$$

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

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \dots + \binom{n}{r} a^{n-r} b^r + \dots + b^n,$$

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 $\triangle ABC$

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

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

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





1 Solve the inequality $|5x + 2| \geq 3$.

[4]



- 2 In this question, all lengths are in metres and time is in seconds.

A particle P moves in a straight line such that its displacement s from a fixed point O at time t is given by $s = (t-4)^2(t-1)$ for $t \geq 0$.

- (a) On the axes, sketch the displacement–time graph of P , stating the intercepts with the axes. [2]



- (b) Find an expression for the velocity, v , of P .
Give your answer in a factorised form. [2]





(c) On the axes, sketch the velocity–time graph of P , stating the intercepts with the axes.

[2]



(d) Find an expression for the acceleration, a , of P .

[1]

(e) On the axes, sketch the acceleration–time graph of P , stating the intercepts with the axes.

[3]





3 Functions f and g are such that

$$f(x) = \frac{3x}{x+4} \quad \text{for } x > 0$$

$$g(x) = \sqrt{x+2} \quad \text{for } x > -2.$$

Solve the equation $fg(x) = 1$.

[4]





- 4 (a) Given that $y = 4 \sin 2x \cos 2x$, find the value of $\frac{dy}{dx}$ when $x = \frac{\pi}{6}$.

[4]

- (b) A curve has equation $y = 4 \sin 2x \cos 2x$.

The normal to the curve at the point where $x = \frac{\pi}{6}$ meets the x -axis at the point P .

Find the exact coordinates of P .

[5]





- 5 (a) A 4-digit number is to be formed using the digits 0, 2, 4, 5, 6 and 8. The 4-digit number must **not** start with 0. Any digit may be used at most once in the 4-digit number.

(i) Find how many 4-digit numbers can be formed.

[1]

(ii) Find how many even 4-digit numbers can be formed.

[2]

(iii) Find how many 4-digit numbers that are divisible by 5 can be formed.

[2]

(b) Solve the equation $(n+1) \times {}^{n+1}C_{12} = 33(n-10) \times {}^nC_{10}$.

[3]





- 6 The volume, V , of a sphere is increasing at the constant rate of $2\pi \text{ cm}^3 \text{ s}^{-1}$.
Find the rate of change of the surface area, S , of this sphere when the volume of the sphere is $36\pi \text{ cm}^3$.
[6]





- 7 The first three terms of an arithmetic progression can be written as

$$2 \ln(x^3), \quad 5 \ln(x^2), \quad 2 \ln(x^7).$$

- (a) Given that $x > 1$, find the least number of terms for the sum of this progression to be greater than $43 \ln(x^{24})$. [6]



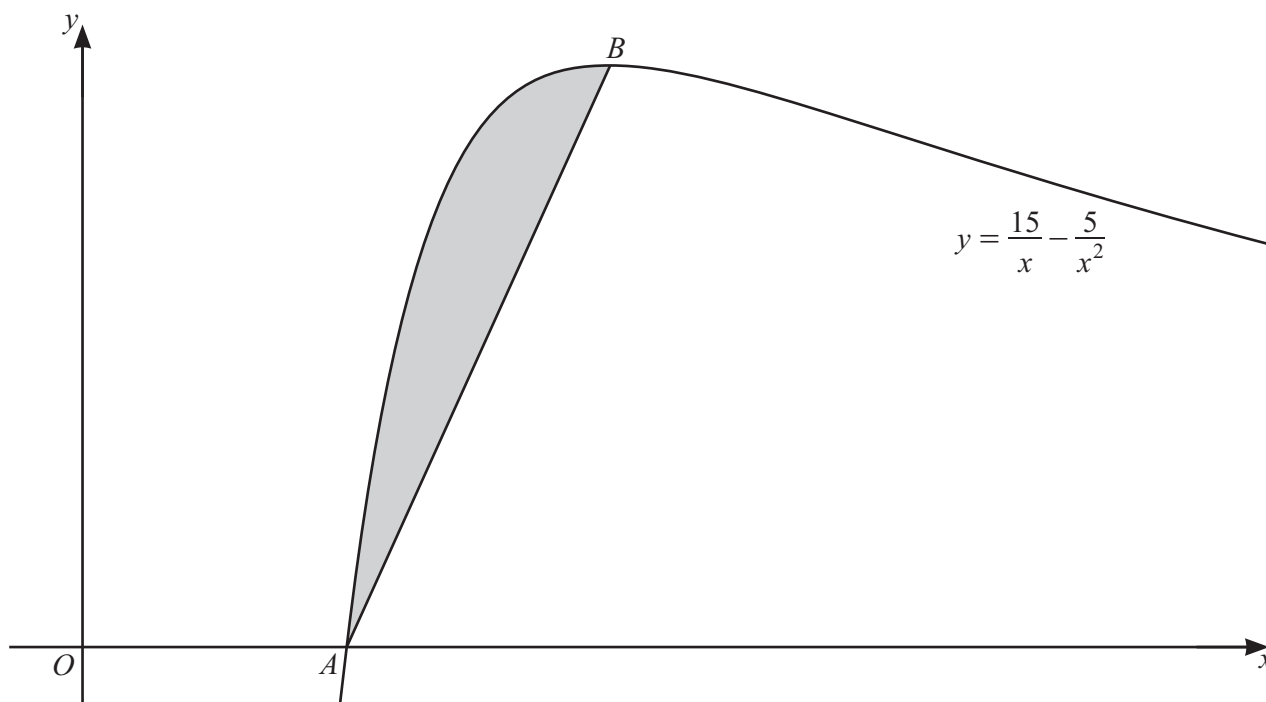


(b) Given that the 25th term of this progression is equal to 408, find the exact value of x .

[3]



8



The diagram shows part of the curve $y = \frac{15}{x} - \frac{5}{x^2}$.

The curve meets the x -axis at the point A .

The curve has a maximum at the point B .

Find the area of the shaded region enclosed by the line AB and the curve.

Give your answer in exact form.

[11]



Continuation of working space for Question 8.





- 9 (a) Solve the equation $3 \sec 3x = \sqrt{3} \operatorname{cosec} 3x$ for $-120^\circ \leq x \leq 120^\circ$.

[5]





(b) Solve the equation $2 \cos\left(y + \frac{\pi}{3}\right) \sin\left(y + \frac{\pi}{3}\right) = \sin\left(y + \frac{\pi}{3}\right)$ for $0 \leq y < 2\pi$.

[5]

Question 10 is printed on the next page.





- 10 The first three terms, in descending powers of x , in the expansion of $(3x^2 - a)^n \left(1 + \frac{1}{x^2}\right)^2$ can be written as $729x^{12} + 972x^{10} + bx^8$, where a , b and n are constants.

Find the values of a , b and n .

[9]

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