



Cambridge International AS & A Level

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MATHEMATICS

9709/12

Paper 1 Pure Mathematics 1

October/November 2025

1 hour 50 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

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.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- 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.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.



- 1 (a) Express $9x^2 - 36x + 8$ in the form $p(x+q)^2 + r$, where p , q and r are constants. [2]

[illegible]

- (b)** Hence find the set of values of the constant k for which the equation $9x^2 - 36x + 8 = k$ has no real roots. [1]

[illegible]

- (c) Find the exact roots of the equation $9x^2 - 36x + 8 = -15$. [2]

[illegible]



2 Find the term independent of x in the expansion of $\left(2x^2 - \frac{3}{x}\right)^6$. [3]

[illegible]

- 3 (a) The graph of $y = f(x)$ is transformed to the graph of $y = f(3x) + 2$.

Describe fully the two transformations which have been combined to give the resulting graph. [3]

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- (b) A different graph has equation $y = g(x)$. This graph is stretched by scale factor 3 in the y -direction and then reflected in the y -axis.

Write down the equation of the transformed graph in terms of the function g . [2]

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- 4 The equation of a curve is such that $\frac{dy}{dx} = kx^3 + \frac{2}{x^2}$, where k is a constant. The curve passes through the point $S(2, 20)$ and the gradient of the curve at S is $\frac{65}{2}$.

(a) Find the value of k .

[1]

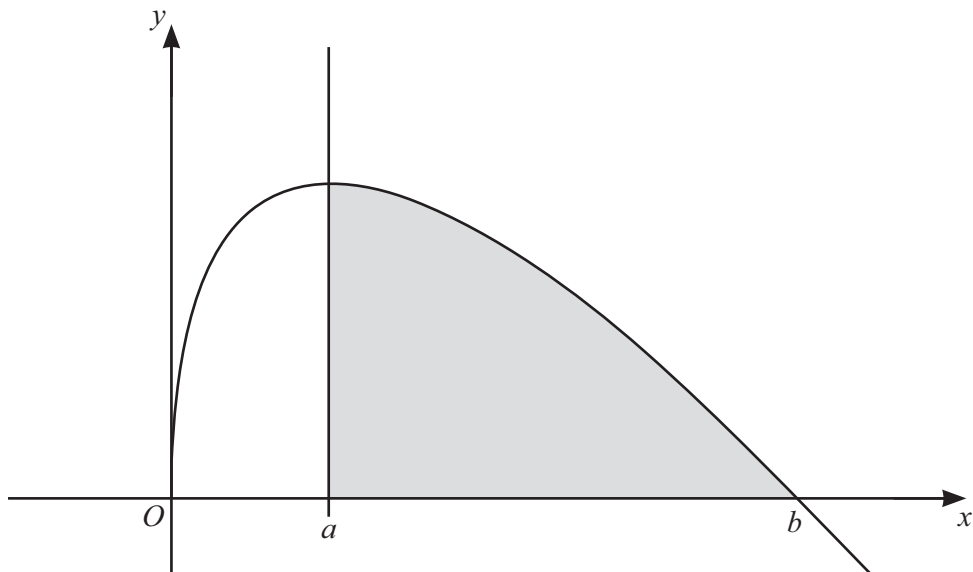
[illegible]

- (b)** The coordinates of a point T on the curve are $(1, t)$.

Find the value of t .

[5]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



The equation of a curve is $y = 4x^{\frac{1}{2}} - x$. The curve has a maximum point when $x = a$ and crosses the x -axis at the point with coordinates $(b, 0)$, where $b > 0$. The shaded region is bounded by the curve, the line $x = a$ and the x -axis (see diagram).

- (a)** Find the value of a .

[3]

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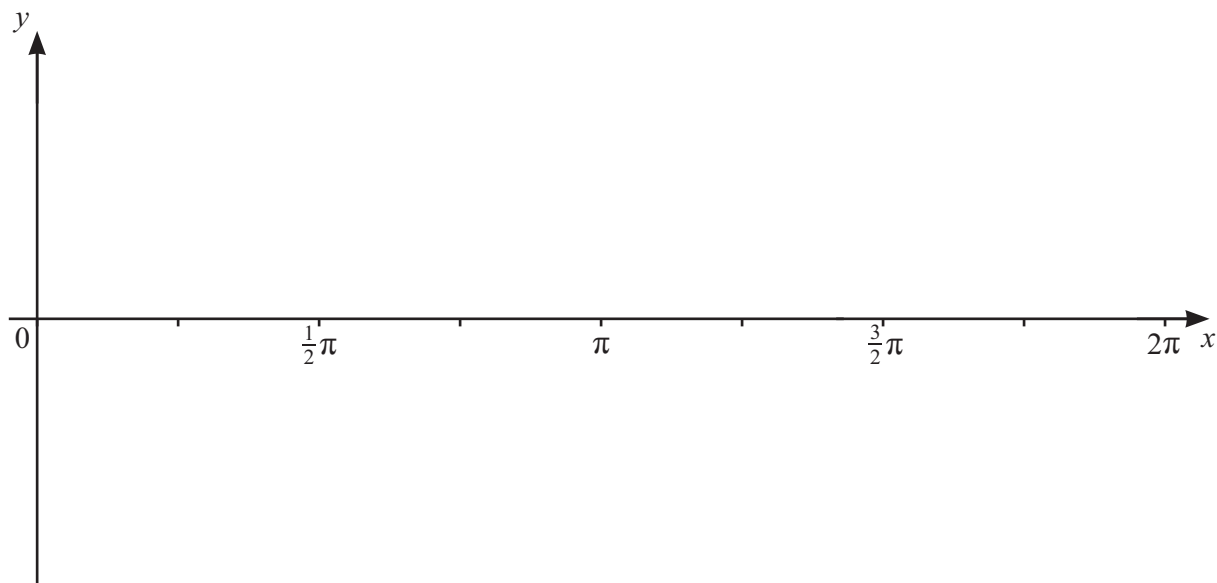
(b) Find the exact area of the shaded region.

[5]

[illegible]

6 (a) Sketch the graph of $y = 3 \sin x + 2$ for $0 \leq x \leq 2\pi$.

[2]



(b) Determine the number of solutions in the interval $0 \leq x \leq 2\pi$ of each of the following equations.

(i) $3 \sin x + 2 = x$

[1]

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(ii) $3 \sin x + 2 = 5 - x$

[1]

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(c) Solve the equation $3 \sin x + 2 = 5 \cos^2 x - 1$ for $0 \leq x \leq 2\pi$.

[5]

This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for writing. The lines are evenly spaced across the entire page, providing a guide for letter height and placement. There is no text or other markings on the page.



- 7 The coordinates of the points P and Q are $(1, 1)$ and $(7, 11)$ respectively. The line segment PQ forms a diameter of a circle.

(a) Find the equation of the circle.

[4]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(b) Find the equation of the tangent to the circle at the point Q .

[3]

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings present.



(c) The other point on the circle with x -coordinate 7 is R .

Find the coordinates of the point of intersection of the tangent at Q with the tangent at R . [4]

[illegible]

- 8 The first three terms of a geometric progression are a , b and c respectively, where a , b and c are positive constants. The first three terms of an arithmetic progression are a , b and $-3c$ respectively.

(a) Show that $a^2 - 10ac + 9c^2 = 0$. [3]

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It is now given that $a = 9$ and c takes the smaller of its two possible values.

(b) (i) Find the sum to infinity of the geometric progression. [5]

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(ii) Find the sum of the first 20 terms of the arithmetic progression. [3]

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9 The function f is defined by $f(x) = \frac{4}{(3x-6)^2} + \frac{1}{(3x-6)^3}$ for $x > 2$.

- (a) Find an expression for $f'(x)$ and hence determine whether f is an increasing function, a decreasing function or neither. [4]

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- (b) State whether f^{-1} exists. Give a reason for your answer. [1]

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The function g is defined by $g(x) = 4x - 3$ for $x > a$.

- (c) Find the range of g in terms of the constant a . [1]

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- (d) Find the set of values of a for which the composite function fg exists. [2]

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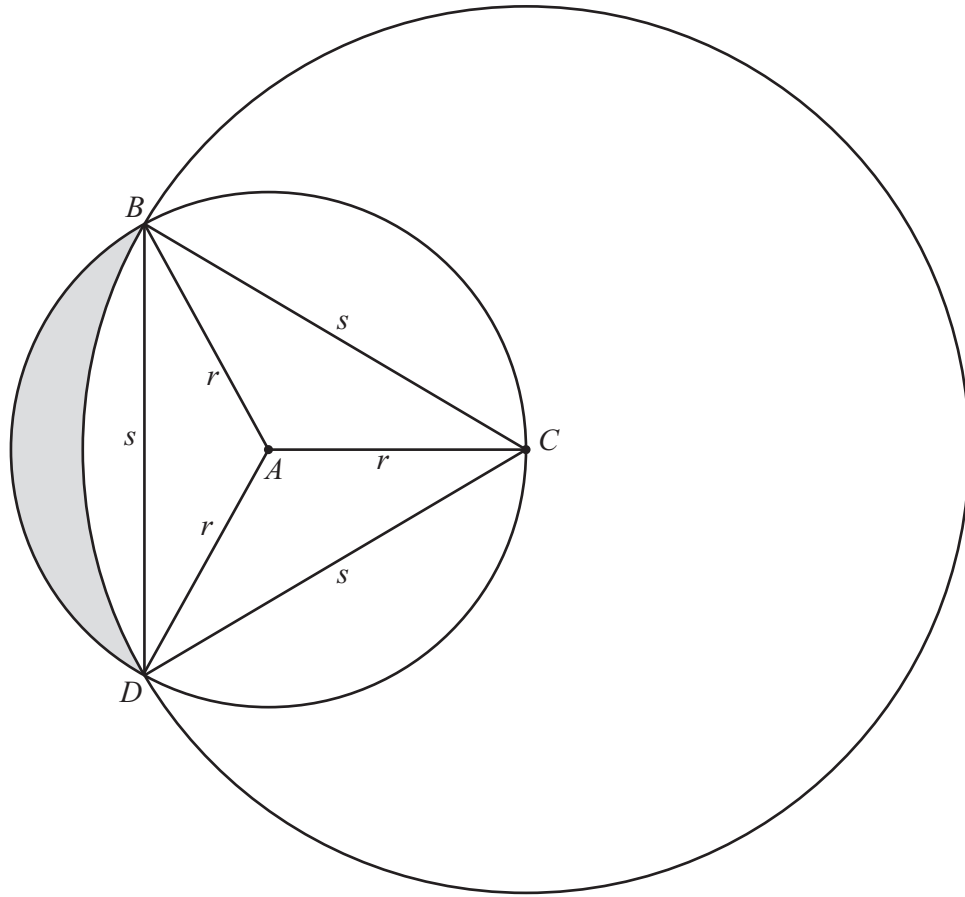
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The diagram shows a circle with centre A and radius r passing through points B , C and D . A larger circle of radius s has centre C and passes through B and D . The length BD is also s .

- (a) Show that $s = \sqrt{3}r$. [2]

This image shows a full page of white paper with ten horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and extend across the width of the page. There is no text or other markings on the paper.



- (b)** Find an expression for the area of the shaded region. Give your answer in the form $(a + b\pi)r^2$, where a and b are constants to be found. [7]

[illegible]



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