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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

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MATHEMATICS **9709/11**

Paper 1 Pure Mathematics 1 **May/June 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.

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1 Solve the equation $6\sin\theta = 1 + \frac{2}{\sin\theta}$ for $-180° < \theta < 180°$. [4]

2 The equation of a curve is such that $\frac{dy}{dx} = 4(2x-5)^3 - 9x^{\frac{1}{2}}$. The curve passes through the point $A\left(4, -\frac{11}{2}\right)$.

(a) Find the gradient of the normal to the curve at the point A. [2]

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(b) Find the equation of the curve. [4]

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3 The third term of a geometric progression is 18 and the sum of the first three terms is 26. It is given that the common ratio is negative.

(a) Find the tenth term of the progression. Give your answer correct to 3 significant figures. [5]

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(b) Find the exact value of the sum to infinity of the progression. [2]

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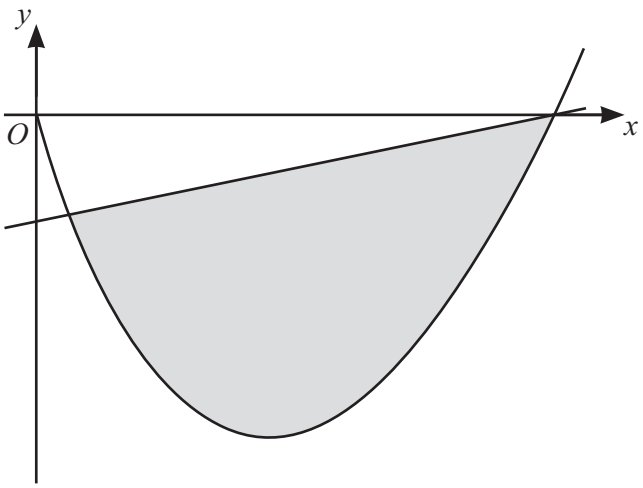
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The diagram shows the curve with equation $y = 5x^{\frac{3}{2}} - 20x$ and the line with equation $y = x - 16$.
The x-coordinates of the points of intersection of the curve and line are 1 and 16.

Find the area of the shaded region between the curve and the line. [5]

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5 **(a)** Find the first three terms, in ascending powers of x, in the expansion of each of the following expressions.

(i) $(2-px)^5$ [2]

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(ii) $\left(1-\frac{1}{2}x\right)^4$ [2]

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(b) Given that the coefficient of x^2 in the expansion of $(2-px)^5\left(1-\frac{1}{2}x\right)^4$ is 93, find the possible values of the constant p. [3]

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6 The equation of a curve is $2x^2 - kxy + 2 = 0$ and the equation of a line is $y = px + 3$, where k and p are constants.

(a) Given that $k = 2$ and $p = 11$, find the coordinates of the points of intersection of the curve and the line. [4]

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(b) Given instead that $p = 4$, find the set of values of k for which the curve and the line do not intersect. [5]

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7 The equation of a curve is $y = 4x^2 + \frac{9}{x^2} - 8$.

(a) A point P is moving along the curve in such a way that its y-coordinate is decreasing at 5 units per second.

Find the rate at which the x-coordinate of point P is changing when $x = 2$. [4]

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(b) Find the coordinates of the stationary points of the curve and determine their nature. [5]

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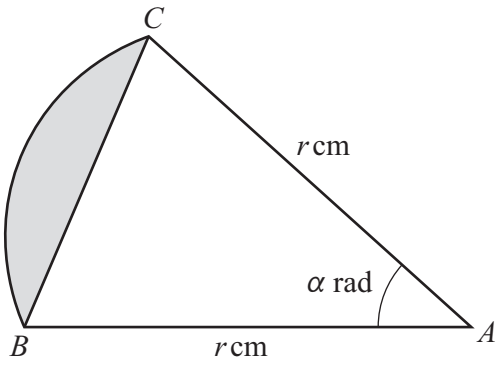
8 The circle with equation $x^2 + y^2 - 6x + 10y - 27 = 0$ intersects the line $x = -2$ at the points P and Q.

Find the area of the triangle formed by the tangents to the circle at P and Q, and the line $x = -2$. [8]

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The diagram shows a sector ABC of a circle with centre A and radius r cm. The angle BAC is α radians, where $0 < \alpha < \frac{1}{2}\pi$.

(a) It is given that the area of the triangle ABC is $4\,\text{cm}^2$ and the area of the sector ABC is $8\alpha\,\text{cm}^2$.

Find the exact area of the shaded segment. [4]

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(b) It is given instead that the length of the chord BC is $\frac{1}{\sqrt{2}}r$ cm but the area of the triangle ABC is still $4\,\text{cm}^2$.

Find the area of the shaded segment. Give your answer correct to 3 significant figures. [4]

10 The functions f and g are defined by

$$\mathrm{f}(x) = \sqrt{x} \qquad \text{for } x \geqslant 0,$$

$$\mathrm{g}(x) = 3\sqrt{x+2} - 5 \qquad \text{for } x \geqslant -2.$$

(a) Describe fully a sequence of transformations which transforms the graph of $y = \mathrm{f}(x)$ to the graph of $y = \mathrm{g}(x)$. You should make clear the order in which the transformations are applied. [5]

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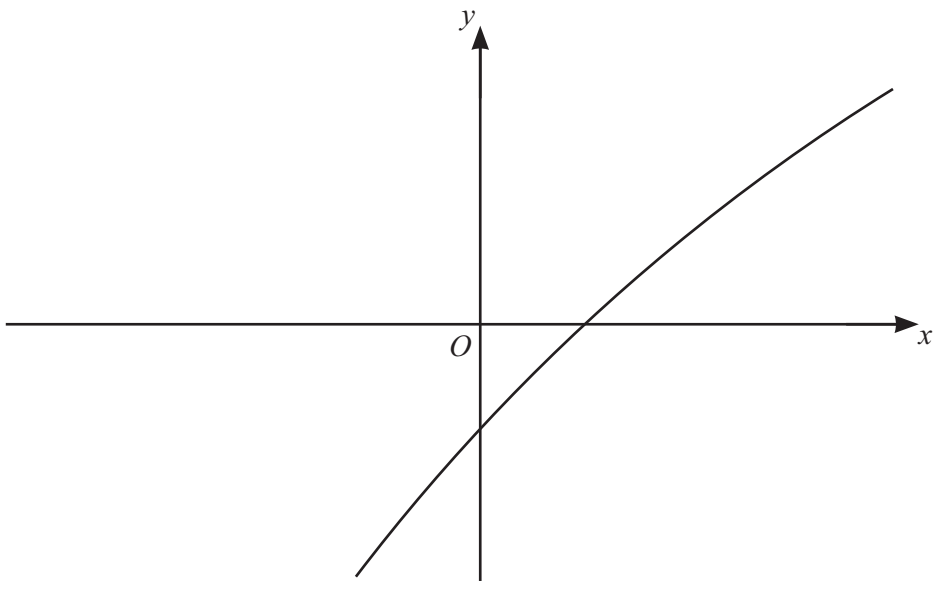
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The diagram shows the graph of $y = \mathrm{g}(x)$.

(b) On the diagram sketch the graph of $y = \mathrm{g}^{-1}(x)$ together with any relevant mirror line. [2]

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

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(d) State the range of g^{-1}. [1]

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The function h is defined by

$$h(x) = x - 2 \qquad \text{for } x \geqslant 0.$$

(e) Find the value of $g^{-1}h(4)$. [1]

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(f) Explain why the composite function hg^{-1} cannot be formed. [1]

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