Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

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MATHEMATICS **9709/15**

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.

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1 A circle has centre (2, 6) and radius 10.

(a) State the equation of the circle. [2]

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(b) The circle passes through the point (8, k).

Find the two possible values of k. [3]

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2 A geometric progression has first term $3+4\sqrt{2}$ and second term $5-\sqrt{2}$.

(a) Find the common ratio of the geometric progression. Give your answer in the form $\sqrt{2}+p$, where p is an integer to be found. [3]

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

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3 **(a)** Express $4x^2 + 10x + 6$ in the form $a(x+b)^2 + c$, where a, b and c are rational constants to be determined. [2]

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(b) The curve with equation $y = 4x^2 + 10x + 6$ and the line $y = k$ have exactly one point of intersection.

Using your answer to part **(a)** or otherwise, state the value of the constant k. [1]

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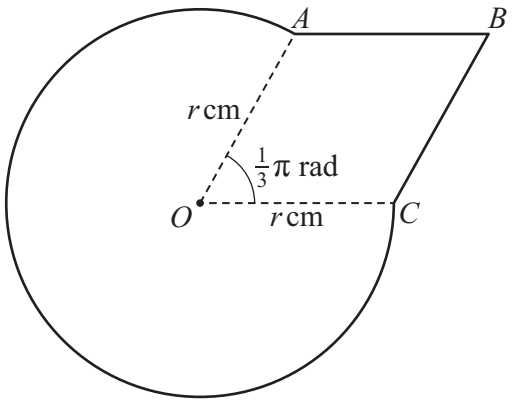
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The diagram shows the design for a company's new logo. The sector of the circle, centre O, has radius r cm. The acute angle $AOC = \frac{1}{3}\pi$ radians. The quadrilateral $OABC$ is a rhombus.

(a) Find an expression for the perimeter of the design. Give your answer in terms of π and r. [2]

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(b) It is now given that the perimeter of the design is 200 cm.

Find the area of the design. Give your answer to 3 significant figures. [5]

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5 Solve the equation

$$x^3 - 28 + \frac{27}{x^3} = 0.$$ [3]

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6 **(a)** Show that the equation

$$6\sin\theta + \frac{1}{\tan\theta} = \frac{4}{\sin\theta}$$

can be written in the form

$$6\cos^2\theta - \cos\theta - 2 = 0.$$ [3]

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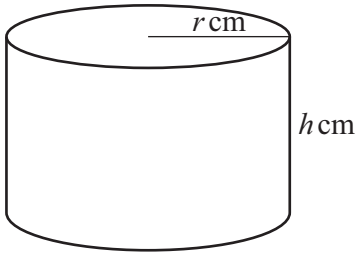
(b) Hence, solve the equation

$$6\sin\theta + \frac{1}{\tan\theta} = \frac{4}{\sin\theta}$$

for $0° \leqslant \theta \leqslant 360°$. [4]

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A manufacturer wishes to design an open cylindrical tank, as shown in the diagram. The tank will have a base but no top. The outside of the tank will have a fixed surface area of $600\pi\,\text{cm}^2$. The radius r cm and height h cm of the tank can vary.

(a) Show that the volume, $V\,\text{cm}^3$, of the tank is given by

$$V = \frac{\pi r(600 - r^2)}{2}.$$

[3]

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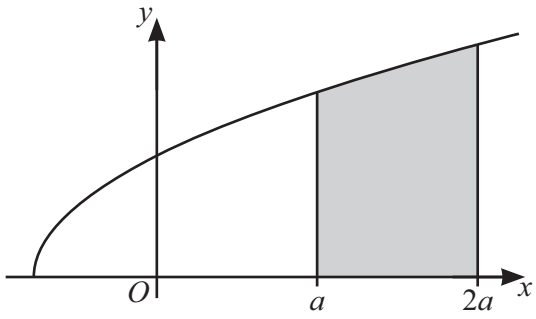
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(b) Find the exact value of r which corresponds to the maximum value of V. [3]

(c) Hence, find the maximum value of V. [2]

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The diagram shows the curve with equation $y = \sqrt{6x+5}$. The shaded region is bounded by the curve, the x-axis and the lines $x = a$ and $x = 2a$, where a is a positive constant.

The shaded region is rotated through 360° about the x-axis to form a solid. The solid has volume, V, such that $V \geqslant 46\pi$.

(a) Show that $9a^2 + 5a - 46 \geqslant 0$. [4]

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(b) Find the range of possible values of a. [3]

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9 In the expansion of $(p+qx)^4$, the coefficient of x is equal to the coefficient of x^2. The constants p and q are both positive.

(a) Find the ratio $p : q$. Give your answer in its simplest form. [3]

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(b) It is given that the coefficient of x^3 is 486.

Find the values of p and q. [4]

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10 The function f is defined by

$$f(x) = 3 + \frac{7}{x-2}$$

for $x > 2$.

(a) It is given that $f(a) = 4$.

Find the value of a. [2]

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(b) Find an expression for $f^{-1}(x)$ and state the domain of f^{-1}. [4]

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(c) The function g is defined by

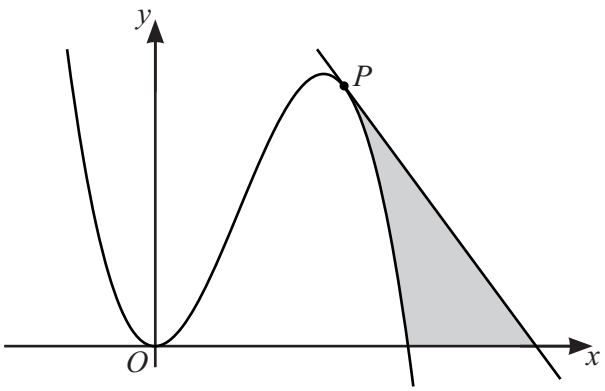
$$g(x) = \frac{1+4x}{2x-3}$$

for $x > \frac{3}{2}$.

Show that $fg(x) \equiv kx$, where k is a constant to be determined. [3]

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The diagram shows the curve with equation $y = 4x^2 - x^3$ and the tangent to the curve at the point P. The point P has x-coordinate 3.

(a) Find the equation of the tangent to the curve at the point P. Give your answer in the form $y = mx + c$. [5]

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(b) The shaded region is bounded by the curve, the x-axis and the tangent to the curve at P.

Find the exact area of the shaded region. [6]

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The graph of $y = 4x^2 - x^3$ is transformed by a stretch of scale factor $\frac{1}{3}$ in the x-direction. The point Q is the image of P under this transformation. The transformed shaded region is bounded by the transformed curve, the x-axis and the tangent to the transformed curve at Q.

(c) (i) Find the equation of the transformed curve in the form $y = mx^2 + nx^3$, where m and n are integers to be found. [1]

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(c) (ii) State the coordinates of Q and the area of the transformed shaded region. [2]

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