Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4216415623

MATHEMATICS **9709/11**

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 Find the set of values of the constant k for which the quadratic equation

$$3kx^2 + (k+8)x + 3 = 0$$

has two distinct real roots. [4]

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2 A geometric progression has first term a and common ratio $\cos\theta$, where $0 < \theta < \frac{1}{2}\pi$. It is given that the second term is 8 and the fifth term is $\frac{1}{8}$.

(a) Find the value of θ. Give your answer correct to 3 significant figures. [3]

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

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3 In the expansion of

$$(px+3)^5 - \left(x^3 + \frac{p}{x}\right)^4,$$

the coefficient of x^4 is 216.

Find the value of the positive constant p. [5]

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4 **(a)** Express $1-6x-x^2$ in the form $a-(x+b)^2$, where a and b are constants. [3]

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(b) The graph of $y=x^2$ is transformed to the graph of $y=1-6x-x^2$ by a reflection followed by a translation of $\begin{pmatrix} m \\ n \end{pmatrix}$. Give details of the reflection and determine the values of m and n. [3]

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5 **(a)** Show that $\tan^4\theta - 1 \equiv \dfrac{1-2\cos^2\theta}{\cos^4\theta}$. [3]

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(b) Hence solve the equation $\cos^2\theta(\tan^4\theta - 1) = 7$ for $0° < \theta < 180°$. [4]

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6 Functions f and g are defined by

$$\mathrm{f}(x) = (x+3)^2 - 12 \quad \text{for } x \geqslant 0,$$

$$\mathrm{g}(x) = 2x - 5 \quad \text{for } x \in \mathbb{R}.$$

(a) State the range of f. [1]

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(b) Find an expression for $\mathrm{f}^{-1}(x)$. [2]

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(c) Solve the equation $\mathrm{gf}(x) = 69$. [4]

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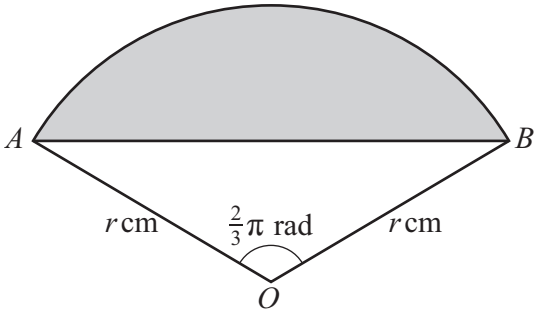
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The diagram shows a sector of a circle with centre O and radius r cm. The shaded region is bounded by the chord AB and the arc AB. The size of angle AOB is $\frac{2}{3}\pi$ radians.

(a) Show that the area of the shaded region is approximately $0.614r^2$ cm^2. [2]

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It is given that the radius of the circle is increasing at a rate of $0.4\,\text{cm}\,\text{s}^{-1}$.

(b) (i) Find the rate of increase of the area of the shaded region at the instant when $r = 20$. Give your answer correct to 2 significant figures. [3]

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(ii) Find the rate of increase of the length of the arc AB. Give your answer correct to 2 significant figures. [3]

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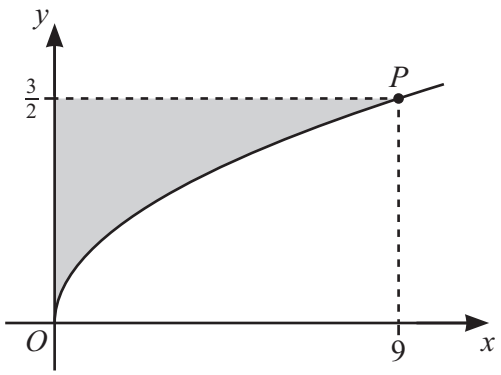
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The diagram shows the curve with equation $y = \frac{1}{2}\sqrt{x}$ and the point P with coordinates $\left(9, \frac{3}{2}\right)$. The shaded region is bounded by the curve and the lines $x = 0$ and $y = \frac{3}{2}$.

(a) Find the area of the shaded region. [3]

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(b) The shaded region is rotated through 360° about the ***y*-axis**.

Find the exact volume of the solid produced. [4]

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9 An arithmetic progression has first term 2 and common difference d. The sum of the first n terms is denoted by S_n.

(a) It is given that $(S_2 - 1)$, S_4, S_9 are the first three terms of a second arithmetic progression.

Find the value of d. [4]

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(b) Hence find the difference between the values of the 15th terms of the two arithmetic progressions. [4]

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10 A circle has equation $x^2 + y^2 + 4y - 21 = 0$ and a straight line has equation $2x + y - 8 = 0$. The line intersects the circle at two points.

(a) Find the coordinates of these two points of intersection. [4]

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(b) The circle has centre C and the two points of intersection are denoted by A and B.

Find the area of the triangle ABC. [3]

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11 A curve passes through the point $P(4, 3)$ and is such that

$$\frac{dy}{dx} = \frac{8}{x^2} - \frac{10}{(2x-3)^2}.$$

(a) Find the equation of the normal to the curve at P. Give your answer in the form $y = mx + c$. [3]

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(b) Find the rate of change of the gradient of the curve when $x = 4$. [3]

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(c) Given that the curve also passes through the point $(-1, q)$, find the value of q. [5]

Additional page

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