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Cambridge Assessment
International Education



Cambridge International AS & A Level

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NUMBER

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MATHEMATICS

9709/13

Paper 1 Pure Mathematics 1

May/June 2024

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 [].

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1 Find the coefficient of x^2 in the expansion of

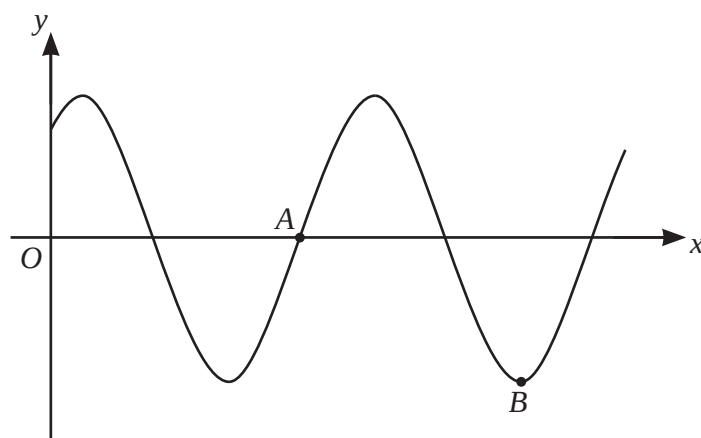
$$(2-5x)(1+3x)^{10}. \quad [4]$$

[4]

This image shows a full page of white paper designed for handwriting practice. It features approximately 20 horizontal dotted lines spaced evenly across the page, providing a guide for letter height and placement. The lines are thin and light gray, allowing for clear visibility while writing. There is no text or other markings on the page.



2 (a)



The diagram shows the curve $y = k \cos(x - \frac{1}{6}\pi)$ where k is a positive constant and x is measured in radians. The curve crosses the x -axis at point A and B is a minimum point.

Find the coordinates of A and B .

[3]

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(b) Find the exact value of t that satisfies the equation

$$3 \sin^{-1}(3t) + 2 \cos^{-1}\left(\frac{1}{2}\sqrt{2}\right) = \pi. \quad [2]$$

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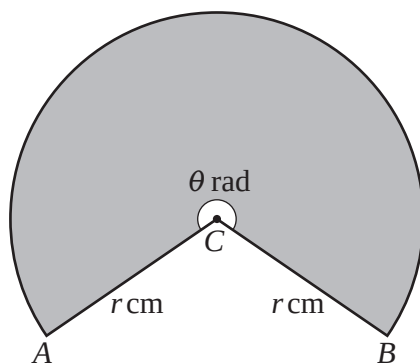
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The diagram shows a sector of a circle with centre C . The radii CA and CB each have length r cm and the size of the reflex angle ACB is θ radians. The sector, shaded in the diagram, has a perimeter of 65 cm and an area of 225 cm^2 .

- (a) Find the values of r and θ . [4]

[illegible]

- (b)** Find the area of triangle ACB . [2]

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- 4 (a) Show that the equation $\cos \theta (7 \tan \theta - 5 \cos \theta) = 1$ can be written in the form $a \sin^2 \theta + b \sin \theta + c = 0$, where a , b and c are integers to be found. [3]

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- (b) Hence solve the equation $\cos 2x (7 \tan 2x - 5 \cos 2x) = 1$ for $0^\circ < x < 180^\circ$. [3]

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5 The equation of a curve is $y = 2x^2 - \frac{1}{2x} + 3$.

(a) Find the coordinates of the stationary point. [3]

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(b) Determine the nature of the stationary point. [2]

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(c) For positive values of x , determine whether the curve shows a function that is increasing, decreasing or neither. Give a reason for your answer. [2]

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- 6 A curve passes through the point $\left(\frac{4}{5}, -3\right)$ and is such that $\frac{dy}{dx} = \frac{-20}{(5x-3)^2}$.

(a) Find the equation of the curve.

[4]

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- (b) The curve is transformed by a stretch in the x -direction with scale factor $\frac{1}{2}$ followed by a translation of $\begin{pmatrix} 2 \\ 10 \end{pmatrix}$.

Find the equation of the new curve.

[3]

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- 8** A circle with equation $x^2 + y^2 - 6x + 2y - 15 = 0$ meets the y -axis at the points A and B . The tangents to the circle at A and B meet at the point P .

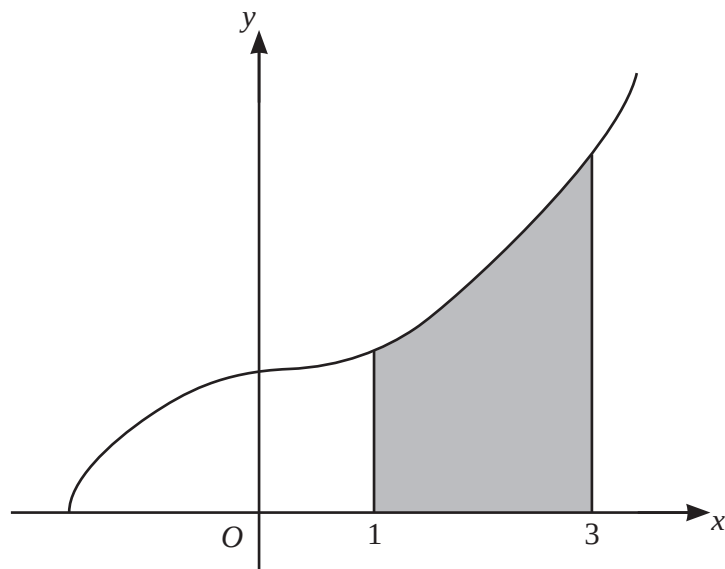
Find the coordinates of P .

[8]

[illegible]

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The diagram shows the curve with equation $y = \sqrt{2x^3 + 10}$.

- (a) Find the equation of the tangent to the curve at the point where $x = 3$. Give your answer in the form $ax + by + c = 0$ where a , b and c are integers. [5]

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- (b)** The region shaded in the diagram is enclosed by the curve and the straight lines $x = 1$, $x = 3$ and $y = 0$.

Find the volume of the solid obtained when the shaded region is rotated through 360° about the x -axis. [3]

[illegible]



- 10** The geometric progression $a_1, a_2, a_3, \dots$ has first term 2 and common ratio r where $r > 0$. It is given that $\frac{9}{2}a_5 + 7a_3 = 8$.

(a) Find the value of r .

[3]

[illegible]

- (b)** Find the sum of the first 20 terms of the geometric progression. Give your answer correct to 4 significant figures. [2]

[illegible]



(c) Find the sum to infinity of the progression $a_2, a_5, a_8, \dots$.

[3]

[illegible]



11 The function f is defined by $f(x) = 10 + 6x - x^2$ for $x \in \mathbb{R}$.

(a) By completing the square, find the range of f . [3]

[illegible]



The function g is defined by $g(x) = 4x + k$ for $x \in \mathbb{R}$ where k is a constant.

- (b)** It is given that the graph of $y = g^{-1}f(x)$ meets the graph of $y = g(x)$ at a single point P .

Determine the coordinates of P .

[6]

[illegible]



Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.

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