



Cambridge International AS & A Level

CANDIDATE
NAME

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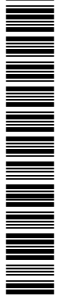
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MATHEMATICS

9709/11

Paper 1 Pure Mathematics 1

October/November 2022

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.

2 The equation of a curve is such that $\frac{dy}{dx} = 12\left(\frac{1}{2}x - 1\right)^{-4}$. It is given that the curve passes through the point $P(6, 4)$.

(a) Find the equation of the tangent to the curve at P . [2]

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

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- 3 A curve has equation $y = ax^{\frac{1}{2}} - 2x$, where $x > 0$ and a is a constant. The curve has a stationary point at the point P , which has x -coordinate 9.

Find the y -coordinate of P .

[5]

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4 The coefficient of x^2 in the expansion of $\left(1 + \frac{2}{p}x\right)^5 + (1 + px)^6$ is 70.

Find the possible values of the constant p . [6]

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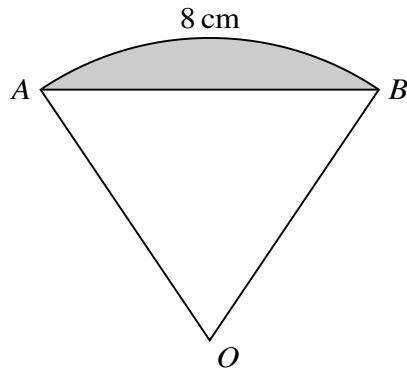
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The diagram shows a sector OAB of a circle with centre O . The length of the arc AB is 8 cm . It is given that the perimeter of the sector is 20 cm .

(a) Find the perimeter of the shaded segment. [4]

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(b) Find the area of the shaded segment.

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6 (a) Show that the equation

$$\frac{1}{\sin \theta + \cos \theta} + \frac{1}{\sin \theta - \cos \theta} = 1$$

may be expressed in the form $a \sin^2 \theta + b \sin \theta + c = 0$, where a , b and c are constants to be found. [3]

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(b) Hence solve the equation $\frac{1}{\sin \theta + \cos \theta} + \frac{1}{\sin \theta - \cos \theta} = 1$ for $0^\circ \leq \theta \leq 360^\circ$. [3]

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(b) Find, to the nearest millimetre, the total depth of the post in the ground after 20 impacts. [2]

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(c) Find the greatest total depth in the ground which could theoretically be achieved. [2]

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8 The function f is defined by $f(x) = 2 - \frac{3}{4x-p}$ for $x > \frac{p}{4}$, where p is a constant.

(a) Find $f'(x)$ and hence determine whether f is an increasing function, a decreasing function or neither. [3]

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9 Functions f and g are both defined for $x \in \mathbb{R}$ and are given by

$$f(x) = x^2 - 4x + 9,$$

$$g(x) = 2x^2 + 4x + 12.$$

(a) Express $f(x)$ in the form $(x - a)^2 + b$.

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(b) Express $g(x)$ in the form $2[(x + c)^2 + d]$.

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(c) Express $g(x)$ in the form $kf(x + h)$, where k and h are integers. [1]

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(d) Describe fully the two transformations that have been combined to transform the graph of $y = f(x)$ to the graph of $y = g(x)$. [4]

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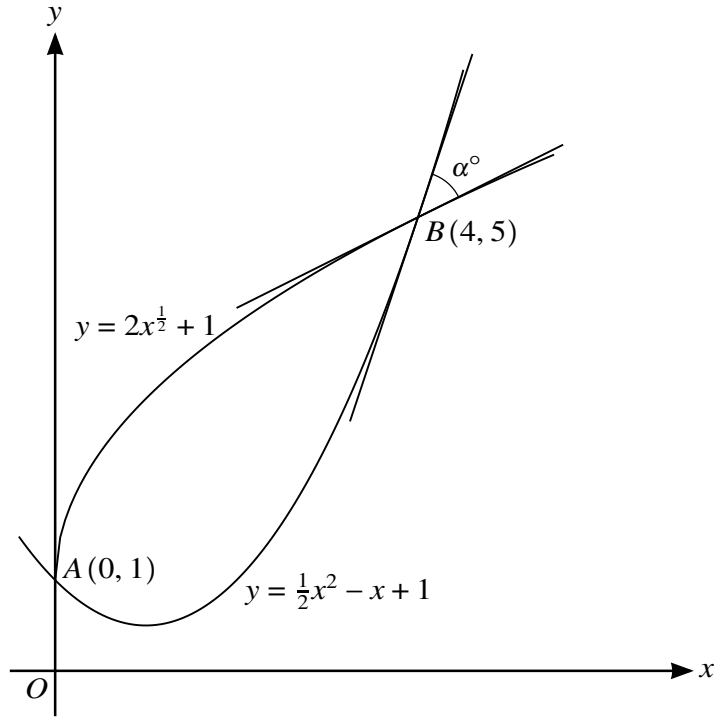
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Curves with equations $y = 2x^{\frac{1}{2}} + 1$ and $y = \frac{1}{2}x^2 - x + 1$ intersect at $A(0, 1)$ and $B(4, 5)$, as shown in the diagram.

- (a) Find the area of the region between the two curves. [5]

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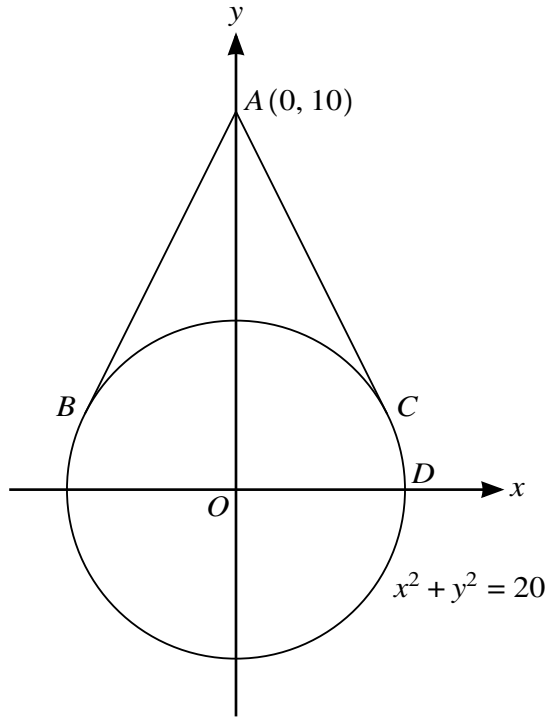
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The diagram shows the circle with equation $x^2 + y^2 = 20$. Tangents touching the circle at points *B* and *C* pass through the point *A* (0, 10).

- (a) By letting the equation of a tangent be $y = mx + 10$, find the two possible values of m . [4]

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(b) Find the coordinates of B and C .

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The point D is where the circle crosses the positive x -axis.

(c) Find angle BDC in degrees.

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