



Cambridge International AS & A Level

CANDIDATE
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MATHEMATICS

9709/11

Paper 1 Pure Mathematics 1

May/June 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.



1 (a) Express $x^2 - 8x + 11$ in the form $(x + p)^2 + q$ where p and q are constants. [2]

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(b) Hence find the exact solutions of the equation $x^2 - 8x + 11 = 1$. [2]

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- 3 The coefficient of x^4 in the expansion of $\left(2x^2 + \frac{k^2}{x}\right)^5$ is a . The coefficient of x^2 in the expansion of $(2kx - 1)^4$ is b .

(a) Find a and b in terms of the constant k .

[3]

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(b) Given that $a + b = 216$, find the possible values of k .

[3]

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4 (a) Prove the identity $\frac{\sin^3 \theta}{\sin \theta - 1} - \frac{\sin^2 \theta}{1 + \sin \theta} \equiv -\tan^2 \theta(1 + \sin^2 \theta)$. [4]

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(b) Hence solve the equation

$$\frac{\sin^3 \theta}{\sin \theta - 1} - \frac{\sin^2 \theta}{1 + \sin \theta} = \tan^2 \theta(1 - \sin^2 \theta)$$

for $0 < \theta < 2\pi$.

[2]

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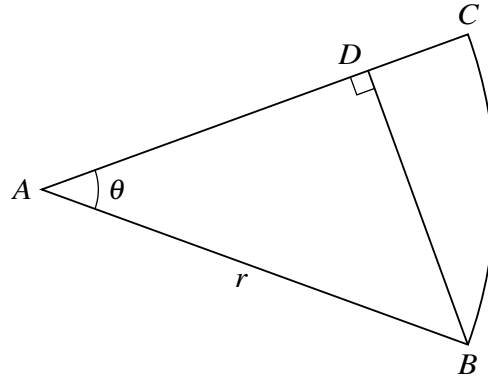
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The diagram shows a sector ABC of a circle with centre A and radius r . The line BD is perpendicular to AC . Angle CAB is θ radians.

(a) Given that $\theta = \frac{1}{6}\pi$, find the exact area of BCD in terms of r . [3]

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6 The function f is defined as follows:

$$f(x) = \frac{x^2 - 4}{x^2 + 4} \quad \text{for } x > 2.$$

(a) Find an expression for $f^{-1}(x)$. [3]

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(b) Show that $1 - \frac{8}{x^2 + 4}$ can be expressed as $\frac{x^2 - 4}{x^2 + 4}$ and hence state the range of f. [4]

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(c) Explain why the composite function ff cannot be formed. [1]

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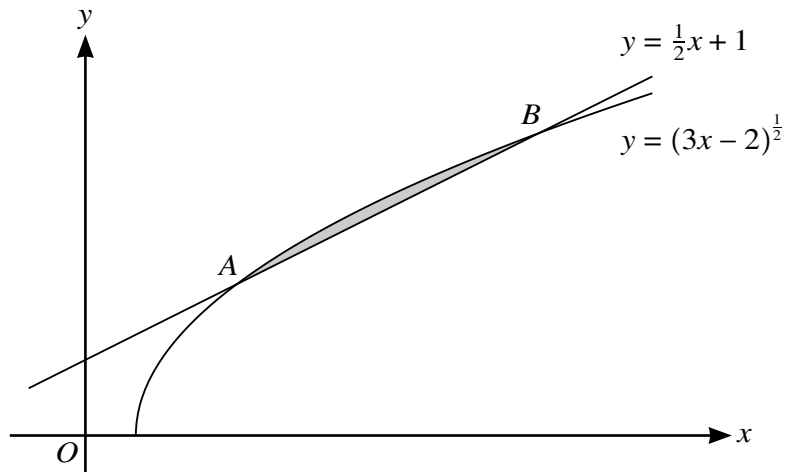
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The diagram shows the curve with equation $y = (3x - 2)^{\frac{1}{2}}$ and the line $y = \frac{1}{2}x + 1$. The curve and the line intersect at points A and B .

(a) Find the coordinates of A and B . [4]

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8 (a) The curve $y = \sin x$ is transformed to the curve $y = 4 \sin\left(\frac{1}{2}x - 30^\circ\right)$.

Describe fully a sequence of transformations that have been combined, making clear the order in which the transformations are applied. [5]

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(c) Show that the curve has no other stationary points. [3]

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(d) A point A is moving along the curve and the y -coordinate of A is increasing at a rate of 5 units per second.

Find the rate of increase of the x -coordinate of A at the point where $x = 1$. [3]

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