

Cambridge International AS & A Level

CANDIDATE
NAME

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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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- 2** The thirteenth term of an arithmetic progression is 12 and the sum of the first 30 terms is -15 .

Find the sum of the first 50 terms of the progression.

[5]

[illegible]

- 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]

[illegible]

- 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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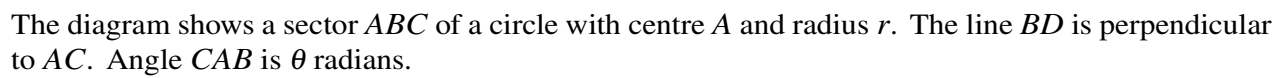
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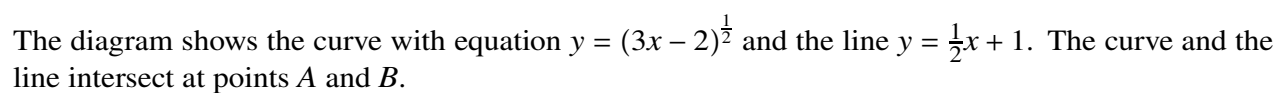
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- This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[illegible]

- (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]

[illegible]

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



- [illegible]

(b) Hence find the area of the region enclosed between the curve and the line.

[5]

[illegible]

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

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

This image shows a full page of a document template. It consists of approximately 28 evenly spaced horizontal dotted lines across the entire width of the page, providing a guide for handwriting practice or structured note-taking. The background is plain white, and there are no margins, headers, or footers present.

- (b)** Find the exact solutions of the equation $4 \sin(\frac{1}{2}x - 30^\circ) = 2\sqrt{2}$ for $0^\circ \leq x \leq 360^\circ$. [3]

[illegible]

- 9** The equation of a circle is $x^2 + y^2 + 6x - 2y - 26 = 0$.

- (a) Find the coordinates of the centre of the circle and the radius. Hence find the coordinates of the lowest point on the circle. [4]

[illegible]

- (b)** Find the set of values of the constant k for which the line with equation $y = kx - 5$ intersects the circle at two distinct points. [6]

[illegible]

10 The equation of a curve is such that $\frac{d^2y}{dx^2} = 6x^2 - \frac{4}{x^3}$. The curve has a stationary point at $(-1, \frac{9}{2})$.

(a) Determine the nature of the stationary point at $(-1, \frac{9}{2})$. [1]

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(b) Find the equation of the curve. [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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