

Cambridge
International
AS & A Level

Cambridge International Examinations

Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE
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MATHEMATICS

9709/11

Paper 1 Pure Mathematics 1 (P1)

October/November 2017

1 hour 45 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 75.

This document consists of **19** printed pages and **1** blank page.

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of horizontal dashed lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.

[illegible]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

6

- 4 Machines in a factory make cardboard cones of base radius r cm and vertical height h cm. The volume, V cm³, of such a cone is given by $V = \frac{1}{3}\pi r^2 h$. The machines produce cones for which $h + r = 18$.

(i) Show that $V = 6\pi r^2 - \frac{1}{3}\pi r^3$. [1]

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(ii) Given that r can vary, find the non-zero value of r for which V has a stationary value and show that the stationary value is a maximum. [4]

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(iii) Find the maximum volume of a cone that can be made by these machines. [1]

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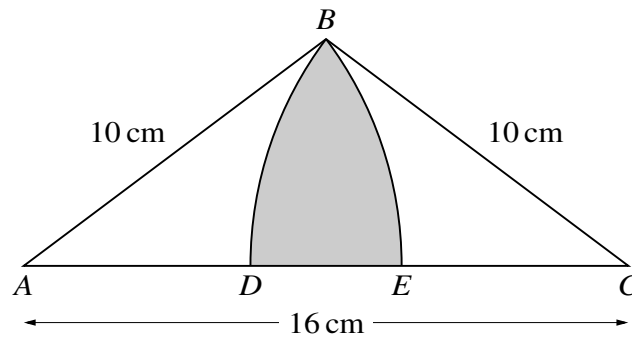
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The diagram shows an isosceles triangle ABC in which $AC = 16$ cm and $AB = BC = 10$ cm. The circular arcs BE and BD have centres at A and C respectively, where D and E lie on AC .

- (i) Show that angle $BAC = 0.6435$ radians, correct to 4 decimal places. [1]

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- (ii) Find the area of the shaded region. [5]

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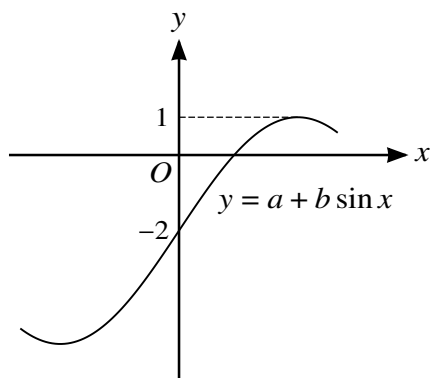
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(i) Show that the equation of the perpendicular bisector of AB is $2y = 13 - x$. [4]

[illegible]

- (ii) Find, by calculation, the distance CD , giving your answer in the form $\sqrt{\left(\frac{p}{q}\right)}$, where p and q are integers. [5]

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

[illegible]

(b) (i) Show that the equation

$$(\sin \theta + 2 \cos \theta)(1 + \sin \theta - \cos \theta) = \sin \theta(1 + \cos \theta)$$

may be expressed as $3 \cos^2 \theta - 2 \cos \theta - 1 = 0$.

[3]

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(ii) Hence solve the equation

$$(\sin \theta + 2 \cos \theta)(1 + \sin \theta - \cos \theta) = \sin \theta(1 + \cos \theta)$$

for $-180^\circ \leq \theta \leq 180^\circ$.

[4]

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- 8** (a) Relative to an origin O , the position vectors of two points P and Q are \mathbf{p} and \mathbf{q} respectively. The point R is such that PQR is a straight line with Q the mid-point of PR . Find the position vector of R in terms of \mathbf{p} and \mathbf{q} , simplifying your answer. [3]

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[illegible]

16

- 9 Functions f and g are defined for $x > 3$ by

$$f : x \mapsto \frac{1}{x^2 - 9},$$

$$g : x \mapsto 2x - 3.$$

- (i) Find and simplify an expression for $gg(x)$. [2]

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- (ii) Find an expression for $f^{-1}(x)$ and state the domain of f^{-1} . [4]

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(iii) Solve the equation $fg(x) = \frac{1}{7}$.

[4]

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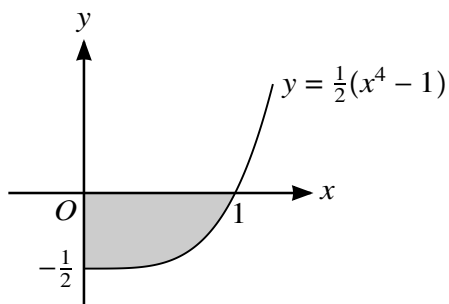
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The diagram shows part of the curve $y = \frac{1}{2}(x^4 - 1)$, defined for $x \geq 0$.

- (i) Find, showing all necessary working, the area of the shaded region. [3]

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- (ii) Find, showing all necessary working, the volume obtained when the shaded region is rotated through 360° about the x -axis. [4]

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- (iii) Find, showing all necessary working, the volume obtained when the shaded region is rotated through 360° about the y-axis. [5]

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