

Cambridge  
International  
AS & A Level

**Cambridge International Examinations**  
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE  
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CENTRE  
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**MATHEMATICS**

**9709/12**

Paper 1 Pure Mathematics 1 (P1)

**February/March 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 **20** printed pages.



- 1 Find the set of values of  $k$  for which the equation  $2x^2 + 3kx + k = 0$  has distinct real roots.

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- 2 In the expansion of  $\left(\frac{1}{ax} + 2ax^2\right)^5$ , the coefficient of  $x$  is 5. Find the value of the constant  $a$ . [4]

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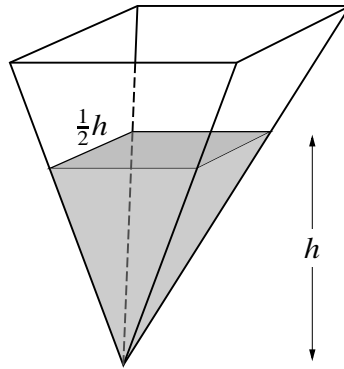
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The diagram shows a water container in the form of an inverted pyramid, which is such that when the height of the water level is  $h$  cm the surface of the water is a square of side  $\frac{1}{2}h$  cm.

- (i) Express the volume of water in the container in terms of  $h$ . [1]

[The volume of a pyramid having a base area  $A$  and vertical height  $h$  is  $\frac{1}{3}Ah$ .]

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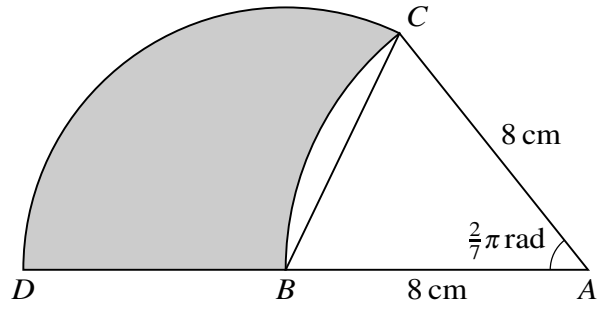
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In the diagram,  $AB = AC = 8\text{ cm}$  and angle  $CAB = \frac{2}{7}\pi$  radians. The circular arc  $BC$  has centre  $A$ , the circular arc  $CD$  has centre  $B$  and  $ABD$  is a straight line.

(i) Show that angle  $CBD = \frac{9}{14}\pi$  radians. [1]

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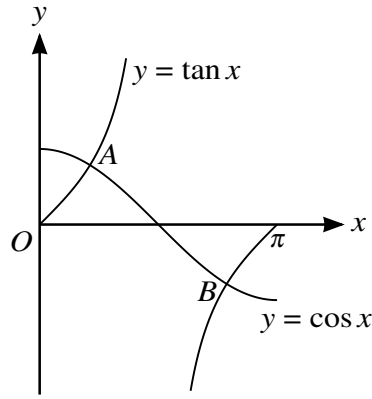
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The diagram shows the graphs of  $y = \tan x$  and  $y = \cos x$  for  $0 \leq x \leq \pi$ . The graphs intersect at points  $A$  and  $B$ .

(i) Find by calculation the  $x$ -coordinate of  $A$ .

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8 The functions  $f$  and  $g$  are defined for  $x \geq 0$  by

$$f : x \mapsto 2x^2 + 3,$$

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

(i) Show that  $gf(x) = 6x^2 + 11$  and obtain an unsimplified expression for  $fg(x)$ . [2]

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(ii) Find an expression for  $(fg)^{-1}(x)$  and determine the domain of  $(fg)^{-1}$ . [5]

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9 The point  $A(2, 2)$  lies on the curve  $y = x^2 - 2x + 2$ .

(i) Find the equation of the tangent to the curve at  $A$ . [3]

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The normal to the curve at  $A$  intersects the curve again at  $B$ .

(ii) Find the coordinates of  $B$ . [4]

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The tangents at  $A$  and  $B$  intersect each other at  $C$ .

**(iii)** Find the coordinates of  $C$ . [4]

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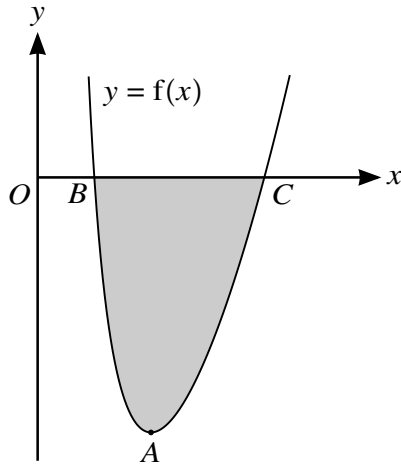
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The diagram shows the curve  $y = f(x)$  defined for  $x > 0$ . The curve has a minimum point at  $A$  and crosses the  $x$ -axis at  $B$  and  $C$ . It is given that  $\frac{dy}{dx} = 2x - \frac{2}{x^3}$  and that the curve passes through the point  $(4, \frac{189}{16})$ .

(i) Find the  $x$ -coordinate of  $A$ . [2]

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(ii) Find  $f(x)$ . [3]

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**(iii)** Find the  $x$ -coordinates of  $B$  and  $C$ . [4]

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**[Question 10 (iv) is printed on the next page.]**

(iv) Find, showing all necessary working, the area of the shaded region.

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