



Cambridge Assessment International Education

Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	
MATHEMATICS			9709/12
Paper 1 Pure Mathe	matics 1 (P1)	Octo	ber/November 2019
			1 hour 45 minutes
Candidates answer o	n 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 in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.

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.

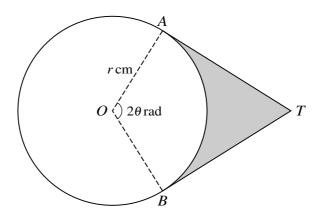
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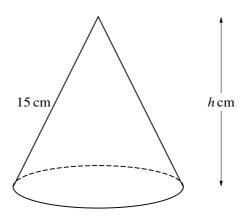
A curve is such that $\frac{dy}{dx}$ curve. Find the equation	$\frac{\lambda}{x} = \frac{k}{\sqrt{x}}$, where k is a constant. In of the curve.	The points $P(1, -1)$ and $Q(4, 4)$ lie on the [4]



The diagram shows a circle with centre O and radius r cm. Points A and B lie on the circle and angle $AOB = 2\theta$ radians. The tangents to the circle at A and B meet at T.

(i)	Express the perimeter of the shaded region in terms of r and θ .	[3]
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(ii)	In the case where $r = 5$ and $\theta = 1.2$, find the area of the shaded region.	[4]
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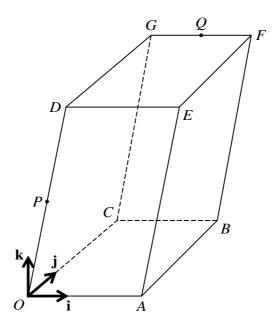
The diagram shows a solid cone which has a slant height of $15\,\mathrm{cm}$ and a vertical height of $h\,\mathrm{cm}$.

(i)	Show that the volume, $V \text{ cm}^3$, of the cone is given by $V = \frac{1}{3}\pi(225h - h^3)$. [2]
	[The volume of a cone of radius r and vertical height h is $\frac{1}{3}\pi r^2 h$.]

(ii)	Given that h can vary, find the value of h for which V has a stationary value. Determine, showing all necessary working, the nature of this stationary value. [5]

Given that $x > 0$, find the two smallest values of x , in radians, for which $3 \tan(2x + 1) = 1$. Sho all necessary working.

(b)	(b) The function $f: x \mapsto 3\cos^2 x - 2\sin^2 x$ is defined for $0 \le x \le \pi$.				
	(i)	Express $f(x)$ in the form $a\cos^2 x + b$, where a and b are constants. [1]			
	(ii)	Find the range of f. [2]			
	()	[-]			



The diagram shows a three-dimensional shape OABCDEFG. The base OABC and the upper surface DEFG are identical horizontal rectangles. The parallelograms OAED and CBFG both lie in vertical planes. Points P and Q are the mid-points of OD and GF respectively. Unit vectors \mathbf{i} and \mathbf{j} are parallel to \overrightarrow{OA} and \overrightarrow{OC} respectively and the unit vector \mathbf{k} is vertically upwards. The position vectors of A, C and D are given by $\overrightarrow{OA} = 6\mathbf{i}$, $\overrightarrow{OC} = 8\mathbf{j}$ and $\overrightarrow{OD} = 2\mathbf{i} + 10\mathbf{k}$.

(i)	Express each of the vectors \overrightarrow{PB} and \overrightarrow{PQ} in terms of \mathbf{i} , \mathbf{j} and \mathbf{k} . [4]

(ii)	Determine whether P is nearer to Q or to B .	[2]
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(iii)	Use a scalar product to find angle <i>BPQ</i> .	[3]
()	ese a semial product to find angle 21 g.	[6]
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(i)	Find the distance she runs on the last day of the 21-day period.
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(!!)	Find the total distance the many in the 21 decreased
(11)	Find the total distance she runs in the 21-day period.

(b)	The	first, second and third terms of a geometric progression are x , $x - 3$ and $x - 3$	- 5 respectively.
	(i)	Find the value of x .	[2]
	(ii)	Find the fourth term of the progression.	[2]
	(iii)	Find the sum to infinity of the progression.	[2]

9 Functions f and g are defined by

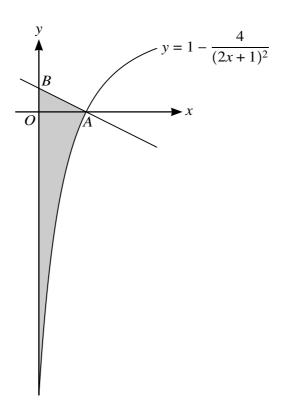
$$f(x) = 2x^2 + 8x + 1 \quad \text{for } x \in \mathbb{R},$$

$$g(x) = 2x - k \quad \text{for } x \in \mathbb{R},$$

where k is a constant.

Tind the value of	f k for which the lir	<i>y</i>	, , ,	
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In the case wher	e $k = -9$, find the s	et of values of x for where x	hich $f(x) < g(x)$.	
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The diagram shows part of the curve $y = 1 - \frac{4}{(2x+1)^2}$. The curve intersects the *x*-axis at *A*. The normal to the curve at *A* intersects the *y*-axis at *B*.

(i)	Obtain expressions for $\frac{dy}{dx}$ and	$\int y dx$.	[4]

Find, showing all necessary working, the area of the shaded region. [4)	Find the coordinates of B . [4
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