Cambridge International AS & A Level

CANDIDATE NAME					
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MATHEMATICS 9709/12

Paper 1 Pure Mathematics 1

February/March 2024

1 hour 50 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

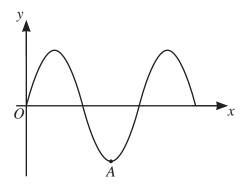
- Answer all questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do not use an erasable pen or correction 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 16 pages.

Find the exact value of $\int_3^\infty \frac{2}{x^2} dx$.	



The diagram shows part of the curve with equation $y = k \sin \frac{1}{2}x$, where k is a positive constant and x is measured in radians. The curve has a minimum point A.

(a)	State the coordinates of A.	1]
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		•••
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(b)	A sequence of transformations is applied to the curve in the following order.	
	Translation of 2 units in the negative y-direction	
	Reflection in the <i>x</i> -axis	
	Find the equation of the new curve and determine the coordinates of the point on the new curve corresponding to A .	ve [3]
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Find the val	ue of a.						
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4	(~)	θ	$+\cos\theta)^2-1$	24 0		[2]
4	(a)	Prove that $\frac{(\sin \theta)}{(\cos \theta)}$	$\frac{1}{\cos^2\theta}$	$2 \tan \theta$.		[3]
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	(b)	Hence solve the e	equation ($\frac{1}{\cos^2\theta} = 5\tan^3\theta$	θ for $-90^{\circ} < \theta < 90^{\circ}$.	[3]
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6	It is given that the coefficient of x^3 in the expansion of
	$(2+ax)^4(5-ax)$
	is 432.
	Find the value of the constant a . [5]

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(a)	Find the value of the constant k .	
		••••••
(b)	Find the coordinates of <i>P</i> .	

	An arithmetic progression is such that its first term is 6 and its tenth term is 19.5.
	Find the sum of the first 100 terms of this arithmetic progression. [4]
(b)	A geometric progression a_1 , a_2 , a_3 , is such that $a_1 = 24$ and the common ratio is $\frac{1}{2}$.
	The sum to infinity of this geometric progression is denoted by S . The sum to infinity of the even-numbered terms (i.e. a_2 , a_4 , a_6 ,) is denoted by S_E .
	Find the values of S and S_E . [4]
	The the values of S and S_E .
	The the values of S and S _E .

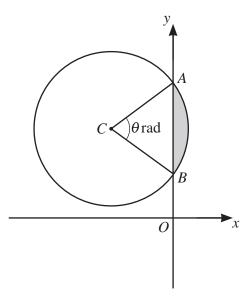
9 The functions f and g are defined for all real values of x by

$$f(x) = (3x-2)^2 + k$$
 and $g(x) = 5x-1$,

where k is a constant.

G	Given that the range of the function gf is gf $(x) \ge 39$, find the value of k.	[4
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 Fe	For this value of k , determine the range of the function fg.	[2

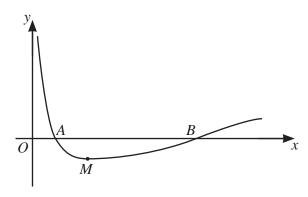
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(c)	The function h is defined for all real values of x and is such that $gh(x) = 35x + 19$.	
	Find an expression for $g^{-1}(x)$ and hence, or otherwise, find an expression for $h(x)$.	[3]
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The diagram shows the circle with centre C(-4,5) and radius $\sqrt{20}$ units. The circle intersects the *y*-axis at the points *A* and *B*. The size of angle *ACB* is θ radians.

(a)	Find the equation of the tangent to the circle at the point $(-6,9)$.	[3]
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(b)	Find the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$.	[2]
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(c)	Find the value of θ correct to 4 significant figures.	[3]
. = \		
(d)	Find the perimeter and area of the segment shaded in the diagram.	[4]



The diagram shows the curve with equation $y = 2x^{-\frac{2}{3}} - 3x^{-\frac{1}{3}} + 1$ for x > 0. The curve crosses the x-axis at points A and B and has a minimum point M.

(a)	Find the exact coordinates of M .	[4]

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Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.					

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