



#### Cambridge International AS & A Level

CANDIDATE NAME	
CENTRE NUMBER	CANDIDATE NUMBER

MATHEMATICS 9709/12

Paper 1 Pure Mathematics 1

October/November 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.

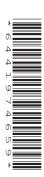
#### **INFORMATION**

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].

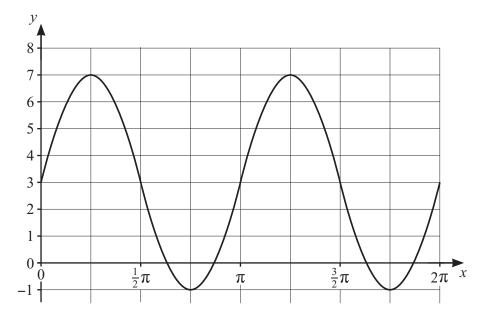
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2



The diagram shows the curve with equation  $y = a\sin(bx) + c$  for  $0 \le x \le 2\pi$ , where a, b and c are positive constants.

(a)	State the values of $a$ , $b$ and $c$ .	[3]

(b) For these values of a, b and c, determine the number of solutions in the interval  $0 \le x \le 2\pi$  for each of the following equations:

(i) 
$$a\sin(bx) + c = 7 - x$$
 [1]

(ii) 
$$a\sin(bx) + c = 2\pi(x-1)$$
. [1]

The first term of an arithmetic progression is -20 and the common difference is 5.

(a)	Find the sum of the first 20 terms of the progression.	[2]
It is	given that the sum of the first $2k$ terms is 10 times the sum of the first $k$ terms.	
(b)	Find the value of $k$ .	[3]



3 The equation of a curve is  $y = 2x^2 - 3$ . Two points A and B with x-coordinates 2 and (2+h) respectively lie on the curve.

(a)	Find and simplify an expression for the gradient of the chord AB in terms of n.	[3]
(b)	Explain how the gradient of the curve at the point $A$ can be deduced from the answ	er to part (a),
	and state the value of this gradient.	[2]
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4 Find the term independent of x in the expansion of each of the following:

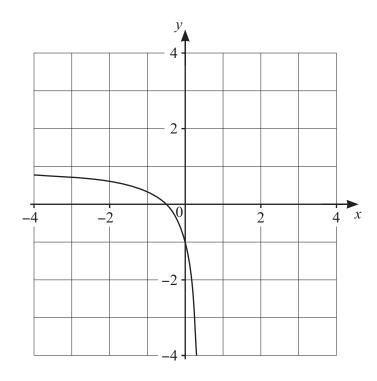
(a)	$\left(x + \frac{3}{x^2}\right)^6$	[2]
(b)	$(4x^3 - 5)\left(x + \frac{3}{x^2}\right)^6.$	[4]



5 The function f is defined by  $f(x) = \frac{2x+1}{2x-1}$  for  $x < \frac{1}{2}$ .

(a) (i) State the value of f(-1). [1]

(ii)



The diagram shows the graph of y = f(x). Sketch the graph of  $y = f^{-1}(x)$  on this diagram. Show any relevant mirror line. [2]

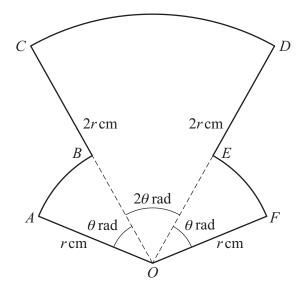
(iii) Find an expression for  $f^{-1}(x)$  and state the domain of the function  $f^{-1}$ . [4]

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	function g is defined by $g(x) = 3x + 2$ for $x \in \mathbb{R}$ .
b)	Solve the equation $f(x) = gf(\frac{1}{4})$ . [3]



6



The diagram shows a metal plate OABCDEF consisting of sectors of two circles, each with centre O. The radii of sectors AOB and EOF are r cm and the radius of sector COD is 2r cm. Angle AOB = angle EOF =  $\theta$  radians and angle COD =  $2\theta$  radians.

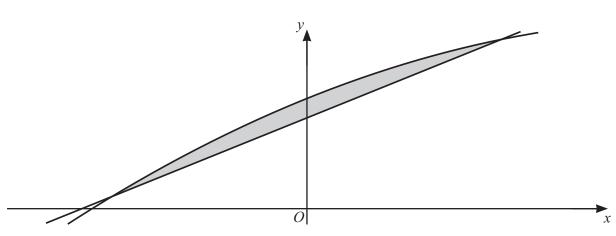
It is given that the perimeter of the plate is 14 cm and the area of the plate is 10 cm<sup>2</sup>.

Given that $r > \frac{3}{2}$ and $\theta < \frac{3}{4}$ , find the values of $r$ and $\theta$ .	[6]

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7 (a) By expressing  $-2x^2 + 8x + 11$  in the form  $-a(x-b)^2 + c$ , where a, b and c are positive integers, find the coordinates of the vertex of the graph with equation  $y = -2x^2 + 8x + 11$ . [3]

**(b)** 



The diagram shows part of the curve with equation  $y = -2x^2 + 8x + 11$  and the line with equation y = 8x + 9.

Find the area of the shaded region. [5]

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8 The equation of a circle is  $x^2 + y^2 + px + 2y + q = 0$ , where p and q are constants.

(a)		ress the equation in the form $(x-a)^2 + (y-b)^2 = r^2$ , where a is to be given in	in terms of $p$ and
	$r^2$ i	s to be given in terms of $p$ and $q$ .	[2]
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The	line	with equation $x + 2y = 10$ is the tangent to the circle at the point $A(4, 3)$ .	
(b)	(i)	Find the equation of the normal to the circle at the point $A$ .	[3]
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(ii)	Find the values of $p$ and $q$ .

	13
Find the values of $p$ and $q$ .	[5]





9 The equation of a curve is  $y = \frac{1}{2}k^2x^2 - 2kx + 2$  and the equation of a line is y = kx + p, where k and p are constants with 0 < k < 1.

)	It is given that one of the points of intersection of the curve and the line has coordinates $\left(\frac{5}{2}, \frac{1}{2}\right)$ .						
	Find the values of $k$ and $p$ , and find the coordinates of the other point of intersection. [7]						

**(b)** 

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It is given instead that the line and the curve do <b>not</b> intersect.	
Find the set of possible values of $p$ .	[3]
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10	A function f with domain $x > 0$ is such that $f'(x) = 8(2x-3)^{\frac{1}{3}} - 10x^{\frac{2}{3}}$ . It is given that the curve with
	equation $y = f(x)$ passes through the point $(1, 0)$ .

	•••••
Find $f(x)$ .	
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It is given that the equation f'(x) = 0 can be expressed in the form

#### $125x^2 - 128x + 192 = 0.$

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