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INTERNATIONAL AS **MATHEMATICS**

(9660/MA02) Unit PSM1 Pure Mathematics, Statistics and Mechanics

Wednesday 8 January 2025 07:00 GMT Time allowed: 1 hour 30 minutes

Materials

- For this paper you must have the OxfordAQA Booklet of Formulae and Statistical Tables (enclosed).
- You may use a graphical calculator.

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer all questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- There are three sections to this paper.
- The maximum mark for this paper is 80. There are 40 marks for **Section A**, 20 marks for **Section B** and 20 marks for **Section C**.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- Show all necessary working; otherwise marks may be lost.



For Examiner's Use		
Question	Mark	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
TOTAL		







The point with coordinates $(k, 10)$ lies on the curve.	Do not write outside the box
Find the value of k	
Give your answer in the form $\log_2 n$ where <i>n</i> is an integer.	
[3 marks]	
	<u> </u>
k =	0
Turn over for the next question	
Turn over ►	



1 (b)





2	(b)	The shaded region is bounded by the line segments <i>BC</i> and <i>CD</i> and the arc	BD
2	(b) (i)	Find the area of the shaded region.	
		Give your answer in cm ² to three significant figures.	[3 marke]
			[5 marks]
		Answer	
2	(b) (ii)	Find the perimeter of the shaded region.	
		Give your answer in cm to three significant figures.	[4 marks]
		Answer	



Do not write outside the box





3	(b)	A different circle C_2 touches C_1 at the point R	Do not wri outside th box
		The circles C_1 and C_2 have the same radius.	
		1 2	
3	(b) (i)	Find the equation of C_2	
		Give your answer in the form $(x-a)^2 + (y-b)^2 = k$ where <i>a</i> , <i>b</i> and <i>k</i> are integers. [4 marks]	
		Answer	
3	(b) (ii)	Describe the single transformation which maps C_1 onto C_2 [2 marks]	
			10
		Turn over ►	



4	(a)	The function f is defined by
		$f(x) = 5 - 2\cos(x - 47^{\circ})$
4	(a) (i)	State the greatest possible value of $f(x)$ [1 mark]
		Answer
4	(a) (ii)	Find the value of x in the interval $0^{\circ} \le x \le 360^{\circ}$ at which the greatest possible value of $f(x)$ occurs.
		[1 mark]
		Answer



Do not write outside the box

4	(b) (i)	Show that	Do not write outside the box
		$\frac{31 - 29\sin\theta - 21\cos^2\theta}{2 - 3\sin\theta} = 5 + k\sin\theta$	
		where k is a constant and $\sin\theta \neq \frac{2}{3}$	
		[3 marks]	
4	(b) (ii)	Hence solve	
		$\frac{31 - 29\sin y - 21\cos^2 y}{2 - 3\sin y} = 5 + 4\cos y$	
		in the interval $0 \le y \le 2\pi$ radians.	
		Give your values to two decimal places. [3 marks]	
		Answer	8







box

5	(b)	It is given that	Do not write outside the box
		$p = \log_7 625$ and $q = \log_7 6$	
		Express $\log_7\left(\frac{216}{5}\right)$ in terms of p and q	
		[4 marks]	
		Answer	7
		Turn over for the next section	



	Section B	Do not wr outside th
	Statistics	DOX
	Answer all questions in the spaces provided	
	Answer an questions in the spaces provided.	
6	A shop sells vegetables.	
	When visiting the shop, 9% of customers buy carrots.	
	A week is chosen at random.	
	A total of 40 customers visit the shop on Monday.	
	Whether a customer buys carrots is independent of whether another customer buys carrots.	
6 (a)	Find the probability that exactly 6 customers buy carrots on Monday.	
	Give your answer to four decimal places. [1 mark	3
		_
		_
		-
	Answer	-
		-
6 (b)	Find the probability that more than 4 customers buy carrots on Monday.	
	Give your answer to four decimal places. [2 marks	3
		_
		_
		_
		_
		_
	Answer	
		-
L		



6	(c)	The variance of the number of customers who buy carrots on Tuesday is 2.3751
		The variance of the number of customers who buy carrots on Wednesday is 2.1294
		The number of customers who buy carrots on any day is independent of the number of customers who buy carrots on any other day.
6	(c) (i)	Find the variance of the total number of customers who buy carrots over the whole three-day period from Monday to Wednesday. [2 marks]
		Answer
6	(c) (ii)	Find the total number of customers who visit the shop over the whole three-day period from Monday to Wednesday. [2 marks]
		Answer
		Turn over for the next question



Turn over ►

Each weekday, Jing decides whether to go for a run before going to work.

She also decides whether to cycle to work.

A weekday is chosen at random.

R represents the event that Jing goes for a run before going to work.

C represents the event that Jing cycles to work.

It is given that $P(R) = \frac{1}{6}$, $P(C) = \frac{17}{23}$ and $P(R | C') = \frac{23}{36}$

7 (a) Determine whether R and C are mutually exclusive.

[4 marks]

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box







7	(b)	The probability that Jing buys lunch at work on a randomly chosen weekday is	<u>5</u> 7	outside the box
		The probability that Jing goes for a run before going to work and buys lunch at is $\frac{9}{50}$	work	
		Find the probability that Jing goes for a run before going to work or buys lunch	at work. [2 marks]	
		Answer		6
		Turn over for the next question		
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			_
8		A biased spinning top has four sections with values 1, 5, 9 and 14	Do not write outside the box
		14 14 9	
		The random variable A represents the value of the section that the spinning top lands on when it is spun.	
		The probability of this spinning top landing on a particular section is directly proportional to the value on that section.	
8	(a)	Show that the mean of A is $\frac{303}{29}$ [4 marks]	







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10 (1	b)	Find the average speed of the car during the first 2 seconds of its motion.	[4 marks]	Do not write outside the box
		Answer		
10 ((c)	The total distance travelled by the car is $\frac{56}{3}$ metres. Show that $T = 20$	[4 marks]	
				12



		Do no
11	Two particles A and B are moving directly towards each other on a smooth horizontal surface.	outsia
	Particle A has mass 2 kg and moves with speed 12 m s ^{-1}	
	Particle <i>B</i> has mass <i>m</i> kg and moves with speed $2q \text{ m s}^{-1}$ where <i>m</i> and <i>q</i> are positive constants.	
	The particles collide.	
	After the collision, particle A continues to travel in its initial direction and the speed of particle B is 4 m s ⁻¹	
11 (a)	The impulse exerted on particle A during the collision has magnitude I N s	
	Find the range of possible values of <i>I</i> [2 marks]	
	Answer	



11 (b)	By considering the possible speeds of A after the collision, show that	Do not write outside the box
	$0 < 12 - m(2 + q) \le 4$ [3 marks]	
	[0 marks]	
		5
	END OF QUESTIONS	



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