2015年度日本政府(文部科学省) 奨学金留学生選考試験

QUALIFYING EXAMINATION FOR APPLICANTS FOR JAPANESE GOVERNMENT (MONBUKAGAKUSHO) SCHOLARSHIPS 2015

学科試験 問題
EXAMINATION QUESTIONS

(学部留学生) UNDERGRADUATE STUDENTS

数 学(B)
MATHEMATICS(B)

注意 ☆試験時間は60分。 PLEASE NOTE: THE TEST PERIOD IS **60 MINUTES**.

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MATHEMATICS	B

(B) Answer Sheet

(2015)

Nationality		No.	
Name	(Please print full name	e, underlining family name)	Marks

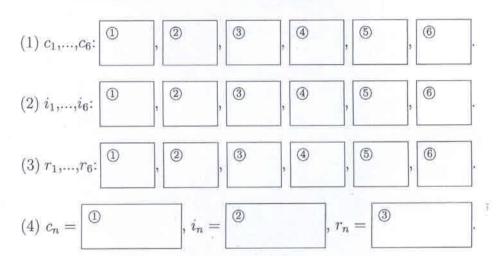
Quest	ion No.			You	r Response)		
1	(1)	1		2		3		
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	(5)		-				•	
2	(1)	1	2	3	4	(5)	6	
	(2)	1	2	3	4	(5)	6	
	(3)	①	2	3	4	(5)	6	
	(4)	①		2	3			
3	(1)	①			2	2		
	(2)							
	(3)							

Nationality	No.	
Name	(Please print full name, underlining family name)	Marks

Answer the following questions and fill in your responses in the corresponding boxes on the answer sheet.

- 1. Fill in the blanks with the correct numbers.
- (1) If the equation $\log_{10}(ax)\log_{10}(bx)+1=0$ with $a>0,\ b>0$ constants has a solution x>0, it follows that $\frac{b}{a}\geq \boxed{\textcircled{1}}$ or $\boxed{\textcircled{2}}$ $\geq \frac{b}{a}>\boxed{\textcircled{3}}$.
- (2) If $\cos \theta = \sqrt{\frac{1}{2} + \frac{1}{2\sqrt{2}}}$ and $\sin \theta = -\sqrt{\frac{1}{2} \frac{1}{2\sqrt{2}}}$ with $0 \le \theta < 2\pi$, it follows that $2\theta = \boxed{\pi}$.
- (3) If $y = \log_2(x + \sqrt{x^2 + 1})$, then $2^y 2^{-y} = x$.
- (4) The function $f(x) = \log_2(\log_3(\log_2(\log_3(\log_2 x))))$ has the interval x > as its maximum domain on real numbers.
- (5) The total number of subtractions that result in 11111 remaining after a four-digit number has been subtracted from a five-digit number and the digits 1 through 9 have all been used is

- 2. Draw a circle C on a plane. Put n distinct points on the circumference of C. Join any two of the n points with a chord. Suppose that no three chords intersect at any one point inside C. Let c_n be the number of such chords, i_n that of intersections of the chords inside C, and r_n that of regions in C bounded by an arc and/or some chords. Fill in the blanks with the answers to the following questions.
 - (1) Find $c_1, c_2, c_3, c_4, c_5, c_6$ and write their values in this order.
 - (2) Find $i_1, i_2, i_3, i_4, i_5, i_6$ and write their values in this order.
 - (3) Find $r_1, r_2, r_3, r_4, r_5, r_6$ and write their values in this order.
 - (4) Express c_n , i_n , r_n with binomial coefficients in terms of n. (For binomial coefficients $\binom{m}{k}$, note that $\binom{m}{k} = 0$ if m < k.)



- 3. Let C be the plane curve y = f(x) defined by the cubic function $f(x) = x^3 4x^2 + ax + b$ with a, b real constants. Fill in the blanks with the answers to the following questions.
 - (1) When C is tangent to the x-axis at x = 3, what are a and b?
 - (2) When (1) holds, find all x such that C has points in common with the x-axis.
 - (3) When (1) holds, calculate the area S of the limited region bounded by C and the x-axis.

Ya V	(I)		2	
$(1) \ a =$		b = 0		

(2)
$$x =$$

(3)
$$S =$$