

2025 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 THE JAPANESE
GOVERNMENT (MEXT) SCHOLARSHIP 2025

学科試験 問題

EXAMINATION QUESTIONS

(学部留学生 (文科系専攻))

UNDERGRADUATE STUDENTS

数 学 (A)

MATHEMATICS(A)

注意 ☆試験時間は 60 分。

PLEASE NOTE: THE TEST PERIOD IS 60 MINUTES.

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

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

(1) The function $f(x) = |x + 1| + |2x - 4|$ takes the minimum value of $\boxed{[1-1]}$ at $x = \boxed{[1-2]}$.

(2) Let a be a real number. The graphs $y = x^2$ and $y = ax - a$ have two different common points. Then the range of a is $a < \boxed{[1-3]}$, $\boxed{[1-4]} < a$.

(3) Suppose the sequence $\{a_n\}$

$$\begin{cases} a_1 = 1 \\ a_{n+1} = a_n + 2^n + \cos\left(\frac{n\pi}{6}\right), \quad n = 1, 2, \dots, 6. \end{cases}$$

Then $a_7 = \boxed{[1-5]}$.

(4) Consider the circle $C : x^2 + y^2 = 1$ and the line $\ell : 4y = -3x + 6$. If the point $P(x_0, y_0)$ moves on C , then the distance L between P and ℓ is

$$L = \frac{\boxed{[1-6]}x_0 + \boxed{[1-7]}y_0 + 6}{\boxed{[1-8]}}.$$

Furthermore, L takes the minimum of $\boxed{[1-9]}$.

(5) Let x and y be integers that are not less than 0. The number of pairs x, y that satisfies the following inequalities is $\boxed{[1-10]}$.

$$\begin{aligned} y &\leq -\frac{1}{2}x^2 + 6 \\ y &\geq -\frac{1}{3}x + 2 \end{aligned}$$

- (6) In the x, y -coordinate system, a graph of quadratic function $y = ax^2 + bx + c$ passes through three points $(2, 3)$, $(3, 5)$, and $(4, 11)$. Then, $a = \boxed{[1-11]}$, $b = \boxed{[1-12]}$, and $c = \boxed{[1-13]}$.
- (7) There are coins of type A and type B that we cannot distinguish in appearance. The probabilities of heads for type A and type B are $\frac{1}{2}$ and $\frac{1}{4}$, respectively. We toss a coin four times. When the number of trials where its head appears is not greater than 1, we estimate that the coin is type B. Otherwise, we estimate that the coin is type A. The probability of the case that we estimate a type A coin as type B is $\boxed{[1-14]}$, and the probability of the case that we estimate a type B coin as type A is $\boxed{[1-15]}$. We have five coins of type A and two coins of type B, and extract a coin from them randomly. Then the probability that we miss the estimation is $\boxed{[1-16]}$.
- (8) Let x and y be non-negative and non-positive integers, respectively. The pair x and y that satisfies $12x + 7y = 2$ and x is minimum is given by $x = \boxed{[1-17]}$ and $y = \boxed{[1-18]}$.

2. Let $a > 0$ and let $C_1 : y = x^2$ and $C_2 : y = x^2 - 2ax + a^2 - 2a$. Suppose that the straight line ℓ is tangent to both C_1 and C_2 .

Answer the following questions and fill in your responses in the corresponding boxes on the answer sheet. Each answer should be an integer or a fraction expressing a rational number. Fractions should be simplified as much as possible and the denominators should be positive integers.

(1) The equation of ℓ is $y = \boxed{[2-1]}x + \boxed{[2-2]}$.

(2) The xy -coordinate of the tangent point between ℓ and C_2 is

$$\left(\boxed{[2-3]}a + \boxed{[2-4]}, \boxed{[2-5]}a + \boxed{[2-6]} \right).$$

(3) The area enclosed by C_1 , C_2 , and ℓ is $\boxed{[2-7]}a^3$.

3. Let quadrilateral ACDB be inscribed in circle O, where edge AB is the diameter of circle O. Let E be the intersection point of line AD and line BC, and F be the intersection point of line AC and line BD. We denote the length of edge XY as XY in general. We assume that $AC = 5$, $AD = 7$, $CD = 3\sqrt{2}$.

Answer the following questions and fill in your responses in the corresponding boxes on the answer sheet. Each answer should be an integer or a fraction expressing a rational number. Fractions should be simplified as much as possible and the denominators should be positive integers.

$$(1) \ AB = \boxed{[3-1]} + \boxed{[3-2]}\sqrt{2}.$$

$$(2) \ AE = \boxed{[3-3]}.$$

$$(3) \ BD = \boxed{[3-4]}.$$

$$(4) \ \frac{BD}{DF} \frac{AF}{AC} \frac{CE}{BE} = \boxed{[3-5]}.$$

$$(5) \ FC = \boxed{[3-6]}.$$

$$(6) \ FD = \boxed{[3-7]}.$$