

2019 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 2019

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**.

MATHEMATICS (B)

(2019)

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

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) The total number of positive divisors of 2019 is ①,
 and the whole sum of those divisors is ②.
- (2) For the three points $O(0, 0)$, $A(3, 0)$, and $B(3, 4)$ on the xy -plane, the equation of the angle bisector of $\angle AOB$ is $y =$ x .
- (3) For parabola $y = x^2$ and two points $(-1, 1)$ and $(3, 9)$ on it, its tangent line parallel to the line through the two points is the line $y =$ ① $x +$ ②, whose point of tangency is the point $\left(\begin{array}{c} \text{③} \\ \text{④} \end{array} \right)$.
- (4) When the line $y = m(x - 5) + 3$ intersects the circle $x^2 + y^2 = r^2$ ($r > 0$) if and only if $0 \leq m \leq$ ①, $r =$ ②.
- (5) When $|x| \leq \frac{\pi}{2}$, the maximum of $\sin x + \cos x$ is ①,
 and the minimum of that is ②.
- (6) By $\log_{10} 2 \approx 0.3010$ and $\log_{10} 3 \approx 0.4771$, the number of digits of 6^{100} is ①, and its leading digit is ②.

2. Let $I(m, n)$ be a function of a pair (m, n) of natural numbers that is inductively defined by the following:

- (i) $I(m, 1) = I(1, n) = 1$ (for any (m, n));
- (ii) $I(m + 1, n) + I(m, n + 1) = I(m + 1, n + 1)$ (for any (m, n)).

Fill in the blanks with the answers to the following questions.

(1) Express $I(2, n)$ and $I(3, n)$ in terms of n .

(2) Find the value of $I(5, 3)$.

(1) $I(2, n) =$ ① $I(3, n) =$ ②

(2) $I(5, 3) =$

3. Let $f(x) = e^x$, $g(x) = 1 + x$, and $h(x) = 1 + x + \frac{1}{2}x^2$. Fill in the blanks with the answers to the following questions.

(1) When $x < 0$, arrange $f'(x)$, $g'(x)$, and $h'(x)$ in ascending order.

(2) When $x < 0$, arrange $f(x)$, $g(x)$, and $h(x)$ in ascending order.

(3) Compute $I_1 = \int_{-1}^0 |f(x) - g(x)| dx$ and $I_2 = \int_{-1}^0 |f(x) - h(x)| dx$.

(1) ① $<$ ② $<$ ③

(2) ① $<$ ② $<$ ③

(3) $I_1 =$ ① $I_2 =$ ②