

2006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 2006

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.

(2006)

MATHEMATICS (B)

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

1 Fill in the blanks with the correct numbers.

(1) The solution of the inequality $|2x - 1| < x + 2$ is

$$\boxed{\textcircled{1}} < x < \boxed{\textcircled{2}} .$$

(2) The x -axis is tangent to the graph of the function $y = x^2 + ax + 1$

if and only if $a = \boxed{\textcircled{1}}$ or $\boxed{\textcircled{2}}$.

(3) The minimum of the function $f(x) = (\log_2 x)^2 + \log_4 x + 1$ is $\boxed{}$.

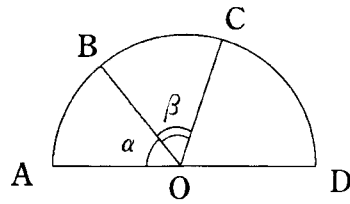
(4) The three points $(1, 2, 4)$, $(2, 5, 6)$, and $(\boxed{\textcircled{1}}, \boxed{\textcircled{2}}, 10)$ are on the same line.

(5) $\int_0^{\frac{\pi}{2}} x \sin x dx = \boxed{}$.

- 2 Four points A, B, C and D lie on a circle in that order. The radius of this circle is 1 and the center is O . Suppose the line AD is a diameter of this circle and the ratio of the areas of the triangles is

$$\triangle OAB : \triangle OBC : \triangle OCD = 1 : 2 : 2.$$

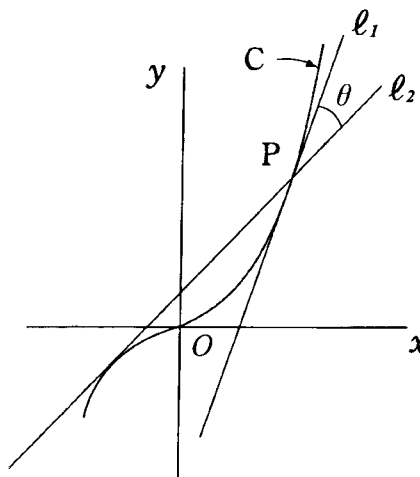
- (1) Let $\alpha = \angle AOB$ and $\beta = \angle BOC$. Find $\sin \alpha : \sin \beta$.



- (2) Find the area of the rectangle $ABCD$.

- 3 Let p be a positive number. Let C be the curve $y = 2x^3$ and $P(p, 2p^3)$ a point on C . Let l_1 be the tangent line at P and l_2 be another tangent line of C which passes through P .

- (1) Express the slope of l_2 in terms of p .



- (2) Find $\tan \theta$, where θ is the angle formed by l_1 and l_2 and $0 < \theta < \frac{\pi}{2}$.

- (3) Find the maximum value of $\tan \theta$.