

2007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 2007

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)

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

1 Fill in the blanks with the correct numbers.

(1) If  $2^x \cdot 4^y = 32$  and  $\frac{3^x}{9^y} = 3$ , then  $\frac{5^x}{125^y} = \boxed{\phantom{000}}$ .

(2) When  $a - \frac{1}{a} = 2$ , then  $a^3 - 2a^2 - \frac{2}{a^2} - \frac{1}{a^3} = \boxed{\phantom{000}}$ .

(3)  $4 \log_2 \sqrt{2} - \frac{1}{2} \log_2 3 + \log_2 \frac{\sqrt{3}}{2} = \boxed{\phantom{000}}$ .

(4) The lengths of the sides of  $\triangle ABC$  are  $AB = 6$ ,  $BC = 4$ , and  $CA = 5$ . Then

$\cos A = \boxed{\phantom{000}}$ .

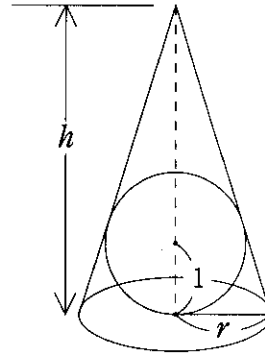
(5) Let  $\alpha, \beta$  be the two solutions of the quadratic equation

$$3x^2 + 6x + 7 = 0.$$

Then the value of  $(2\alpha - \beta)(2\beta - \alpha)$  is  $\boxed{\phantom{000}}$ .

2 Suppose that a sphere of radius 1 is inscribed in a right circular cone with radius  $r$  and height  $h$ .

(1) Express  $r$  in terms of  $h$ .



(2) Find the minimum of the volume of such a right circular cone.

3 Let  $\{a_n\}$  be the sequence defined by

$$a_n = \left[ \frac{n^2 + 8n + 10}{n + 9} \right],$$

where  $[x]$  denotes the largest integer which does not exceed  $x$ . Find the value

of  $\sum_{n=1}^{30} a_n$