2013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 2013

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) (2013)

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

Marks	

1. Fill in the blanks with the correct answers.

(1) The minimum of the function $f(x) = (2+\sin x)(5-\sin x)$ is $\boxed{\quad}$.

(2) If $(2k+1)x-(k-2)y+3k-1=0$ for every k, then $x = \boxed{\text{(i)}}$ and $y = \boxed{\text{(ii)}}$.

(3) If three straight lines $x+2y-1=0, x-y+2=0, ax-y+3=0$ meet at one point, then $a = \boxed{\quad}$.

(4) Let a and b be rational numbers. If $\dfrac{(\sqrt{3}+\sqrt{2})^3}{\sqrt{3}-\sqrt{2}} = a+b\sqrt{6}$, then $a = \boxed{\text{(i)}}$ and $b = \boxed{\text{(ii)}}$.

(5) If $3^x = 2^y = 5$, then $\dfrac{1}{x}+\dfrac{1}{y} = \log_5 \boxed{\quad}$.

2. Consider the function $F(x) = \int_a^x f(t)dt = x^3 - 2x^2 + x - a \quad (a \neq 0)$. Fill in the blanks with the answers to the following questions.

(1) Find a.

(2) Find the range of x where $F(x) > 0$.

(3) Find the area of the region surrounded by the x-axis and the graph of $f(x)$.

(1) [ ] (2) [ ] (3) [ ]

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

(1) Find the range of m such that the equation $|x^2-3x+2| = mx$ has 4 distinct real solutions α, β, γ, δ.

(2) Express the value of $s(m) = \dfrac{1}{\alpha^2} + \dfrac{1}{\beta^2} + \dfrac{1}{\gamma^2} + \dfrac{1}{\delta^2}$ in terms of m.

(3) When m varies as in (1), find the range of $s(m)$.

(1) [ ] (2) [ ]

(3) [ ]