2008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 2008

学科試験　　問題

EXAMINATION QUESTIONS

（専修留学生）

SPECIAL TRAINING COLLEGE STUDENTS

数　　学

MATHEMATICS

注意　☆試験時間は60分。

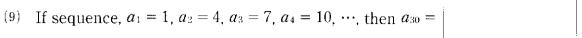PLEASE NOTE : THE TEST PERIOD IS 60 MINUTES.

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

1 Fill in the following blanks with correct answers.

(1) $2\sqrt{12} - 3\sqrt{6} \div \sqrt{18} = $ [_____] .

(2) $\dfrac{x^2 - x - 6}{x^2 + x - 2} - \dfrac{2x - 4}{x - 1} = $ [_____] .

(3) When $\alpha + \beta = 2$ and $\alpha\beta = 4$, then $\alpha^2 + \beta^2 = $ ① [_____]

and $\alpha^3 = $ ② [_____] .

(4) The smallest solutions of equation $x^4 - 13x^2 + 36 = 0$ is [_____] .

(5) The solutions of equation $\sin^2 x - \cos x + 1 = 0 \quad (0° \leqq x < 360°)$

is [_____] .

(6) The solutions of equation $2\log_{10}(x - 4) - \log_{10} 4(x - 1) = 0$

is [_____] .

(7) The area of the common region expressed by two inequalities, $x^2 + y^2 \leqq 4$ and

$x + y \leqq -2$, is [_____] .(circular constant : π)

(8) There are five boys and five girls.

(i) How many ways can three be chosen from ten? The answer is

[_____] .

(ii) How many ways can three boys and two girls be chosen from the ten?

The answer is [ ] .

(9) If sequence, $a_1 = 1$, $a_2 = 4$, $a_3 = 7$, $a_4 = 10$, $\cdots$, then $a_{30} =$ [ ] .

(10) Let vector $\vec{a} = (2, 3)$ and $\vec{b} = (x, 2)$. When $\vec{a}$ and $\vec{b}$ are vertical,

$x =$ ① [ ] . When $\vec{a}$ and $\vec{b}$ are parallel, $x =$ ② [ ] .

(11) Let $f(x) = x^3 - 6x^2 + 9x$.

(i) $f'(x) =$ ① [ ] , and when $x =$ ② [ ] , the graph

of $y = f(x)$ has a maximum value.

(ii) The area enclosed by $y = f(x)$ and x axis is [ ] .

2 On the plane xy, there are three points: O (0, 0), A (2, 4), B (3, 0).
Fill in the following blanks with correct answers.

(1) Taking point D in the fourth quadrant and when the quadrilateral ODBA is

parallelogram, the coordinates of point D is

(① [ ] , ② [ ]).

(2) When a straight line $x = p$ bisects the area of $\triangle$OAB,

$p =$ [ ] .

(3) When a straight line $y = q$ bisects the area of $\triangle$OAB,

$q =$ [ ] .

(4) When the straight line L drawn from point B bisects the area of $\triangle$OAB, the equation of the straight line L is $y = $

$$\boxed{}.$$

(5) The equation of a parabola which passes three points : O, A, B is

$$y = \boxed{}.$$

3 Given ten functions, (1) to (10) and five properties of function, (a) to (e).

Which properties does each function have?

Choose one or two properties and write the appropriate answer in the box.

Functions :

(1) $|x|$ (2) x (3) x^2 (4) x^3 (5) $x - \dfrac{1}{x}$

$$\boxed{} \quad \boxed{} \quad \boxed{} \quad \boxed{} \quad \boxed{}$$

(6) $\sin x$ (7) $\cos x$ (8) 2^x (9) 2^{-x} (10) $\log_2 x$

$$\boxed{} \quad \boxed{} \quad \boxed{} \quad \boxed{} \quad \boxed{}$$

Properties :

(a) $f(-x) = -f(x)$ (b) $f(-x) = f(x)$ (c) $f\left(\dfrac{1}{x}\right) = -f(x)$

(d) $f(kx) = kf(x)$ (e) $f(x) \cdot f(y) = f(x+y)$