2012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 2012

学科試験 問題

EXAMINATION QUESTIONS

(高等専門学校留学生)

COLLEGE OF TECHNOLOGY STUDENTS

数 学

MATHEMATICS

注意 ☆試験時間は60分

PLEASE NOTE: THE TEST PERIOD IS 60 MINUTES.

(2012)

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

- 1 Answer all questions and write your answers in the boxes provided.
 - 1) Solve the equation $2x^3 + 3x^2 8x + 3 = 0$.

 $x = \frac{1}{1000}$

2) Solve the equation $4\sin x \cos x - 1 = 0$ for $0 \le x \le \frac{\pi}{2}$.

x =

3) Solve the inequality $4^x - 2^{x+1} > 48$.

4) Solve the inequality $\log_4(2-x) > \log_2 x$.

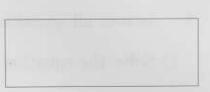
5) Let $\vec{a} = (2, 5)$ and $\vec{b} = (1, -1)$. Find the value of the constant t which minimizes $|\vec{a} + t\vec{b}|$.

t =

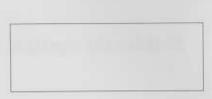
6) Find the angle θ between the two lines x-2y=3 and 3x-y=2, where the range of values of θ is $0 \le \theta \le \frac{\pi}{2}$.



7) Calculate $\sum_{k=1}^{100} \frac{1}{k(k+1)}$.



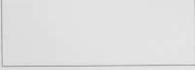
8) Calculate $\lim_{x\to\infty} \frac{\sqrt{x+1} - \sqrt{x}}{\sqrt{3x+5} - \sqrt{3x+1}}$.



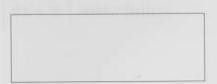
9) Calculate $\lim_{x\to 0} \frac{\log(1+3x)}{x}$.



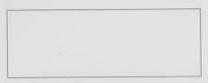
10) A single dice is thrown four times. Find the probability of getting a 5 twice.



11) Find the derivative $\frac{dy}{dx}$ of $y = \log \sqrt{\frac{1 + \sin x}{1 - \sin x}}$.



12) Calculate $\int_0^{\frac{\pi}{6}} \cos^3 x dx$.



- 2 Let $A = \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$ and $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$.
 - 1) Calculate $A^2 5A$.

2) Calculate $A^3 - 5A^2 + A + I$.

3) Calculate $A^4 - 3A^3 - 10A^2 + A + I$.

- 3 Let l be the tangent line to the curve $y = 4 x^2$ at the point $(a, 4 a^2)$, where a > 0. Denote by S(a) the area of the triangle enclosed by the x-axis, the y-axis and l.
 - 1) Find the equation of l.

2) Find S(a).

3) Find the minimum value of S(a).