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 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.

(2013)

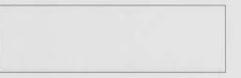
MATHEMATICS

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



Answer all questions and write your answers in the boxes provided. 1

1) Let
$$x = \frac{3 + \sqrt{5}}{3 - \sqrt{5}}$$
 and $y = \frac{3 - \sqrt{5}}{3 + \sqrt{5}}$. Calculate $x^3 + y^3$.



2) Solve the equation $x^3 + 5x^2 + 8x + 6 = 0$.

$$x = \frac{1}{2}$$

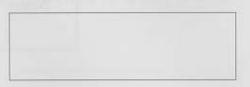
3) Solve the equation $3^{2x+1} + 2 \cdot 3^x - 1 = 0$.

$$x =$$

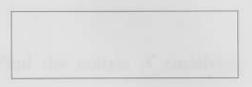
4) Solve the equation $\cos^2 x - \sin x \cos x = 1$ $(0 \le x < 2\pi)$.

$$x =$$

5) Solve the inequality $x^2 - 4x + 2 < 0$.



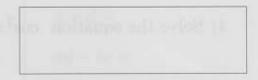
6) Solve the inequality $(\log_2 x)^2 - 2\log_4 x^3 + 2 < 0$.



7) Let $\vec{a}=(2,\ 1,\ -3),\ \vec{b}=(1,\ 0,\ -2)$ and $\vec{c}=\vec{a}+t\vec{b}$. Find the value of the constant t which satisfies $\vec{c}\perp\vec{a}$.

$$t =$$

8) Calculate the area of the triangle OAB with vertices O(0, 0, 0), A(3, 1, 4), B(-1, 4, 3).

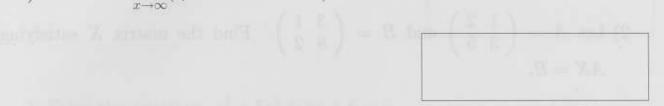


9) A sequence $\{a_n\}$ satisfies the following conditions. Calculate $\lim_{n\to\infty} a_n$.

$$a_1 = 3$$
, $a_{n+1} = \frac{2}{3}a_n + \frac{1}{4}$ $(n = 1, 2, 3, \cdots)$



10) Calculate $\lim_{x\to\infty} (\sqrt{x^2 + 3x + 1} - x)$.



11) Find the value of the constant k for which the line y = 2x + 1 is a tangent to the curve $y = x^3 + kx + 3$.

of Solid the equation (2) and
$$k = 1$$
 and $k = 1$ and

12) Find the value of x which minimizes $f(x) = x - \sqrt{1 - x^2}$.

$$x =$$

- 2 Let $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ and $O = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$. Answer the following questions and write your answers in the boxes provided.
 - 1) Let $A = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & a \\ b & 2 \end{pmatrix}$. Find the values of a and b which satisfy AB = O.

$$a =$$

$$b =$$

2) Let $A=\begin{pmatrix}1&2\\3&5\end{pmatrix}$ and $B=\begin{pmatrix}3&1\\8&2\end{pmatrix}$. Find the matrix X satisfying AX=B.

$$X =$$

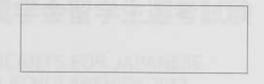
3) Let $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ satisfying $A^2 + A - 6I = O$ and a + d > 0. Find the values of a + d and ad - bc.

$$a + d =$$

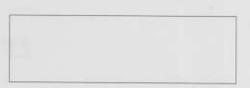
$$ad - bc =$$

3 Answer all questions and write your answers in the boxes provided.





2) Calculate $\int_0^{\pi} t \sin^2 t \, dt$.



3) Find the function f(x) which satisfies $f(x) = x + \frac{1}{\pi} \int_0^{\pi} f(t) \sin^2 t \, dt$.

$$f(x) =$$