Pre 1st Kyu

Section 1 : Calculation Test

数学検定

PROFICIENCY TEST
IN
PRACTICAL MATHEMATICS

Test Time : 60 minutes

Test Instructions

1 . Make sure that you have the correct level (Kyu) test.

2 . Do not open the booklet until you are told to do so.

3 . Write your examinee number and name on this page.

4 . Write your name, examinee number and other necessary information on the answer sheets.

5 . Write only answers on the answer sheets provided.

6 . You may not use a calculator, ruler or compass.

7 . Turn off your cell phone and do not use it during the test.

8 . Ask an examination supervisor if your problem sheets have inconsistent page numbering or missing pages.

9 . It is prohibited to disclose the problems to the general public, such as on the Internet, without permission.

Examinee Number	–	Name	

※Your personal information will be handled appropriately according to the "Handling of Personal Information" agreement that was approved at the time of registration.

公益財団法人
日本数学検定協会
The Mathematics Certification Institute of Japan

[Pre-1st Kyu] Section 1: Calculation Test

1 Find the range of values of θ that satisfies the following inequality for $0 < \theta < \pi$.

$$\sqrt{3}\tan^2\theta + (\sqrt{3}-1)\tan\theta - 1 < 0$$

2 Let r be a positive real number. Find the range of values of r such that the two circles $(x-2)^2 + (y+1)^2 = 9$ and $(x+1)^2 + (y-3)^2 = r^2$ intersect at two distinct points.

3 Let $S_n = \sum_{k=1}^{n} 3^k$. Find the following sum.

$$\sum_{n=1}^{6} S_n$$

4 Consider the two complex numbers $z = 1 - i$ and $w = \sqrt{3} + i$. Note that i represents the imaginary unit.

① Find the modulus of $z^6 w^3$.

② Find the argument θ of $z^6 w^3$, where $0 \leq \theta < 2\pi$.

5 Consider the function $f(x) = \cos x - \sin 2x$.

① Find the derivative function $f'(x)$.

② For the curve $y = f(x)$ in the xy-plane, find the equation of the tangent line to the curve at the point $(\pi,\ f(\pi))$.

6 Find the coordinates of the focus of the parabola $y^2 - 12y = 12x$ in the xy-plane.

7 Evaluate the following limit.

$$\lim_{n\to\infty}\left(1+\frac{5}{n}\right)^{2n}$$