2nd Kyu

Section 1 : Calculation Test

数学検定

PROFICIENCY TEST
IN
PRACTICAL MATHEMATICS

Test Time : 50 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 name and examinee number 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. If your answer contains a fraction, write the fraction in simplest form by reducing it to lowest terms.
7. If your answer contains a radical, write your answer in simplest radical form. For example, $\sqrt{12}$ must be expressed as $2\sqrt{3}$.
8. You may not use a calculator, ruler or compass.
9. Turn off your cell phone and do not use it during the test.
10. Ask an examination supervisor if your problem sheets have inconsistent page numbering or missing pages.
11. It is prohibited to disclose the problems to the general public, such as on the Internet, without permission.

Please submit this test upon agreeing to the following "handling of personal information".

Information regarding the handling of all personal information attached to this form

1. Name of Organization : The Mathematics Certification Institute of Japan
2. Title, Affiliation and Contact Information of Personal Information Protection Administrator :
   Title : Personal Information Protection Administrator
   Department: Secretariat Contact Information : 03-5812-8340
3. Purpose for Use of Personal Information : Management of examinee information, marking, and for the purpose of identifying candidates
4. Provision of Personal Information to Third Parties : In cases where an application is made through the organization's office, registration information, names, test level and test results for the purpose of informing certification results via the Internet, fax, mail or electronic mail attachment, etc. will be provided to the applicant.
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6. Requests for Disclosure of Personal Information : Examinees may submit inquiries to customer information concerning the disclosure of personal information concerning themselves. In this case, the Organization shall confirm the customer's identity and respond within a reasonable period.
   [Customer Information]
   The Mathematics Certification Institute of Japan, Certification Inquiry Desk
   Bunshodo Building 6F, 5-1-1 Ueno, Taito Ward, Tokyo, 110-0005
   Tel : 03-5660-4804 (Monday to Friday 9:30-17:00 not including national holidays, New Year's holidays and organization holidays)
7. Voluntariness of the Provision of Personal Information : Whether to provide personal information to the Organization is entirely up to the examinee. However, if the Organization does not receive accurate information, it may not be possible to provide certain services in an appropriate manner.

Name	
Examinee Number	–

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

[2nd Kyu] Section 1: Calculation Test

1 Expand and simplify the following expression.

$$(x+y+3z)^2$$

2 Factorize the following expression.

$$x^3+18x^2+108x+216$$

3 Simplify the following expression. If the answer is a fraction, rationalize the denominator.

$$\frac{2\sqrt{2}}{1+\sqrt{3}}-\sqrt{24}$$

4 Find the value of $\tan\theta$ when $\cos\theta=-\frac{1}{10}$ for $90°<\theta<180°$.

5 In how many different ways can the five letters, A, A, B, B, C be arranged in a line?

6 Let the universal set $U = \{ x \mid x$ is a positive integer less than or equal to $9\}$ and the two subsets of U, A and B be

$A = \{ 2,\ 3,\ 5,\ 7 \}$ and $B = \{ 2,\ 4,\ 6,\ 8 \}$.

How many elements does set $\overline{A} \cup B$ have? Note that $\overline{A}$ represents the complement of set A.

7 Consider the parabola $y = x^2 + (k+1)x - k$, where k is a constant. Determine the value of k such that the parabola is tangent to the x-axis.

8 Find the remainder when the polynomial $2x^3 - x^2 + x + 1$ is divided by the polynomial $x + 2$.

9 Find the exact value of $\sin 165°$. If the answer is a fraction, rationalize the denominator.

10 Find the real numbers a and b that satisfy the following equality. Note that i represents the imaginary unit.

$$(3 + 5i)(a + bi) = 7 - 2i$$

11 Simplify.

$(2-\log_3 18)\log_2 9$

12 Find the coordinates of the centroid of $\triangle$ABC whose coordinates of the three vertices are $A(2,\ 1)$, $B(3,\ -2)$ and $C(4,\ 7)$.

13 Find the 8th term of the arithmetic sequence whose 2nd term is 2 and 4th term is -4.

14 Consider the two vectors, $\vec{a}=(1,-1)$ and $\vec{b}=(3,4)$.

① Find the scalar product (dot product) of $\vec{a}$ and $\vec{b}$, $\vec{a}\cdot\vec{b}$.

② Find the value of $\cos\theta$, where θ is the angle between the two vectors for $0^\circ \le \theta \le 180^\circ$.

15 Answer the following.

① Find the following indefinite integral.

$$\int (1-4x+8x^2)\,dx$$

② Evaluate the following definite integral.

$$\int_0^2 (1-4x+8x^2)\,dx$$