

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 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. 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.

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.
5. Outsourcing of Personal Information Handling : Personal information only for the purposes described in the preceding section, "purpose for using personal information", may be outsourced.
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

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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 quotient when the polynomial $x^8 + x^4 + 1$ is divided by the polynomial $x^2 + x + 1$ (the remainder is 0).
- 2** The five real numbers 1, a , b , c , 9 form a geometric sequence in this order. Find the possible values of a (you don't need to answer the values of b and c).
- 3** The three unit vectors \vec{a} , \vec{b} and \vec{c} in the space satisfy $\vec{a} \perp \vec{b}$, $\vec{b} \perp \vec{c}$ and $\vec{c} \perp \vec{a}$.
Let θ be the angle between the two vectors $\vec{a} + 2\vec{b} + 3\vec{c}$ and $3\vec{a} + \vec{b} - 2\vec{c}$. Find the value of $\cos\theta$.

4 Consider the complex number $z = \frac{\sqrt{3}}{2} - \frac{1}{2}i$. Note that i represents the imaginary unit.

① Find the argument θ of z , where $0 \leq \theta < 2\pi$.

② Find the real numbers a and b that satisfy $z^5 + \frac{1}{z^5} = a + bi$.

5 Answer the followings. Note that e represents the base of the natural logarithm.

① Find the following indefinite integral.

$$\int \frac{1}{x^2 e^{\frac{1}{x}}} dx$$

② Evaluate the following definite integral.

$$\int_{\frac{1}{2}}^1 \frac{1}{x^2 e^{\frac{1}{x}}} dx$$

- 6** For the hyperbola $x^2 - y^2 = 2$ in the xy -plane, find the coordinates of the foci.

- 7** Evaluate the following limit.

$$\lim_{x \rightarrow 0} \frac{1}{x} \left(\frac{1}{\sin x} - \frac{1}{\tan x} \right)$$