

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 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. 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.

Examinee Number	—	Name	
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※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

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- 1 Expand and simplify the following expression.

$$(x^2 + 2xy + 3y^2)(x^2 - 2xy + 3y^2)$$

- 2 Factorize the following expression.

$$12a^2 + 35a + 8$$

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

$$\frac{3\sqrt{5}}{\sqrt{5} - \sqrt{2}} - \frac{6}{\sqrt{10} + 2}$$

- 4 Solve the following quadratic inequality.

$$-x^2 + 2x + 24 > 0$$

- 5 In $\triangle ABC$, find the length of side CA if $AB = 10$, $BC = 8$ and $\cos B = \frac{1}{8}$.

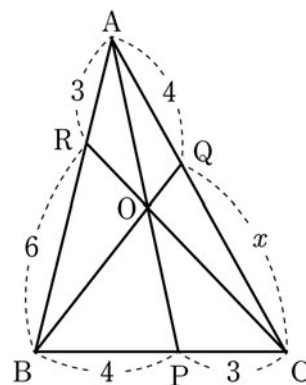
- 6 Let the universal set be $U = \{x \mid x \text{ is a positive integer less than or equal to } 500\}$ and the two subsets A and B be

$$A = \{x \mid 0 < x \leq 500, x \text{ is a multiple of } 3\},$$

$$B = \{x \mid 0 < x \leq 500, x \text{ is a multiple of } 7\}.$$

Find the number of elements of set $A \cup B$.

- 7 In the figure of $\triangle ABC$, three points P, Q and R lie on sides BC, CA and AB, respectively. Three line segments AP, BQ and CR intersect at one point O. Find the value of x .



- 8 Find the remainder when the polynomial $2x^3 + 3x^2 + 7x + 15$ is divided by $x + 2$.

- 9 Simplify the following expression. Note that i represents the imaginary unit.

$$(3 - i)(1 + 2i)(1 - i)$$

- 10 Find the value of $\cos 2\theta$ if $\sin \theta = -\frac{5}{6}$.

11 Simplify the following expression.

$$\log_4 \frac{16}{9} + \log_2 3$$

12 In the xy -plane, find the radius of the circle $x^2 + y^2 - 2x + 6y - 3 = 0$.

13 If the variance of random variable X is $\frac{5}{36}$, find the variance of random variable $Y = 2X - 3$.

14 An arithmetic sequence has first term -2 and common difference 5 .

① Find the 14th term.

② Find the sum of the first 14 terms.

15 Answer the following.

① Find the following indefinite integral.

$$\int (3x^2 - 8x + 5)dx$$

② Evaluate the following definite integral.

$$\int_1^5 (3x^2 - 8x + 5)dx$$