

# 2025 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 (MEXT) SCHOLARSHIP 2025

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.

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

|       |  |
|-------|--|
| Marks |  |
|-------|--|

1 Answer the following questions and write your answers in the boxes provided on your answer sheet.

1) Find the values  $a$  and  $b$  such that  $\frac{3x+1}{(x-2)(x+3)} = \frac{a}{x-2} + \frac{b}{x+3}$  is an identity.

2) Solve the inequality  $x^3 - 4x^2 + 5x - 2 \geq 0$ .

3) Solve the equality  $\sin x - \sqrt{3} \cos x = 0$  ( $0 \leq x < 2\pi$ ).

4) Assume that  $\log_{10} 2 = 0.30102$  and  $\log_{10} 3 = 0.4771$ . Find the number of digits in  $12^{10}$ .

- 5) Find the coordinates of the foci of the ellipse  $x^2 + \frac{y^2}{4} = 1$ .
- 6) Find the coefficient of  $x$  in the expansion of  $\left(x - \frac{2}{x}\right)^7$ .
- 7) Let  $\{a_n\}$  be the sequence satisfying the recurrence relation  $a_1 = 2$ ,  $a_{n+1} = a_n + 2n$  for all  $n \geq 1$ . Find the value of  $a_{101}$ .
- 8) Find the value of  $\lim_{x \rightarrow 0} \frac{\sin 2x}{3x}$ .

9) Find the function  $f(x)$  such that  $f(x) = \lim_{h \rightarrow 0} \frac{\cos(x+h) - \cos x}{h}$ .

10) Find the value of the definite integral  $\int_0^2 x^2 e^{x^3} dx$ .

11) Let  $A = \begin{pmatrix} -1 & -2 \\ 0 & 5 \end{pmatrix}$  and  $B = \begin{pmatrix} 1 & 1 \\ 0 & x \end{pmatrix}$ . If  $AB = BA$ , then find the value of  $x$ .

12) Find the value of the determinant  $\begin{vmatrix} -1 & 2 & 4 \\ 0 & 1 & 3 \\ 1 & -2 & -1 \end{vmatrix}$ .

2 For the three points on the  $xy$ -plane  $A = (2, -1)$ ,  $B = (-1, 3)$  and  $C = (3, 1)$ , answer the following questions and write your answers in the boxes provided.

1) Find the equation of the straight line passing through the points A and B.

2) Find the perpendicular distance from the point C to the line found in 1).

3) Find the area of the triangle ABC.

3 Consider the function  $f(x) = -2x^3 + x^2 + 1$ . Answer the following questions and write your answers in the boxes provided.

1) Find the local maximum value  $y_{max}$  of  $f(x)$ .

2) Find the local minimum value  $y_{min}$  of  $f(x)$ .

3) Find the coordinates of the points of intersections of the curve  $y = -2x^3 + x^2 + 1$  and the curve  $y = -x^2 + 1$ .

4) Find the area of the region bounded by the curve  $y = -2x^3 + x^2 + 1$ , and the curve  $y = -x^2 + 1$ .