

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

- 1** Determine the values of  $a$  and  $b$  such that the following equality is identity.

$$x^3 + x = (x-1)^3 + a(x-1)^2 + b(x-1) + 2$$

- 2** Determine the real numbers  $a$  and  $b$  such that they satisfy the following equality. Note that  $i$  represents the imaginary unit.

$$\frac{1}{i + \frac{2}{i + \frac{3}{i + 4}}} = a + bi$$

- 3** A circle passes through three points, A(0, 0), B(1, -3) and C(4, -2) on  $xy$ -plane. Find the equation of the circle.

**4** Consider two  $2 \times 2$  matrices,  $A = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$  and  $B = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ .

① Find the  $2 \times 2$  matrix  $X$ , such that  $AX = B$ .

② Find the  $2 \times 2$  matrix  $Y$ , such that  $YA = B$ .

**5** Answer the following.

① Evaluate the following indefinite integral.

$$\int \frac{x}{\sqrt{x+1}} dx$$

② Evaluate the following definite integral.

$$\int_0^1 \frac{x}{\sqrt{x+1}} dx$$

- 6** Find the equation of the parabola on  $xy$ -plane with focus at the point  $(0, 0)$  and whose directrix is the line  $y = 2$ .

- 7** Evaluate the following limit.

$$\lim_{x \rightarrow 0} \frac{2^x - 1}{x}$$