

## Quadratic function

1

If the functions  $f(x)$  and  $g(x)$  are  $f(x)=3x-1$  and  $g(x)=-2x^2+4x$ , find the following values.

(1)  $f(0)$

(2)  $f\left(-\frac{1}{3}\right)$

(3)  $f(3a)$

(4)  $g(2)$

(5)  $g\left(\frac{1}{2}\right)$

(6)  $g(a-1)$

2

Find the value range of the following function.

(1)  $y=3x+1$  ( $-2 \leq x \leq 0$ )

(2)  $y = -\frac{1}{3}x - 2$  ( $-3 \leq x \leq 1$ )

3

Answer how the graphs of the following quadratic functions are each parallel shifts of the graph of the quadratic function  $y=2x^2$ . Sketch the graph of each and find its axis and vertex.

(1)  $y=2x^2-1$

(2)  $y=2(x-2)^2$

(3)  $y=2(x+1)^2-3$

4

- (1) Sketch the quadratic function  $y = -3x^2 - 2x + 1$  and find its axis and vertex.
- (2) When the vertices of two parabolas  $y = x^2 - 8x$  and  $y = -\frac{1}{2}x^2 + ax - 3b$  coincide, find the values of the constants  $a$  and  $b$ .

5

- (1) How much parallel shift of the parabola  $y = -2x^2 - 14x - 13$  will overlap the parabola  $y = -2x^2 + 8x + 7$  ?
- (2) When the graph of the quadratic function  $y = x^2 + ax + 4$  is translated by 2 along the  $x$ -axis direction to form the graph of the quadratic function  $y = x^2 - 9x + b$ , find the values of the constants  $a$  and  $b$ .
- (3) Fill in the following blanks.

The graph of the quadratic function  $y = x^2$  was translated by  along the  $x$ -axis direction and translated by  along the  $y$ -axis direction, and then symmetrically shifted with respect to , yields the graph of the quadratic function  $y = -x^2 - 2x - 2$ .



7

Find a quadratic function that satisfies the following conditions.

- (1) Through 3 points  $(2, 0)$ ,  $(1, 1)$ ,  $(3, 5)$ .
- (2) Tangent to the  $x$ -axis and passing through two points  $(1, 1)$  and  $(4, 4)$ .

8

Solve the following quadratic equations.

(1)  $x^2 - 10x + 24 = 0$

(2)  $14x^2 + 29x - 15 = 0$

(3)  $x^2 + 5x + 5 = 0$

(4)  $x^2 - 6x - 6 = 0$



9

(1) Find the number of real solutions to the following quadratic equations.

①  $-2x^2 + 6x - \frac{9}{2} = 0$

②  $x^2 - \frac{9}{2}x + 5 = 0$

(2) When the quadratic equation  $x^2 - mx + m + 3 = 0$  has multiple solution, find the value of the constant  $m$ .

Also, find the multiple solution of the quadratic equation at that time.

10

How does the number of common points by the graph of the quadratic function  $y = -x^2 + 4x + 2k$  with the  $x$ -axis vary with the value of the constant  $k$ ?

1 1

(1) Solve the following quadratic inequalities.

①  $2x^2 \leq 7x$

②  $x^2 - x + \frac{1}{4} > 0$

(2) Solve the simultaneous inequalities  $\begin{cases} x^2 + 2x - 3 \leq 0 \\ x^2 + x - 1 > 0 \end{cases}$ .

1 2

Find the range of values of the constant  $k$  such that the quadratic inequality  $x^2 + (k-2)x - k + 10 > 0$  holds for all real numbers  $x$ .

13

Determine the range of values of the constant  $m$  so that the graph of the quadratic function  $y=x^2-(m+2)x+5$  has two different common points on the positive part of the  $x$ -axis.

**Study**

- (1) Find the coordinates of the common point by the parabola  $y = -x^2 + 2x + 5$  and the line  $y = x + 3$ .
- (2) Let  $b$  be a real number. Find the value of the constant  $b$  such that the parabola  $y = x^2 - 2x - 2$  and the line  $y = 2x + b$  are tangent.