1 Quadratic Function

- A quadratic function is described as

$$f(x) = ax^2 + bx + c \text{ where } a \neq 0$$

  - The curve representing any quadratic function is always a parabola. A simple example of parabola is shown in Figure 1.
  - The equation of axis of symmetry of a parabola : $x = \frac{-b}{2a}$.
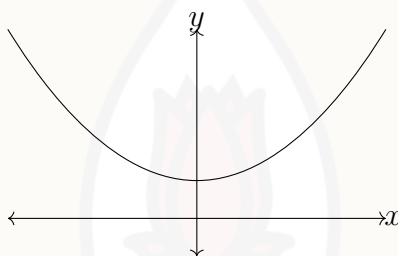 - The x-coordinate of the vertex of a parabola: $\frac{-b}{2a}$.

Figure 1 : A parabola

- A parabola will

  - open towards positive y-axis and has minimum value, if $a > 0$. This is called **Upward parabola**.[Figure 2 : (I)]
  - open towards negative y-axis and has maximum value if $a < 0$. This is called **Downward parabola**.[Figure 2 : (II)]

- For the quadratic function described as $f(x) = ax^2 + bx + c$ where $a \neq 0$, the slope of f at any given point $(x, f(x))$ is $(2ax + b)$.

- For the quadratic function described as $f(x) = ax^2 + bx + c$ where $a \neq 0$, the equation of the tangent at any given point $(x_1, f(x_1))$ is $(y - f(x_1)) = (2ax_1 + b)(x - x_1)$.
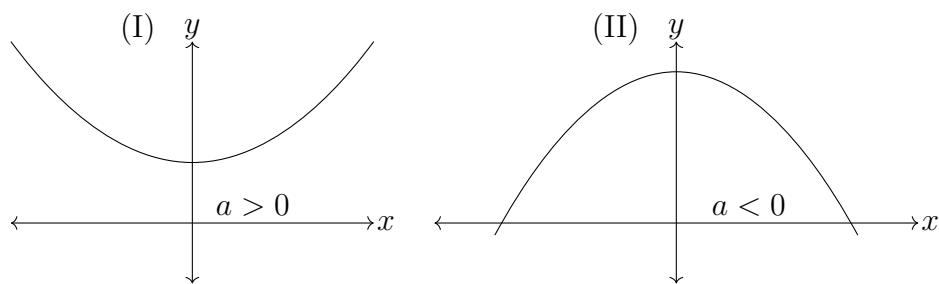
Figure 2 : Two parabolas for (I) $a > 0$ and (II) $a < 0$

2 Quadratic equation

- If a quadratic function is set equal to a value, then the result is a quadratic equation.

- If $ax^2 + bx + c = 0$, with $a \neq 0$, and a, b, c are integers, then the quadratic equation is said to be in the **standard form**.

- The solutions to a quadratic equation are called **roots** of the equation.

- One method for finding the roots of a quadratic equation $f(x) = ax^2 + bx + c = 0$ where $a \neq 0$ and a, b, c are integers, is to find **Zeros** of the quadratic function $f(x)$.

Note: Zeros of a quadratic function $g(x)$ are the x-intercepts of the curve represented by the function $g(x)$ and these are the solutions of the equation $g(x) = 0$.