Section 4.1 Quadratic Functions

Objective 1: Understanding the Definition of a Quadratic Function and its Graph

Definition: A **quadratic function** is a function of the form $f(x) = ax^2 + bx + c$ where a, b, and c are real numbers with $a \neq 0$. Every quadratic function has a "u-shaped" graph called a *parabola*.

The five basic characteristics of a parabola are its
1. vertex
2. axis of symmetry
3. *y*-intercept
4. *x*-intercept(s) or real zeros, and
5. domain and range.

Objective 2: Graphing Quadratic Functions Written in Vertex Form

Vertex Form of a Quadratic Function
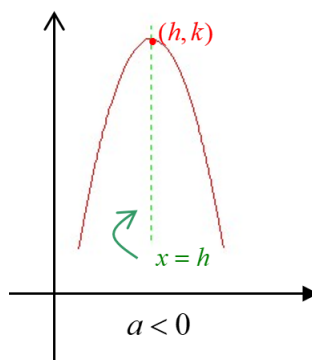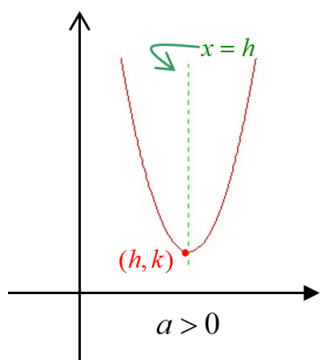A quadratic function is in **vertex form** if it is written as $f(x) = a(x-h)^2 + k$.

> The graph is a parabola with vertex (h, k).
> The parabola "opens up" if a > 0, and the parabola "opens down" if a < 0.
> The domain of the function is $(-\infty, \infty)$.
> The line $x = h$ is the axis of symmetry.
> The range is $[k, \infty)$ if a > 0, and the range is $(-\infty, k]$ if a < 0.

Objective 4: Graphing Quadratic Functions Using the Vertex Formula

Formula for the Vertex of a Parabola

Given a quadratic function of the form $f(x) = ax^2 + bx + c,\ a \neq 0$, the vertex of the parabola is

$$\left(-\frac{b}{2a}, f\left(-\frac{b}{2a} \right) \right).$$

Objective 5: Determining the Equation of a Quadratic Function Given its Graph