Section 4.1 Quadratic Functions

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

Definition: A **quadratic function** is a function that can be written in 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.

The domain of a quadratic function is $(-\infty, \infty)$.

The parabola *opens up* if $a > 0$, so the function has a minimum value at the vertex. That minimum value is the y-coordinate of the vertex.

The parabola *opens down* if $a < 0$, so the function has a maximum value at the vertex. That maximum value is the y-coordinate of the vertex.

The x-intercept(s), if any, are found by solving the equation $f(x) = 0$. The y-intercept is $f(0)$.

Objective 2: Graphing Quadratic Functions Written in Vertex Form

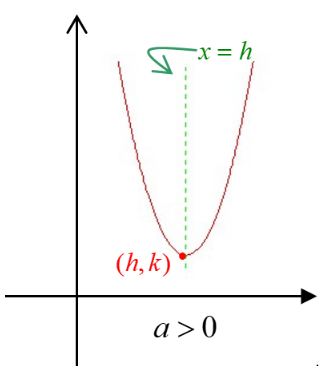
Vertex Form of a Quadratic Function

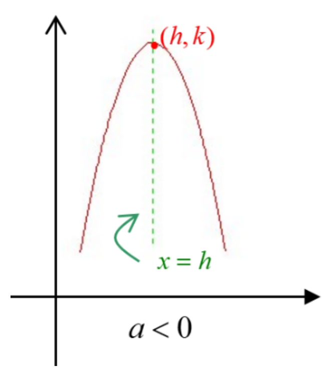
A quadratic function is in **vertex form** if it is written as $f(x) = a(x-h)^2 + k$.

The vertex of the parabola is (h,k).

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