

3.1: Quadratic Functions

A **quadratic function** is a polynomial of **degree 2**.

$$f(x) = ax^2 + bx + c$$

Graphing a Quadratic Using **Vertex Form** (standard form)

$$f(x) = a(x-h)^2 + k$$

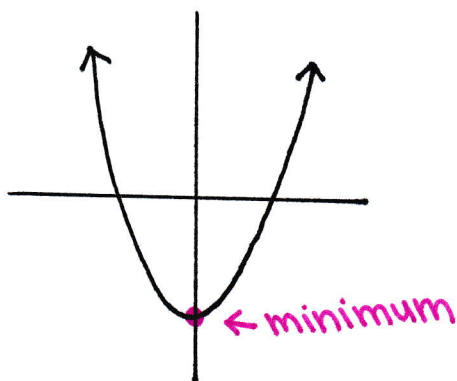
* vertex: (h, k)

* opens upward when $a > 0$

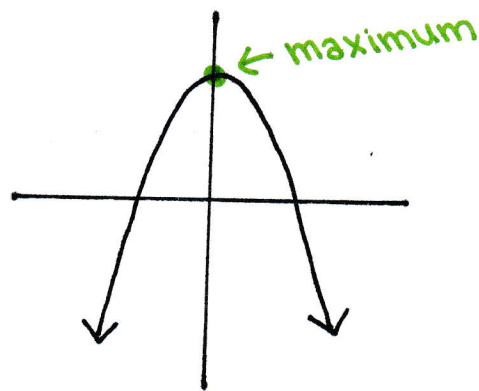
* opens downward when $a < 0$

Maximum & Minimum Values of a Quadratic

* **Maximum** & **Minimum** values occur at the **vertex**



When $a > 0$, the **vertex** is a minimum.



When $a < 0$, the **vertex** is a maximum.

* **Vertex Form** is the most convenient form to obtain information from a **quadratic function**.

* To put a **quadratic function** into **vertex form**, use **completing the square**.

Example: Put the equation into **vertex form**, then graph it.

$$f(x) = -2x^2 + 4x - 1$$

$$\begin{array}{r} -2x^2 + 4x - 1 = 0 \\ \quad \quad \quad +1 \quad +1 \\ \hline \end{array}$$

$$-2x^2 + 4x = 1$$

$$-2(x^2 - 2x + \underline{1}) = 1 + (-2)(\underline{1})$$

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

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

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

$$f(x) = -2(x-1)^2 + 1 \quad \text{Vertex: } (1, 1)$$

↑
opens
downward

