§3.1 Quadratic Functions

Polynomials are <u>continuous</u> (no breaks in the graph) and <u>smooth</u> (no sharp angles, only rounded curves)

Quadratic Function:

A function f is a quadratic function if

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

where a, b and c are real numbers and $a \neq 0$.

The graph of a quadratic function is a **parabola.**

The line of symmetry of a parabola is called the **axis**.

The highest or lowest point on a parabola is called the **vertex**. (Note: this depends on the sign of the coefficient of x^2)

A vertical or horizontal <u>shift</u> of the standard parabola $y = x^2$ is called a **translation**.
(hint: note where vertex is!)

Graph of a Quadratic function (parabola):

The quadratic function defined by $f(x) = ax^2 + bx + c$, can be written in the form:

$$y = f(x) = a(x - h)^2 + k, \quad a \neq 0 \qquad \text{where } h = -\frac{b}{2a} \text{ and } k = f(h).$$

The graph of f has the following characteristics:

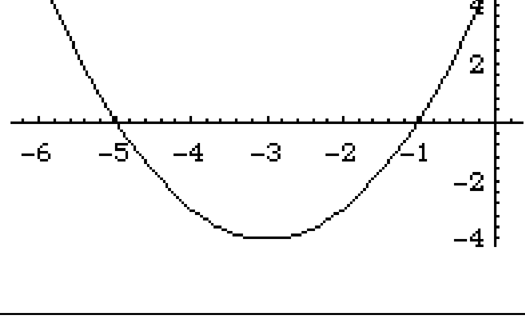
1) It is a parabola with vertex (h, k), and the vertical line x = h as <u>axis</u>.
2) It opens upward if $a > 0$ and downward if $a < 0$.
3) It is broader than $y = x^2$ if $0 < |a| < 1$ and narrower than $y = x^2$ if $|a| > 1$.
4) The y - intercept is $f(0) = c$. (where c is some real number)
5) The x - intercepts are found by solving $ax^2 + bx + c = 0$

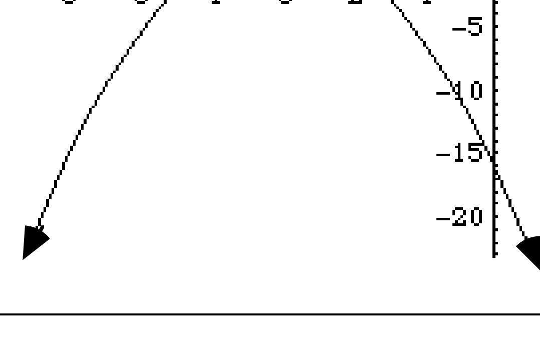
Examples:

1) $y = (x - (-3))^2 - 4$
(graph form)

2) $y = -2x^2 - 12x - 16$
(standard form)

1)	2)
x - int. : (-5, 0), (-1, 0)	x - int.: (-4, 0), (-2, 0)
y - int.: (0, 5)	y - int.: (0, -16)
vertex: (-3, -4) axis: x = -3	vertex: (-3, 2) axis: x = -3
D: (-oo, oo) R: [-4, oo)	D: (-oo, oo) R: (-oo, 2]





Example 1: Find the vertex (h, k) for the following quadratic equation: $y = x^2 + 6x + 5$.

Example 2: Graph the parabola, $y = 2x^2 - 4x + 5$, give the vertex, axis, domain, and range, x and y intercepts.

Example 3: Write the parabola, $y = x^2 - 2x + 3$ in "graphing form".