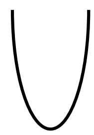
2.1 Quadratic Functions

Polynomial Function: $f(x) = a_n x^n + a_{n-1}x^{n-1} + \ldots + a_2x^2 + a_1x + a_0$

Quadratic Function: $f(x) = ax^2 + bx + c$ a, b, c real numbers, $a \neq 0$

The basic shape is a parabola (u-shaped curve). 

Parabolas occur in real life in satellite dishes, flash light reflectors, etc.



**Discuss page 89

I. Describe how the graph of each is related to $y = x^2$.

Ex 1) $f(x) = -\frac{1}{2}(x + 3)^2 - 1$

Ex 2) $y = 2(x - 3)^2 + 1$

II. **Standard form of a Quadratic**: $\boxed{f(x) = a(x - h)^2 + k, \quad a \neq 0}$

Vertex: (h, k)

$a > 0$: up

$a < 0$: down

$(x-4)^2 + 3$

$V: (4, 3)$

Ex 3) Sketch the graph and identify the vertex and x-intercepts. Use a grapher to verify.

A) $f(x) = (x + 4)^2 - 3$

$V: (-4, -3)$

x-int: $0 = (x+4)^2 - 3$

$\sqrt{3} = \sqrt{(x+4)^2}$

$\pm\sqrt{3} = x + 4$

$-4 \pm \sqrt{3} = x$

B) $f(x) = x^2 - 7$

$f(x) = (x+0)^2 - 7$

$V: (0, -7)$

x-int: $0 = x^2 - 7$

$\sqrt{7} = \sqrt{x^2}$

$\pm\sqrt{7} = x$

C) $f(x) = x^2 + 2x - 6$

$f(x) = (x^2 + 2x + 1) - 6 - 1$

take $\frac{1}{2}$ then square it

$\frac{2}{2} = 1^2 = 1$

$f(x) = (x + 1)^2 - 7$

$V: (-1, -7)$

$0 = (x+1)^2 - 7$

$\sqrt{7} = \sqrt{(x+1)^2}$

$\pm\sqrt{7} = x + 1$

$-1 \pm \sqrt{7} = x$

D) $h(x) = x^2 - 8x + 16$

$h(x) = (x - 4)^2$

$V: (4, 0)$

x-int: $(4, 0)$

E) $h(x) = -x^2 + 6x - 8$

$h(x) = (-x^2 + 6x \quad) - 8 -$

$= -(x^2 - 6x + 9) - 8 - -9$

$\frac{6}{2} = 3^2$

$h(x) = -(x - 3)^2 + 1$

$V: (3, 1)$

$-(x^2 - 6x + 8)$

$-(x-4)(x-2)$

$x - 4 = 0 \qquad x - 2 = 0$

$x = 4 \qquad x = 2$

F) $f(x) = 2x^2 + 8x + 7$

$f(x) = (2x^2 + 8x \quad) + 7 -$

$f(x) = 2(x^2 + 4x + 4) + 7 - 8$

$\frac{4}{2} = 2^2 = 4$

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

$V: (-2, -1)$

x-int:

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

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

$\sqrt{\frac{1}{2}} = \sqrt{(x+2)^2}$

$\pm\sqrt{\frac{1}{2}} = x + 2$

$-2 \pm \sqrt{\frac{1}{2}} = x$