Quadratic Functions

I. Completing the square:

A. If the leading coefficient is one:

Given standard equation: $y = Ax^2 + Bx + C$

When A = 1,

1. Ex: $x^2 - 2x - 2 = 2$

a) first get all non x terms to the other side,

$x^2 - 2x = 4$

b) take half of b and square it: $(-2)(1/2) = (-1)^2 = 1$
then add this number after the last x

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

c) factor the first group

$(x - 1)^2 = 5$ *** Note-** the number inside the parenthesis is always the number you got when divided b by 2.

d) square root both sides: $\sqrt{(x-1)^2} = \pm\sqrt{5}$

$$x - 1 = \pm\sqrt{5}$$

e) solve for x:

$$x = 1 \pm \sqrt{5}$$

B. Leading coefficient: I will use the alternative way by leaving the constant on the same side,

1. Ex: $2x^2 - 8x + 2 = 0$

   a) factor out leading coefficient of first two terms only:
   $2(x^2 - 4x\ \ ) + 2 = 0$

   b) repeat process of dividing b by 2 and squaring it

   $2(x^2 - 4x + 4\ ) + 2 = 0$

   *****Note- most people would say that you added a 4 to the equation, but that is incorrect. The coefficient, 2, means that we actually added a 2 times 4. This would mean that to balance the equation you would subtract 8 from the same side or add 8 to the other side.

   $2(x^2 - 4x + 4) + 2 - 8 = 0$ or $2(x^2 - 4x + 4) + 2 = 0 + 8$

   c) $2(x^2 - 4x + 4) - 6 = 0$ or $2(x^2 - 4x + 4\ ) = 6$

   d) $2(x - 2)^2 = 6 \rightarrow (x - 2)^2 = 3 \rightarrow \sqrt{(x-2)^2} = \pm\sqrt{3}$

   $x - 2 = \pm\sqrt{3}$ $x = 2 \pm \sqrt{3}$

II. Graphing;

A. Using the standard equation of the parabola:

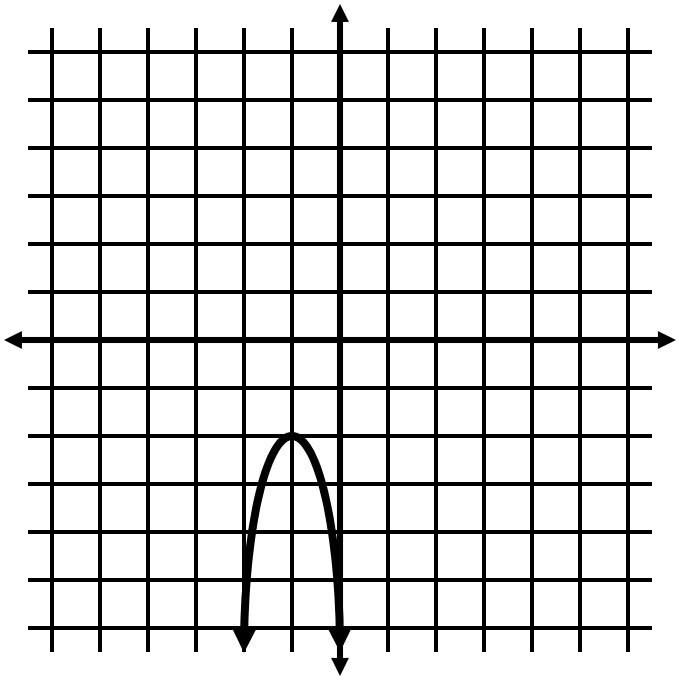
$Y = a (x – h)^2 + k$

Vertex is (h, k), and the axis of symmetry is x = h;

1. Ex: $y = - 2 (x + 1)^2 – 2$

Vertex = (-1, -2)

Axis of symmetry: x = -1

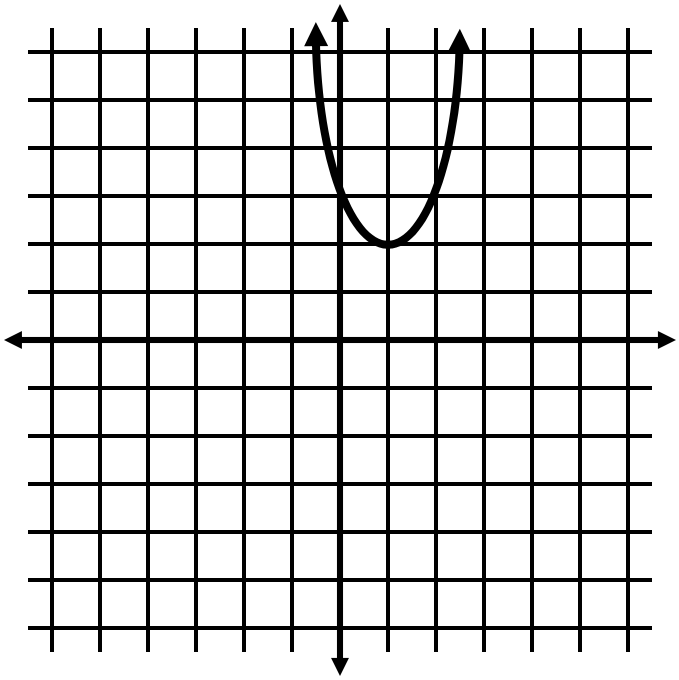


B. If the equation is given in $y = ax^2 + bx + c$

1. ex: $y = x^2 - 2x + 3$ Vertex: x –value : $-b/2a \rightarrow -(-2)/2(1) = 1$

y – value : F(x-value)→ plug in x value into equation: $(1)^2 - 2(1) + 3 \rightarrow y = 2$

V : (1, 2) a of s: x = 1



* **Note - If the coefficient of the x^2 is positive then it opens up, and the point the very bottom is a minimum; therefore, if a is negative, then it opens down and the point at the top is a maximum. If asked in a word problem to find a max/min, all you need is to find the vertex.**