Objective 5 – Quadratic and Nonlinear Functions

PARAMETERS OF QUADRATIC FUNCTIONS

quadratic function: $y = ax^2 + bx + c$ with its parent function being $y = x^2$

vertex: point of maximum or minimum value; c moves vertex up or down

axis of symmetry: line divides graph into 2 mirror images

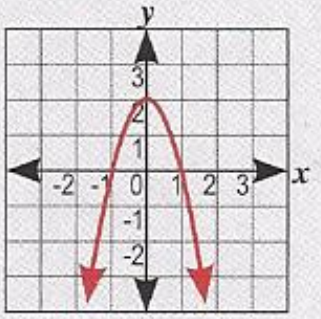
roots or zeros: x-value(s) of quadratic equation where $y = 0$; can have 0, 1, or 2 real roots

parameters: constants a, b, and c in a quadratic equation

Parameter	Effect of Changes
a	if $a > 0$, parabola opens upward if $a < 0$, parabola opens downward as absolute value of $a\uparrow$, graph width$\downarrow$
c	if $c > 0$, vertex is above parent function if $c < 0$, vertex is below parent function graph is translated up or down

Example: $y = -2x^2 + 2$

$a = -2$, $c = 2$



roots: $x = 1$, $x = -1$

vertex: (0, 2)

axis of symmetry $x = 0$

y-intercept (0, 2)

SOLVING QUADRATIC EQUATIONS

Factoring $y = x^2 - 1$

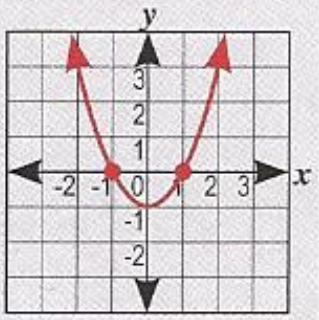
$0 = x^2 - 1$ set $y = 0$

$0 = (x-1)(x+1)$ set each factor = 0

$x - 1 = 0$ and $x + 1 = 0$ $x = 1$ and $x = -1$

Graph

$y = x^2 - 1$ intersects x-axis at $x = 1$ and $x = -1$



Quadratic Formula $y = x^2 - 1$ $(a = 1, b = 0, c = -1)$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{0 \pm \sqrt{0 - 4(1)(-1)}}{2(1)} = \pm 1$$

If $b^2 - 4ac > 0$, then 2 real roots exist.
If $b^2 - 4ac = 0$, then 1 real root exists.
If $b^2 - 4ac < 0$, then no real roots exist.

Table

$y = x^2 - 1$

Identify x-values with y-values equal to 0

x	y
-2	3
-1	0
0	-1
1	0
2	3

FOIL: First, Outer, Inner, Last

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