Name: Date: Period:

Vertex Form of a Quadratic

Vertex form of a quadratic function is given by: $f(x) = a(x - h)^2 + k$, where (h, k) is the vertex of the parabola and x = h is the axis of symmetry.

If the equation is $f(x) = 2(x - 3)^2 + 4$. The vertex is _________. What is the AOS? __________________

If the equation is $f(x) = 3(x + 7)^2 - 5$. The vertex is _________. What is the AOS? __________________

Remember: The number INSIDE the parenthesis is the OPPOSITE of the x-value of the vertex and the number at the end of the equation is the y-value of the vertex.

We will apply what we learned about completing the square to convert standard form quadratics into vertex form.

Completing the Square to Convert a Quadratic Equation from Standard Form to Vertex Form:

	Example: x^2 coefficient = 1	Example: x^2 coefficient ≠ 1
	$y = x^2 + 12x + 32$	$y = 2x^2 - 4x + 5$
1. Isolate the x^2 and x terms ... so move the constant to the other side of the equal sign.		
1a. You ONLY need this step if x^2 coefficient ≠ 1! If x^2 coefficient ≠ 1, factor the coefficient out of both		Factor out leading coefficient of 2. BE SURE to factor the 2 out of **BOTH** terms on the right.
2. Add +_______ to **BOTH** sides of the equal sign to KEEP THE EQUATION BALANCED. Fill in the +______ with the # that completes the square (half of the coefficient of the x-term squared).		When we have a coefficient ≠ 1, add a **double parenthesis** to side without the variables. Both sides must be **multiplied** by 2. **** See Special Note to avoid common pitfalls**
****Special Note**: • Be sure to factor the # out of **BOTH** terms on the right side of the equation. • When you factor out the #, **don't forget** to take that into account on both sides.		
3. Simplify left side and factor the perfect square trinomial		
4. Isolate the y-term (move the constant back)		
	Vertex: **AOS:**	**Vertex:** **AOS:**

Practice Problem 1: $y = x^2 - 8x + 3$		Practice Problem 2: $y = 3x^2 + 12x + 1$	
1.		1.	
1a.		1a.	
2.		2.	
3.		3.	
4.		4.	
Vertex:	AOS:	Vertex:	AOS:

Why the new format?

The new structure of the quadratic equation allows us to determine the **transformation(s)** of the parent function. Each "piece" of the newly constructed equation, helps to tell a story. The story is the description of the transformation(s).

If there is a:	Description of Transformation	
Negative Sign in front?	**Reflection** over the x-axis	
Coefficient in front of Parenthesis?	**Whole #?** **Vertical Stretch** by a factor of "#"	**Fraction?** **Vertical Shrink** by a factor of "#"
	Think of the Mii characters	
Number Added or Subtracted to x **INSIDE** the parenthesis?	**Added?** Shift **Left** # of units	**Subtracted?** Shift **Right** # of units
Number Added or Subtracted **OUTSIDE** the parenthesis?	**Added?** Shift **Up** # of units	**Subtracted?** Shift **Down** # of units

Let's look at an example….

$$y = -3(x + 2)^2 - 4$$

Here is how the story would be told….

- The function is reflected over the x-axis.
- It has a vertical stretch by a factor of 3.
- The vertex shifts 2 left and 4 down from the origin.

Describe the transformation of the function on a separate piece of paper.

1. $y = -2(x - 3)^2 + 4$
2. $y = 4(x + 4)^2 - 3$
3. $y = x^2 + 6x + 5$
4. $y + 2x^2 = 8x - 3$
5. $g(x) = (x - 2)^2 - 5$
6. $g(x) = -3(x + 4)^2 + 1$