

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.

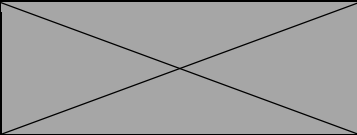
If the equation is  $f(x) = 2(x - 3)^2 + 4$ . The vertex is \_\_\_\_\_. What is the AOS? \_\_\_\_\_

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 $\neq$ 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 <b>ONLY</b> need this step if $x^2$ coefficient $\neq$ 1! If $x^2$ coefficient $\neq$ 1, factor the coefficient out of both		Factor out leading coefficient of 2. BE SURE to factor the 2 out of <b>BOTH</b> terms on the right.
2. Add +_____ to <b>BOTH</b> 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 $\neq$ 1, add a <b>double parenthesis</b> to side without the variables. Both sides must be <b>multiplied</b> by 2.  <b>** See <u>Special Note</u> to avoid common pitfalls</b>
<b>**Special Note:</b>	<ul style="list-style-type: none"> <li>• Be sure to factor the # out of <b>BOTH</b> terms on the right side of the equation.</li> <li>• When you factor out the #, <b>don't forget</b> to take that into account on both sides.</li> </ul>	
3. Simplify left side and factor the perfect square trinomial		
4. Isolate the y-term (move the constant back)		
	<b>Vertex:</b>  <b>AOS:</b>	<b>Vertex:</b>  <b>AOS:</b>

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?	<u>Reflection</u> over the x-axis	
Coefficient in front of Parenthesis?	<b>Whole #?</b> <u>Vertical Stretch</u> by a factor of "#"	<b>Fraction?</b> <u>Vertical Shrink</u> by a factor of "#"
	Think of the Mii characters	
Number Added or Subtracted to x <u>INSIDE</u> the parenthesis?	<b>Added?</b> Shift <u>Left</u> # of units	<b>Subtracted?</b> Shift <u>Right</u> # of units
Number Added or Subtracted <u>OUTSIDE</u> the parenthesis?	<b>Added?</b> Shift <u>Up</u> # of units	<b>Subtracted?</b> Shift <u>Down</u> # 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.  $g(x) = -3(x + 4)^2 + 1$