

# Vertex Form of a Quadratic Function

$$f(x) = \pm a(x - h)^2 + k$$

direction  
+ opens up  
- opens down

Dilation factor  
"stretch" or "shrink" the square outputs

translate left/right

translate up/down

Vertex:  $(h, k)$

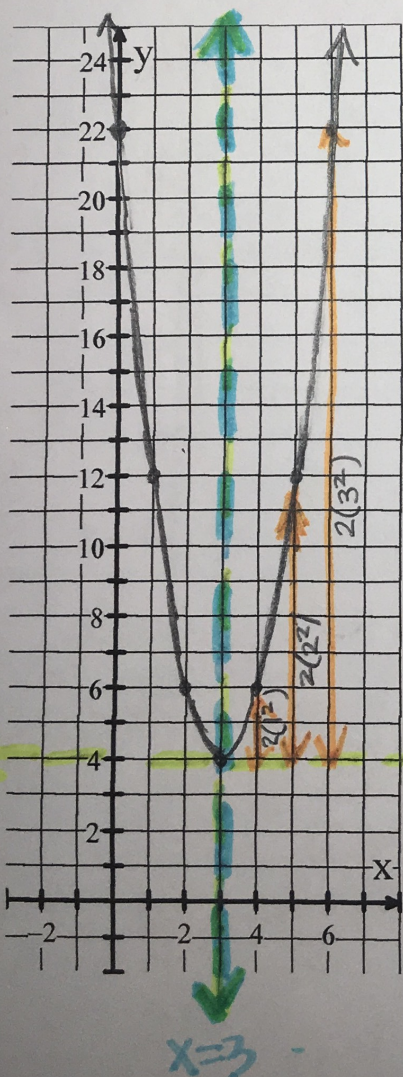
Line of Symmetry:  $x = h$

Transformations based on  $f(x) = x^2$

x	-4	-3	-2	-1	0	1	2	3	4
f(x)	16	9	4	1	0	1	4	9	16

Example:

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



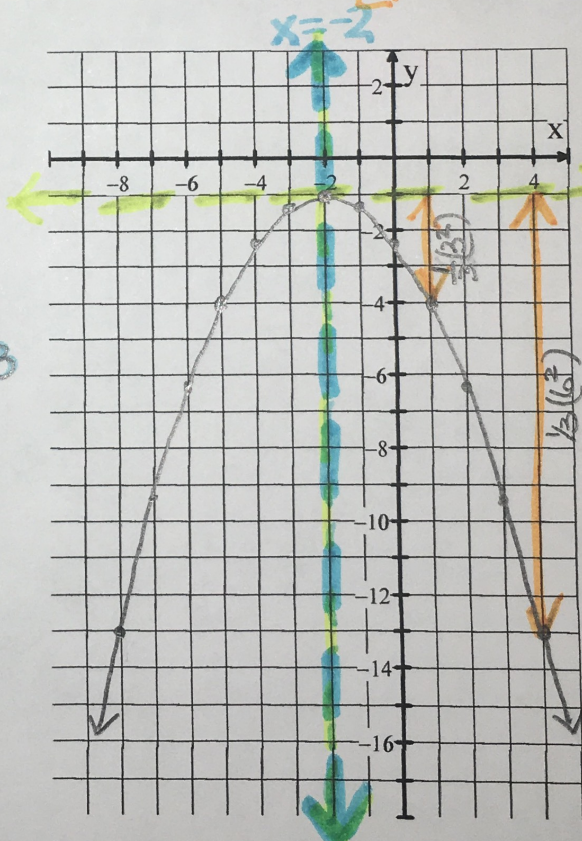
Vertex:  $(3, 4)$

$|a| = 2$

Orientation: up

Line of Symmetry:  $x = 3$

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



Vertex:  $(-2, -1)$

$|a| = \frac{1}{3}$

Orientation: down

Line of Symmetry:  $x = -2$

- Identify & Graph vertex. (This is new "origin").
- From vertex as start point, move over "z" on x, and go up (or down)  $a \cdot z^2$
- Connect/finish parabola (unless it is discrete due to context).