

Quadratic Transformations (a value)

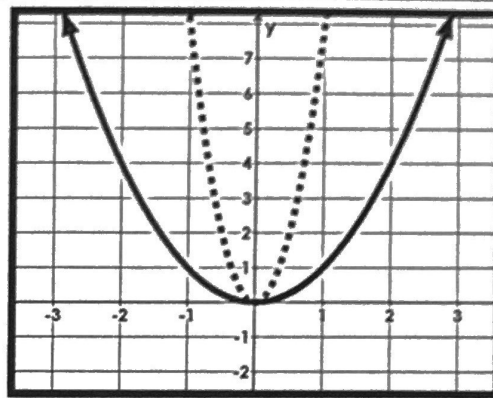
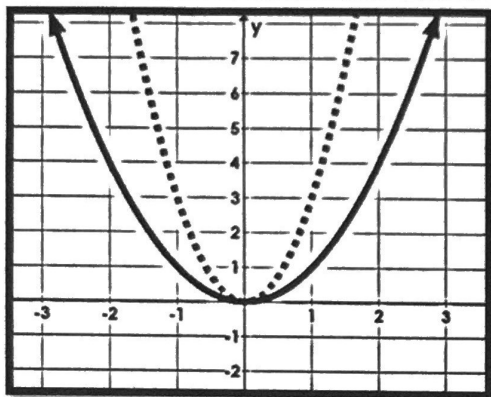
So far, we have discussed what the "h" and "k" values do when a quadratic function is in vertex form. Now we will discuss the "a" value. The "a" value affects the graph in two different ways which you will learn about in this lesson.

Vertex Form
 $f(x) = a(x - h)^2 + k$

$h =$ left or right $k =$ up or down

Vertex ~~(h,k)~~: (h, k)

The a Value (Part 1)



taller -
"stretched"

What is the vertex of $y = x^2$ (solid)? (0, 0)

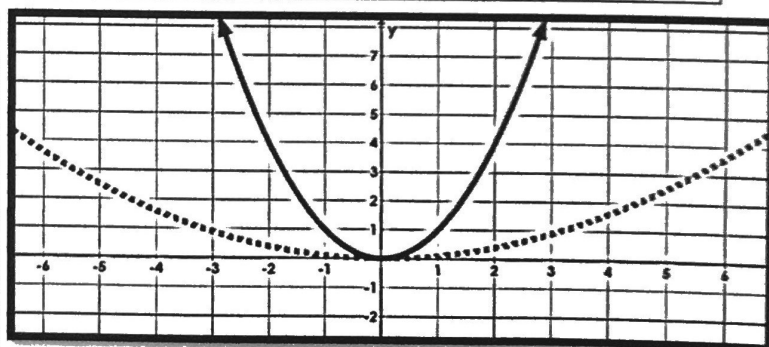
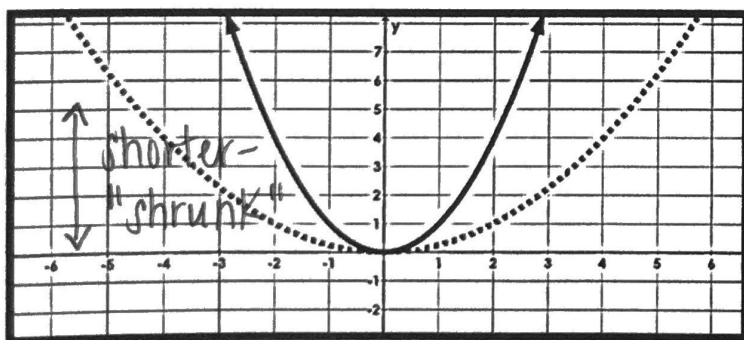
What is the vertex of $y = 3x^2$ (dashed)? (0, 0)

Describe how the graph has been transformed from $y = x^2$ to $y = 3x^2$. stretched by a factor of 3

What is the vertex of $y = x^2$ (solid)? (0, 0)

What is the vertex of $y = 8x^2$ (dashed)? (0, 0)

Describe how the graph has been transformed from $y = x^2$ to $y = 8x^2$. stretched by a factor of 8



What is the vertex of $y = x^2$ (solid)? (0, 0)

What is the vertex of $y = (1/4)x^2$ (dashed)? (0, 0)

Describe how the graph has been transformed from $y = x^2$ to $y = (1/4)x^2$. shrunk by a factor of $\frac{1}{4}$

What is the vertex of $y = x^2$ (solid)? (0, 0)

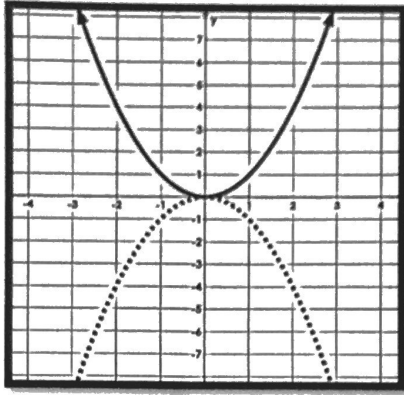
What is the vertex of $y = (1/10)x^2$ (dashed)? (0, 0)

Describe how the graph has been transformed from $y = x^2$ to $y = (1/10)x^2$. shrunk by a factor of $\frac{1}{10}$

So how does the number in front of the equation, 'a', affect the graph? (Part 1)

- if $a > 1$ (whole #), then graph is stretched
 - if $0 < a < 1$ (fraction), then graph is shrunk
- greater than 0, but less than 1

The a Value (Part 2)



What is the vertex of $y = x^2$ (solid)? (0,0)

What is the vertex of $y = -x^2$ (dashed)? (0,0)

Describe how the graph has been transformed from $y = x^2$ to $y = -x^2$.

flipped/reflected over x-axis

So how does the number in front of the equation, 'a', affect the graph? (Part 2)

- if negative, then opens down/reflected over x
- if positive, then opens up

Practice: Describe the transformations from the parent function to the given function.

a. $f(x) = 4x^2$ $a > 1$

stretched by 4

b. $y = \frac{1}{4}x^2$ $0 < a < 1$

shrunk by $\frac{1}{4}$

c. $f(x) = 6x^2$ $a > 1$

stretched by 6

d. $f(x) = -x^2$ a is (-)

opens down/reflected over x

f. $y = -\frac{1}{2}x^2$ a is (-) +

reflected + $0 < a < 1$
shrunk by $\frac{1}{2}$

g. $f(x) = -4x^2$ a is (-) +

reflected + $a > 1$
stretched by 4

Putting It All Together

Practice: Given the equations below, name the vertex and describe the transformations:

a. $y = -(x-4)^2 + 7$

Vertex: (4,7)
reflected, right 4, up 7

b. $y = -2(x+2)^2 + 5$ $(-2,5)$

reflected, stretched by 2,
left 2, up 5

c. $y = \frac{1}{2}(x-3)^2 - 8$ $(3,-8)$

shrunk by $\frac{1}{2}$, right 3,
down 8

Practice: Create an equation to represent the following transformations:

- a. Shifted down 4 units, right 1 unit, and reflected across the x-axis

$y = -(x-1)^2 - 4$

$y = a(x-h)^2 + k$

- b. Shifted up 6 units, reflected across the x-axis, and stretch by a factor of 3

$y = -3(x)^2 + 6$ OR $y = -3x^2 + 6$

- c. Shifted up 2 units, left 4 units, reflected across the x-axis, and shrunk by a factor of $\frac{3}{4}$.

$y = -\frac{3}{4}(x+4)^2 + 2$