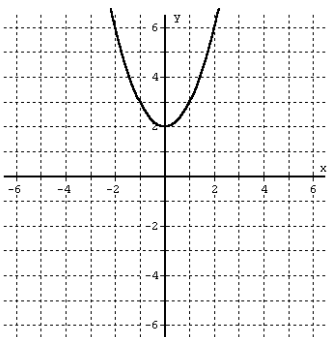


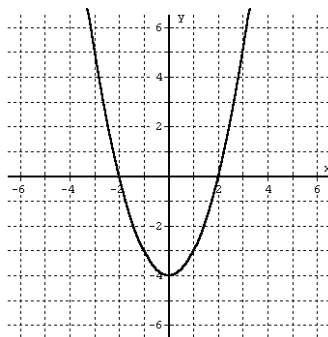
Transformations of $y = f(x) = x^2$



Vertical Shift – Up 2

$$y = x^2 + 2$$

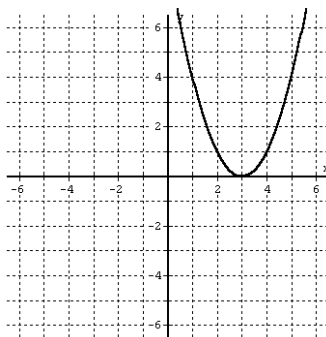
$$y = f(x) + 2$$



Vertical Shift – Down 4

$$y = x^2 - 4$$

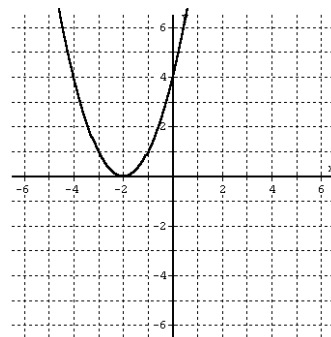
$$y = f(x) - 4$$



Horizontal Shift – Right 3

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

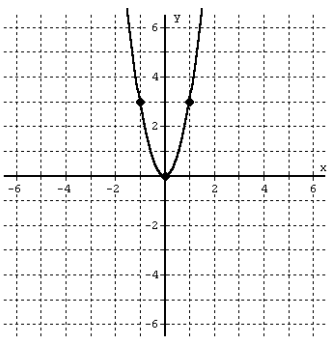
$$y = f(x - 3)$$



Horizontal Shift – Left 2

$$y = (x + 2)^2$$

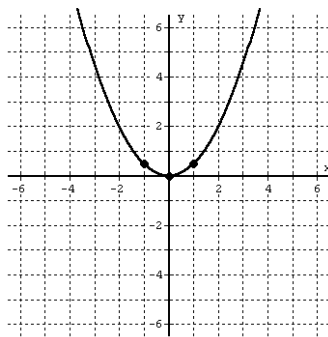
$$y = f(x + 2)$$



Vertical Stretch
Steeper / Narrower

$$y = 3x^2$$

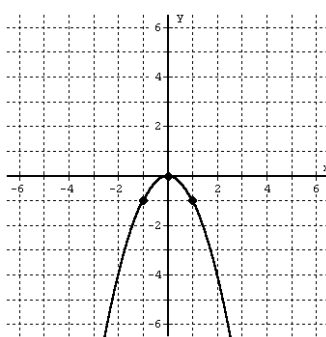
$$y = 3f(x)$$



Vertical Compression
Flatter / Wider

$$y = \frac{1}{2}x^2$$

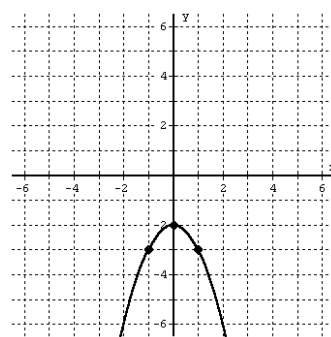
$$y = \frac{1}{2}f(x)$$



Reflection about the x-axis
Upside Down

$$y = -x^2$$

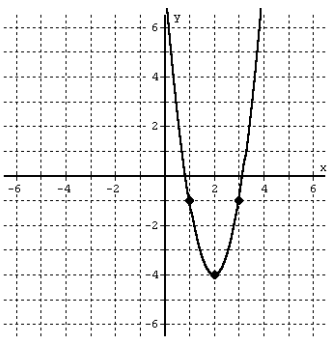
$$y = -f(x)$$



Upside Down
and Down 2

$$y = -x^2 - 2$$

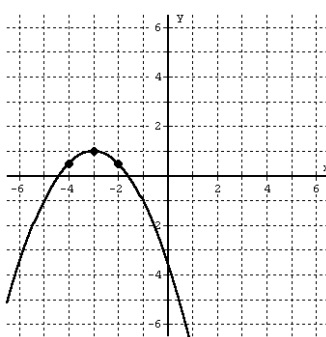
$$y = -f(x) - 2$$



Steeper, Opens Up, Right 2, Down 4

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

$$y = 3f(x - 2) - 4$$



Wider, Opens Down, Left 3, Up 1

$$y = -\frac{1}{2}(x + 3)^2 + 1$$

$$y = -\frac{1}{2}f(x + 3) + 1$$