Name_____

Algebra 2

Lesson 5-3

Transforming Parabolas

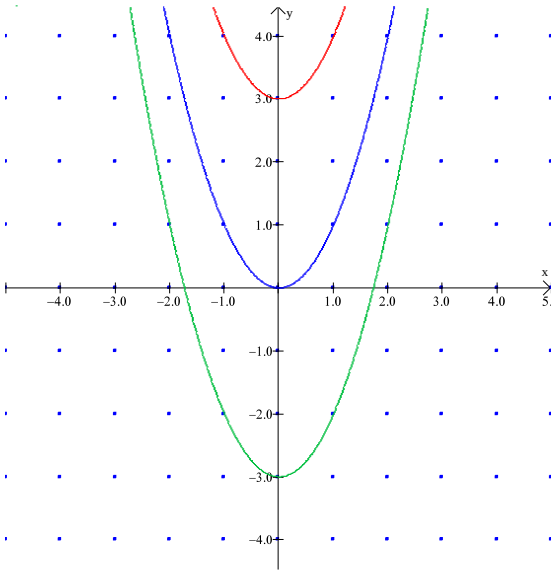
Last section we looked at the equation of a quadratic function and learned how we can get information from the equation and the coefficients. We related this back to our experience with absolute value functions and how changing certain numbers moved the function around the graph. Well, we can do the same with quadratics. The parent function for a quadratic equation is $\boldsymbol{y = x^2}$.

The **vertex form** $\boldsymbol{y = a(x - h)^2 + k}$ is the form that allows us to determine the transformation of the graph – up or down, left or right, or shrink or stretch. **Note:** While we like to graph using the calculator, using the vertex form in some cases may even be faster than using a graphing calculator.

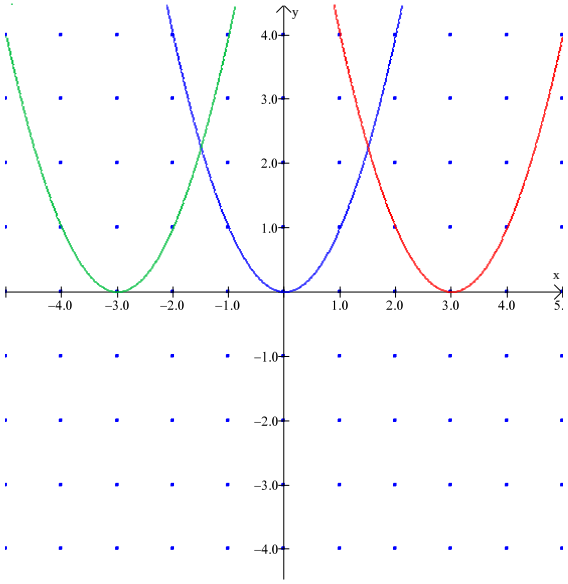
When $\boldsymbol{y = a(x - h)^2 + k}$**:**

1. $y = -ax^2$	reflection across the x-axis (flips upside down)
2. a>1	the graph stretches (gets skinny)
3. 0<a<1	the graph will shrink (gets broad or wide)
4. h>0 or h<0	positive **h** shift right negative **h** graph shifts left
5. k>0 or k<0	positive **k** shift up negative **k** shift down or
6. **vertex= (h,k)**	
7. **axis of symmetry: line x=h**	

graph $y = x^2$, $y = x^2 + 3$, and $x = x^2 - 3$ compare the graphs:

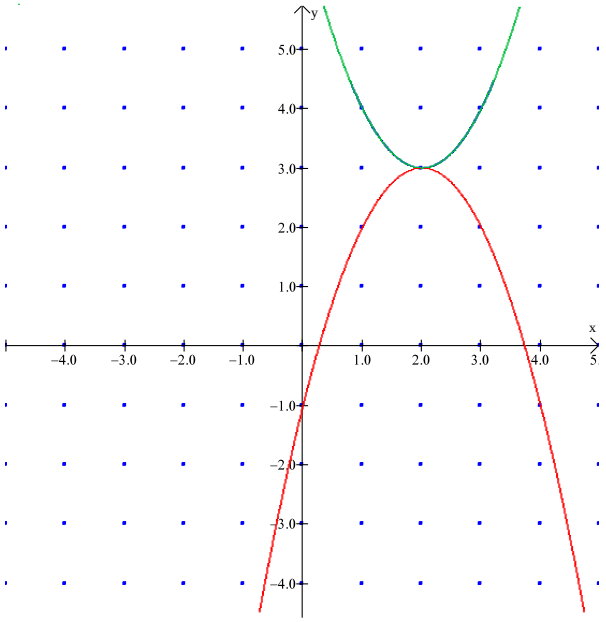


Graph $y = x^2, y = (x-3)^2, and\ y = (x+3)^2$ compare the graphs:



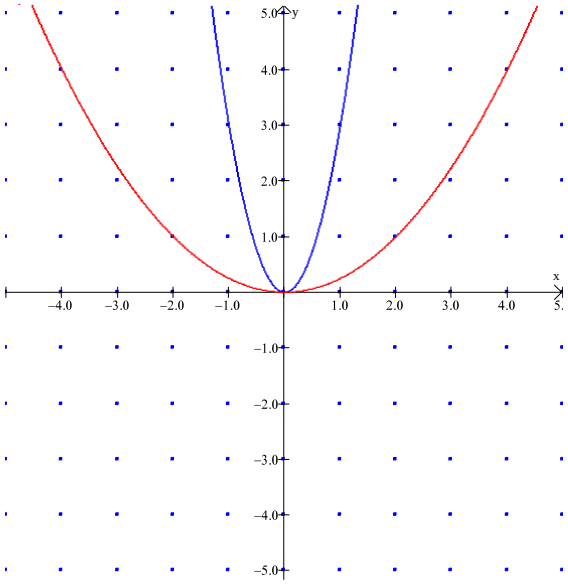
Now consider the graph for $f(x) = (x-2)^2 + 3$
Notice that the graph has both a vertical and a horizontal shift. The graph moves _____2 units and _____3 units. What happens if the graphs is rewritten as: $-g(x) = (x-2)^2 + 3$?

This is called a reflection along the horizontal axis. We can generalize by saying that nay quadratic equation with a negative sign in front of the x^2 term will open downward or be upside down.

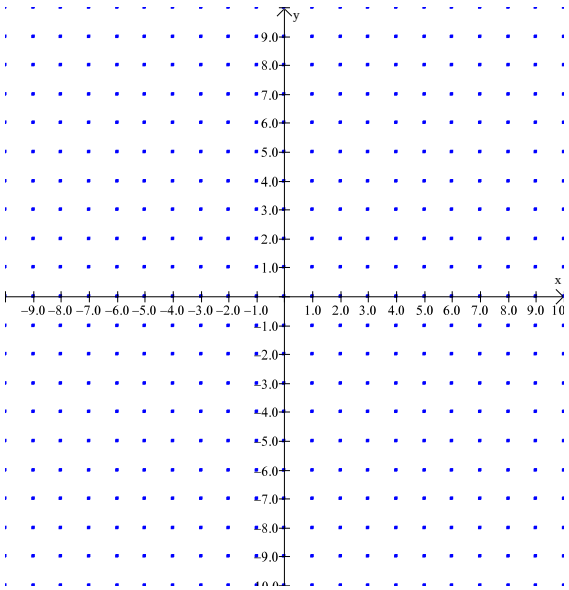


The last idea is consider is the effect of a number in front of a quadratic equation. For example graph $y = 3x^2$. Notice that the graph got skinnier (compressed).

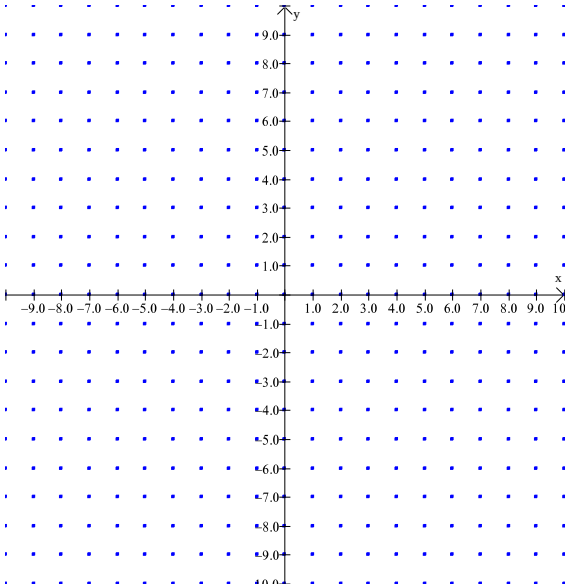
When we graph $y = \frac{1}{4}x^2$, the graph gets fatter (stretches). In general, if the constant, "a", is larger than 1 the graph will get skinny. For values between 0 and 1 the graph will get wider.



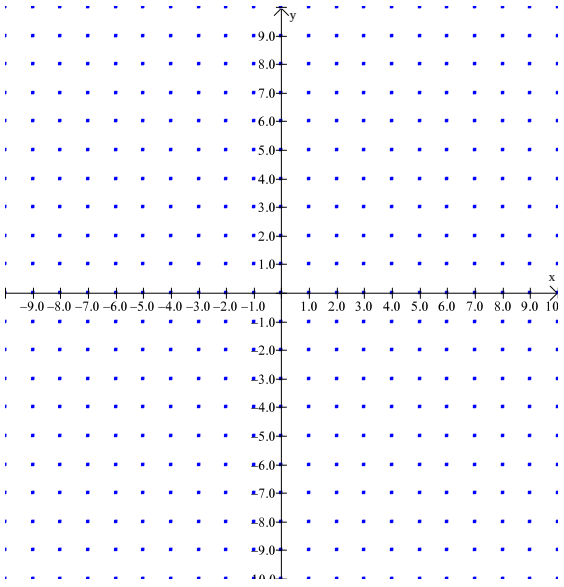
1. Graph $y = x^2 + 5$



3. Graph $\frac{1}{2}(x-1)^2 + 2$



2. Graph $y = -4(x+1)^2 - 5$



4. A ball follows a trajectory path given by $h(x) = -16(x-1.2)^2 + 24$. What is the maximum height the ball can get?