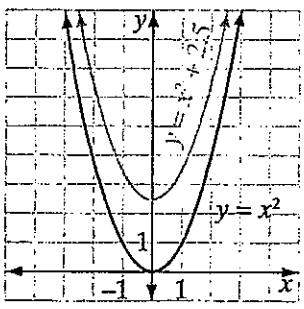
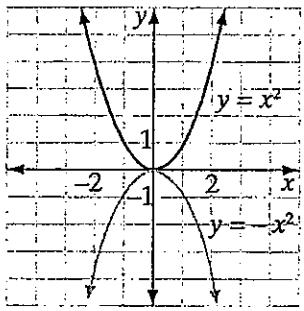
Name _____

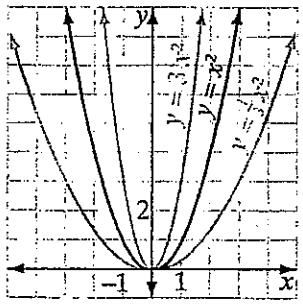
Translating, Reflecting, and Scaling Graphs of Quadratic Functions

Just as linear and absolute value functions can be translated, reflected, or scaled, graphs of quadratic functions can also be manipulated by working with the graph of the quadratic function $y = x^2$.

For instance, the graph of $y = x^2 + 2.5$ is the graph of $y = x^2$ shifted 2.5 units up. The graph of $y = -x^2$ is the graph of $y = x^2$ reflected in the x-axis. The graph of $y = 3x^2$ is the graph of $y = x^2$ stretched vertically by a factor of 3, while the graph of $y = \frac{1}{3}x^2$ is the graph of $y = x^2$ compressed vertically by a factor of $\frac{1}{3}$.







Translation Rules for Quadratic Functions

If c is *positive*:

- The graph of $y = x^2 + c$ is the graph of $y = x^2$ shifted c units up.
- The graph of $y = x^2 - c$ is the graph of $y = x^2$ shifted c units down.
- The graph of $y = (x + c)^2$ is the graph of $y = x^2$ shifted c units to the left.
- The graph of $y = (x - c)^2$ is the graph of $y = x^2$ shifted c units to the right.

Translations

Reflection Rule for Quadratic Functions

- The graph of $y = -x^2$ is the graph of $y = x^2$ reflected in the x-axis. faces down

Scaling Rules for Quadratic Functions

- When $c > 1$ (large #), the graph of $y = cx^2$ is the graph of $y = x^2$ stretched vertically by a factor of c. (narrower)
- When $0 < c < 1$ (decimal), the graph of $y = cx^2$ is the graph of $y = x^2$ compressed vertically by a factor of c. (wider)