

4-1 **Reteaching**

Quadratic Functions and Transformations

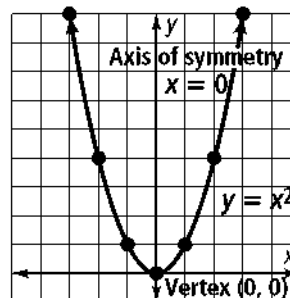
Parent Quadratic Function

The parent quadratic function is $y = x^2$.

Substitute 0 for x in the function to get $y = 0$. The vertex of the parent quadratic function is $(0, 0)$.

A few points near the vertex are:

x	-3	-2	-1	1	2	3
y	9	4	1	1	4	9

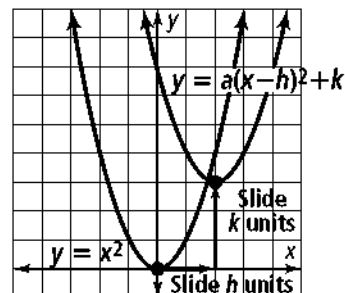


The graph is symmetrical about the line $x = 0$. This line is the axis of symmetry.

Vertex Form of a Quadratic Function

The vertex form of a quadratic function is $y = a(x - h)^2 + k$.

The graph of this function is a transformation of the graph of the parent quadratic function $y = x^2$. The vertex of the graph is (h, k) . If $a = 1$, you can graph the function by sliding the graph of the parent function h units along the x -axis and k units along the y -axis.



Problem

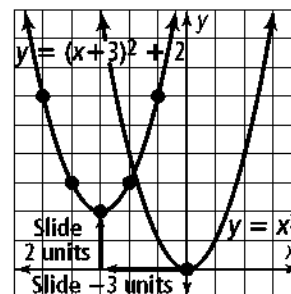
What is the graph of $y = (x + 3)^2 + 2$? What are the vertex and axis of symmetry of the function?

Step 1 Write the function in vertex form: $y = 1[x - (-3)]^2 + 2$

Step 2 Find the vertex: $h = -3, k = 2$. The vertex is $(-3, 2)$.

Step 3 Find the axis of symmetry. Since the vertex is $(-3, 2)$, the graph is symmetrical about the line $x = -3$. The axis of symmetry is $x = -3$.

Step 4 Because $a = 1$, you can graph this function by sliding the graph of the parent function -3 units along the x -axis and 2 units along the y -axis. Plot a few points near the vertex to help you sketch the graph.



x	-5	-4	-3	-2	-1
y	6	3	2	3	6

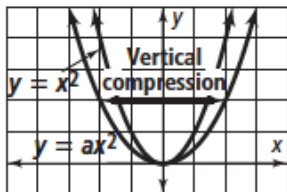
4-1 **Reteaching** (continued)

Quadratic Functions and Transformations

If $a \neq 1$, the graph is a stretch or compression of the parent function by a factor of $|a|$.

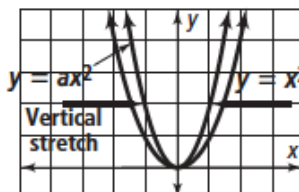
$$0 < |a| < 1$$

The graph is a vertical compression of the parent function.



$$|a| > 1$$

The graph is a vertical stretch of the parent function.



What is the graph of $y = 2(x + 3)^2 + 2$?

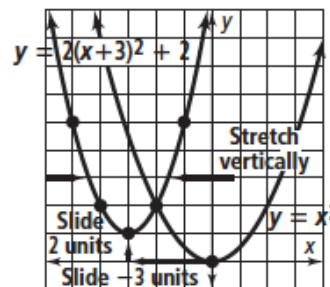
Problem

Step 1 Write the function in vertex form: $y = 2[x - (-3)]^2 + 2$

Step 2 The vertex is $(-3, 2)$.

Step 3 The axis of symmetry is $x = -3$.

Step 4 Because $a = 2$, the graph of this function is a vertical stretch by 2 of the parent function. In addition to sliding the graph of the parent function 3 units left and 2 units up, you must change the shape of the graph. Plot a few points near the vertex to help you sketch the graph.



x	-5	-4	-3	-2	-1
y	10	4	2	4	10

Exercises

Graph each function. Identify the vertex and axis of symmetry.

1. $y = (x - 1)^2 + 3$

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

3. $y = (x + 2)^2 + 1$

4. $y = 2(x - 1)^2 + 3$

5. $y = \frac{1}{2}(x + 4)^2 - 2$

6. $y = 0.9(x + 2)^2 + 1$