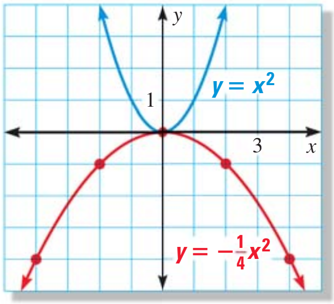
EXAMPLE 2 Graph $y = ax^2$ where $|a| < 1$

Graph $y = -\frac{1}{4}x^2$. Compare the graph with the graph of $y = x^2$.

MAKE A TABLE
To make the calculations easier, choose values of *x* that are multiples of 2.

STEP 1 **Make** a table of values for $y = -\frac{1}{4}x^2$.

x	−4	−2	0	2	4
y	−4	−1	0	−1	−4



STEP 2 **Plot** the points from the table.

STEP 3 **Draw** a smooth curve through the points.

STEP 4 **Compare** the graphs of $y = -\frac{1}{4}x^2$ and $y = x^2$. Both graphs have the same vertex (0, 0), and the same axis of symmetry, $x = 0$. However, the graph of $y = -\frac{1}{4}x^2$ is wider than the graph of $y = x^2$ and it opens down. This is because the graph of $y = -\frac{1}{4}x^2$ is a vertical shrink $\left(\text{by a factor of } \frac{1}{4}\right)$ with a reflection in the *x*-axis of the graph of $y = x^2$.

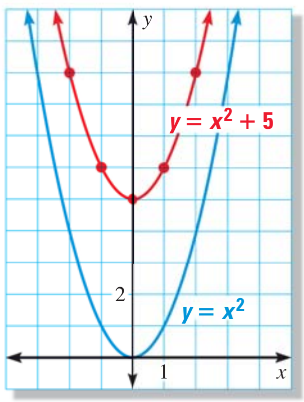
GRAPHING QUADRATIC FUNCTIONS Examples 1 and 2 suggest the following general result: a parabola opens up when the coefficient of x^2 is positive and opens down when the coefficient of x^2 is negative.

EXAMPLE 3 Graph $y = x^2 + c$

Graph $y = x^2 + 5$. Compare the graph with the graph of $y = x^2$.

STEP 1 **Make** a table of values for $y = x^2 + 5$.

x	−2	−1	0	1	2
y	9	6	5	6	9



STEP 2 **Plot** the points from the table.

STEP 3 **Draw** a smooth curve through the points.

STEP 4 **Compare** the graphs of $y = x^2 + 5$ and $y = x^2$. Both graphs open up and have the same axis of symmetry, $x = 0$. However, the vertex of the graph of $y = x^2 + 5$, (0, 5), is different than the vertex of the graph of $y = x^2$, (0, 0), because the graph of $y = x^2 + 5$ is a vertical translation (of 5 units up) of the graph of $y = x^2$.

✓ GUIDED PRACTICE for Examples 1, 2, and 3

Graph the function. Compare the graph with the graph of $y = x^2$.

1. $y = -4x^2$ **2.** $y = \frac{1}{3}x^2$ **3.** $y = x^2 + 2$