

EXAMPLE 4 Graph $y = ax^2 + c$

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

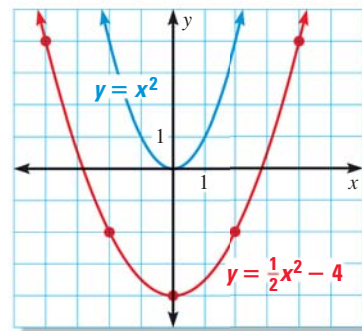
STEP 1 Make a table of values for $y = \frac{1}{2}x^2 - 4$.

x	-4	-2	0	2	4
y	4	-2	-4	-2	4

STEP 2 Plot the points from the table.

STEP 3 Draw a smooth curve through the points.

STEP 4 Compare the graphs of $y = \frac{1}{2}x^2 - 4$ and $y = x^2$. Both graphs open up and have the same axis of symmetry, $x = 0$. However, the graph of $y = \frac{1}{2}x^2 - 4$ is wider and has a lower vertex than the graph of $y = x^2$ because the graph of $y = \frac{1}{2}x^2 - 4$ is a vertical shrink and a vertical translation of the graph of $y = x^2$.



GUIDED PRACTICE for Example 4

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

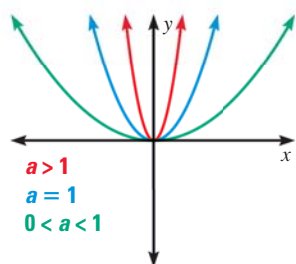
4. $y = 3x^2 - 6$

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

6. $y = \frac{3}{4}x^2 - 2$

KEY CONCEPT

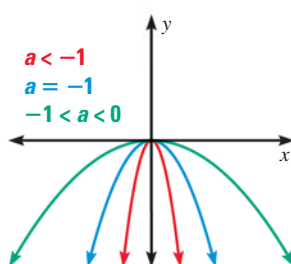
$y = ax^2, a > 0$



Compared with the graph of $y = x^2$, the graph of $y = ax^2$ is:

- a vertical stretch if $a > 1$,
- a vertical shrink if $0 < a < 1$.

$y = ax^2, a < 0$

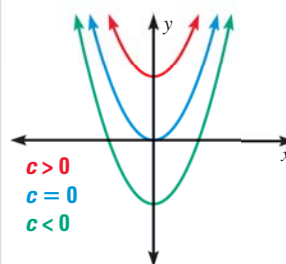


Compared with the graph of $y = x^2$, the graph of $y = ax^2$ is:

- a vertical stretch with a reflection in the x -axis if $a < -1$,
- a vertical shrink with a reflection in the x -axis if $-1 < a < 0$.

For Your Notebook

$y = x^2 + c$



Compared with the graph of $y = x^2$, the graph of $y = x^2 + c$ is:

- an upward vertical translation if $c > 0$,
- a downward vertical translation if $c < 0$.