

Key Vocabulary

quadratic function,
p. 404
parabola, p. 404
vertex, p. 404
axis of symmetry,
p. 404

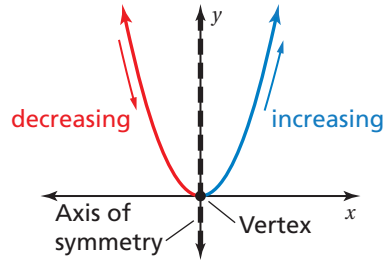
A **quadratic function** is a nonlinear function that can be written in the standard form $y = ax^2 + bx + c$, where $a \neq 0$. The U-shaped graph of a quadratic function is called a **parabola**.

Key Idea

Characteristics of Quadratic Functions

The most basic quadratic function is $y = x^2$.

The lowest or highest point on a parabola is the **vertex**.



The vertical line that divides the parabola into two symmetric parts is the **axis of symmetry**. The axis of symmetry passes through the vertex.

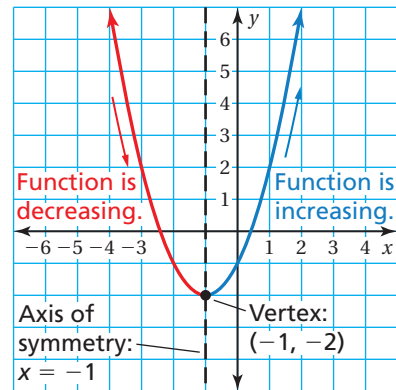
EXAMPLE 1 Identifying Characteristics of a Quadratic Function

Consider the graph of the quadratic function.

Using the graph, you can identify the vertex, axis of symmetry, and the behavior of the graph as shown.

You can also determine the following:

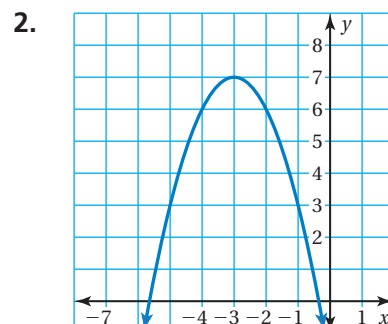
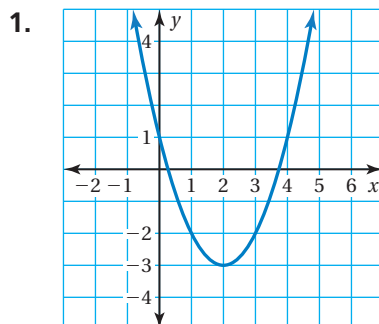
- The domain is all real numbers.
- The range is all real numbers greater than or equal to -2 .
- When $x < -1$, y increases as x decreases.
- When $x > -1$, y increases as x increases.



On Your Own

Identify characteristics of the graph of the quadratic function.

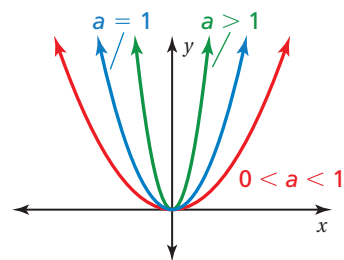
Now You're Ready
Exercises 8–10



Key Ideas

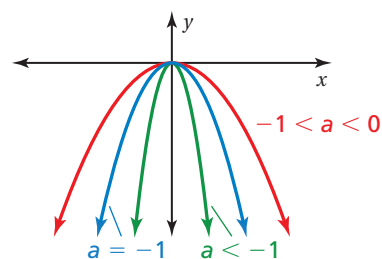
Graphing $y = ax^2$ When $a > 0$

- When $0 < a < 1$, the graph of $y = ax^2$ opens up and is wider than the graph of $y = x^2$.
- When $a > 1$, the graph of $y = ax^2$ opens up and is narrower than the graph of $y = x^2$.



Graphing $y = ax^2$ When $a < 0$

- When $-1 < a < 0$, the graph of $y = ax^2$ opens down and is wider than the graph of $y = x^2$.
- When $a < -1$, the graph of $y = ax^2$ opens down and is narrower than the graph of $y = x^2$.



EXAMPLE 2 Graphing $y = ax^2$ When $a > 0$

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

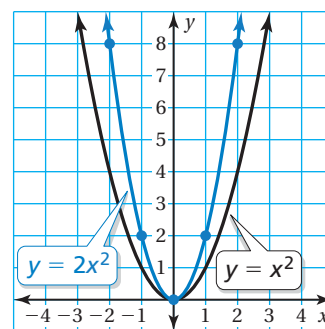
Step 1: Make a table of values.

x	-2	-1	0	1	2
y	8	2	0	2	8

Step 2: Plot the ordered pairs.

Step 3: Draw a smooth curve through the points.

- Both graphs open up and have the same vertex, $(0, 0)$, and the same axis of symmetry, $x = 0$. The graph of $y = 2x^2$ is narrower than the graph of $y = x^2$.



On Your Own

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

3. $y = 5x^2$

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

5. $y = \frac{3}{2}x^2$