Name_____ Date_____



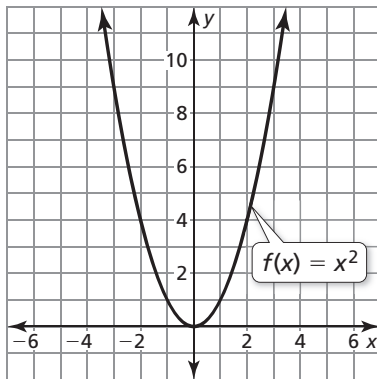## 8.1 Graphing $f(x) = ax^2$
**For use with Exploration 8.1**

**Essential Question** What are some of the characteristics of the graph of a quadratic function of the form $f(x) = ax^2$?
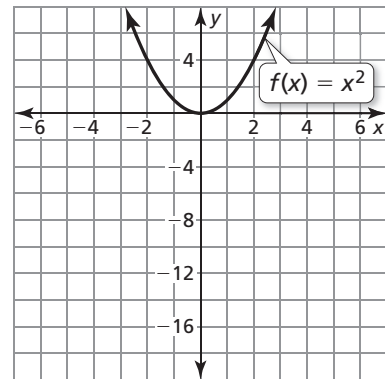
**1  EXPLORATION:** Graphing Quadratic Functions

**Go to** *BigIdeasMath.com* **for an interactive tool to investigate this exploration.**

**Work with a partner.** Graph each quadratic function. Compare each graph to the graph of $f(x) = x^2$.
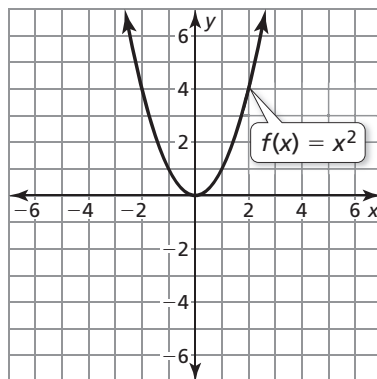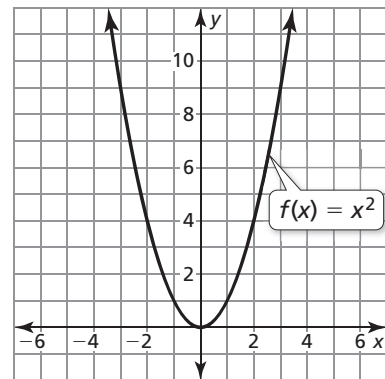
**a.** $g(x) = 3x^2$



**b.** $g(x) = -5x^2$



**c.** $g(x) = -0.2x^2$



**d.** $g(x) = \dfrac{1}{10}x^2$

**8.1** **Graphing $f(x) = ax^2$ (continued)**

## Communicate Your Answer

2. What are some of the characteristics of the graph of a quadratic function of the form $f(x) = ax^2$?

3. How does the value of $a$ affect the graph of $f(x) = ax^2$? Consider $0 < a < 1$, $a > 1, -1 < a < 0$, and $a < -1$. Use a graphing calculator to verify your answers.

4. The figure shows the graph of a quadratic function of the form $y = ax^2$. Which of the intervals in Question 3 describes the value of $a$? Explain your reasoning.
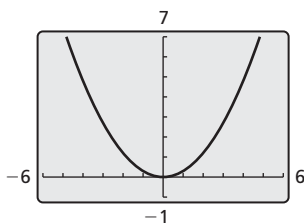
## 8.1 Notetaking with Vocabulary
**For use after Lesson 8.1**

**In your own words, write the meaning of each vocabulary term.**

quadratic function

parabola

vertex

axis of symmetry

## Core Concepts

### Characteristics of Quadratic Functions

The *parent quadratic function* is $f(x) = x^2$. The graphs of all other quadratic functions are *transformations* of the graph of the parent quadratic function.

The lowest point on a parabola that opens up or the highest point on a parabola that opens down is the **vertex.** The vertex of the graph of $f(x) = x^2$ is (0, 0).
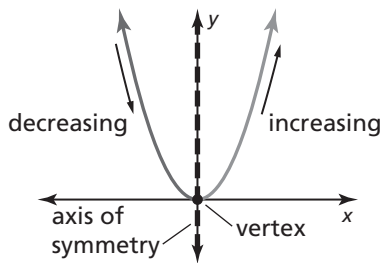


The vertical line that divides the parabola into two symmetric parts is the **axis of symmetry.** The axis of symmetry passes through the vertex. For the graph of $f(x) = x^2$, the axis of symmetry is the *y*-axis, or $x = 0$.

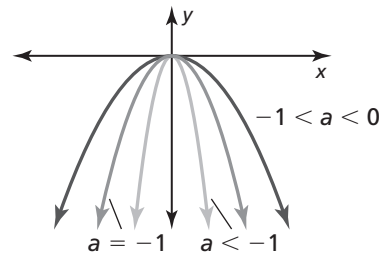**Notes:**

**8.1** **Notetaking with Vocabulary** (continued)

## Graphing $f(x) = ax^2$ When $a > 0$

- When $0 < a < 1$, the graph of $f(x) = ax^2$ is a vertical shrink of the graph of $f(x) = x^2$.

- When $a > 1$, the graph of $f(x) = ax^2$ is a vertical stretch of the graph of $f(x) = x^2$.
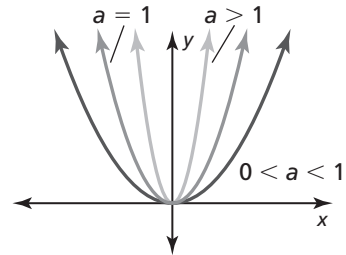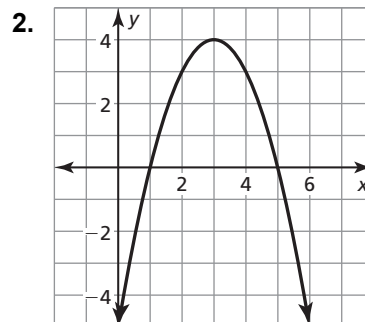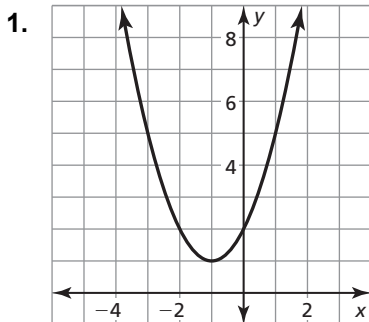
## Graphing $f(x) = ax^2$ When $a < 0$

- When $-1 < a < 0$, the graph of $f(x) = ax^2$ is a vertical shrink with a reflection in the $x$-axis of the graph of $f(x) = x^2$.

- When $a < -1$, the graph of $f(x) = ax^2$ is a vertical stretch with a reflection in the $x$-axis of the graph of $f(x) = x^2$.
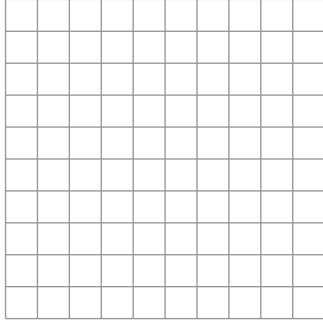
**Notes:**

## Extra Practice

**In Exercises 1 and 2, identify characteristics of the quadratic function and its graph.**
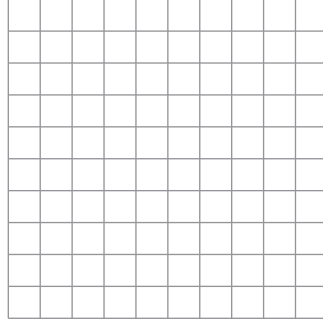
**1.**

**2.**

Name_____ Date _____

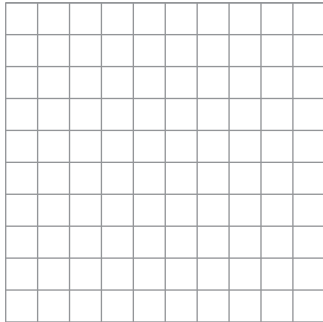**In Exercises 3–8, graph the function. Compare the graph to the graph of $f(x) = x^2$.**
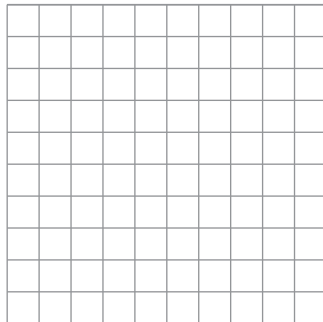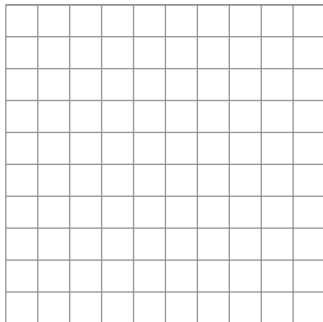
3. $g(x) = 5x^2$

4. $m(x) = -4x^2$
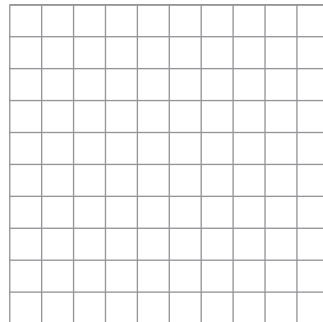
5. $k(x) = -x^2$

6. $l(x) = -7x^2$

7. $n(x) = -\dfrac{1}{5}x^2$

8. $p(x) = 0.6x^2$

**In Exercises 9 and 10, determine whether the statement is *always, sometimes,* or *never* true. Explain your reasoning.**

9. The graph of $g(x) = ax^2$ is wider than the graph of $f(x) = x^2$ when $a > 0$.

10. The graph of $g(x) = ax^2$ is narrower than the graph of $f(x) = x^2$ when $|a| < 1$.