Graph the equation.

1. $y = -x - 1$

2. $y = \frac{3}{2}x + 2$

3. $y = -x - 2$

4. $y = 3x + 3$

5. $y = x$

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

Use the Distributive Property to find the product.

1. $(x - 2)(x - 2)$

2. $(z + 6)(z - 2)$

3. $(g + 8)(g + 1)$

4. $(y - 7)(y - 3)$

5. $(4m)(m - 10)$

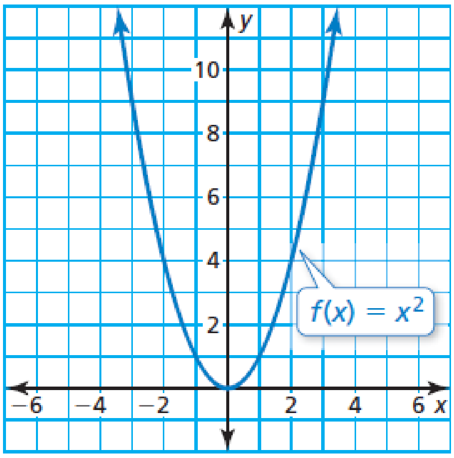
6. $(x - 4)(x - 1)$

Essential Question

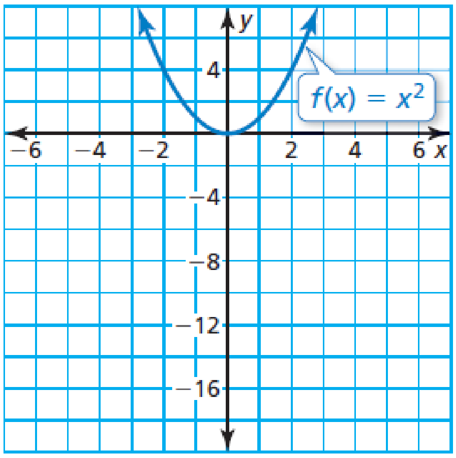
What are some of the characteristics of the graph of a quadratic function of the form $f(x) = ax^2$?

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

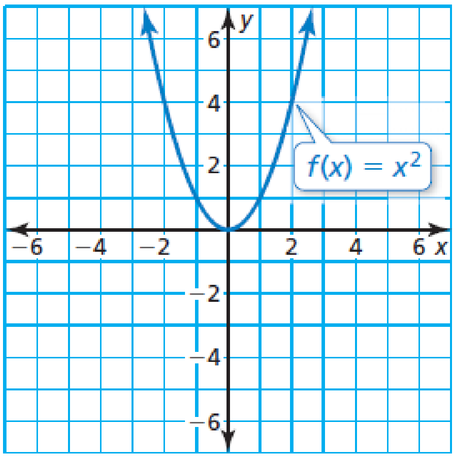
a. $g(x) = 3x^2$



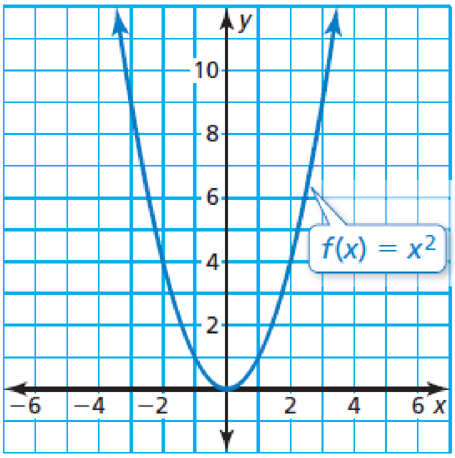
b. $g(x) = -5x^2$



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



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

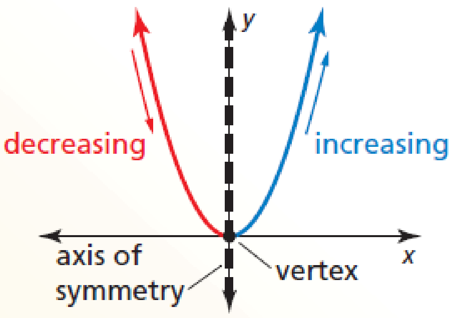


Core Concept

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.

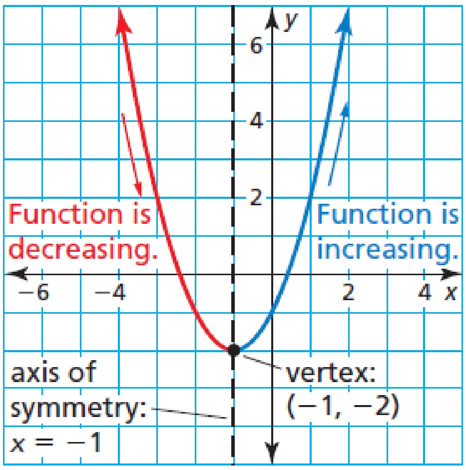
The lowest point on a parabola that opens up or the highest point on a parabola that opens down is the **vertex**. The vertex of the graph of $f(x) = x^2$ is (0, 0).



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 $x = 0$.

Consider the graph of the quadratic function.

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

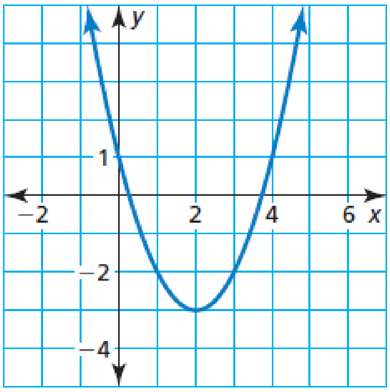


You can also determine the following:

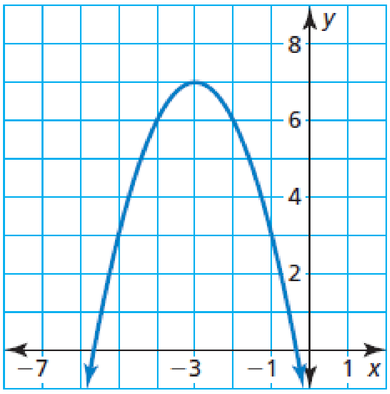
- The domain is all real numbers.
- The range is all real numbers greater than or equal to −2.
- When $x < -1$, y increases as x decreases.
- When $x > -1$, y increases as x increases.

Identify characteristics of the quadratic function and its graph.

1.



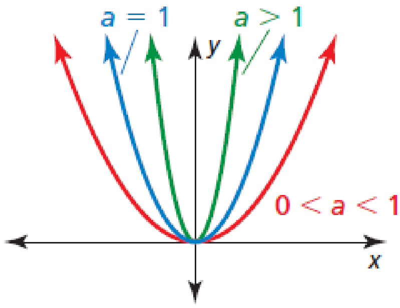
2.



Core Concept

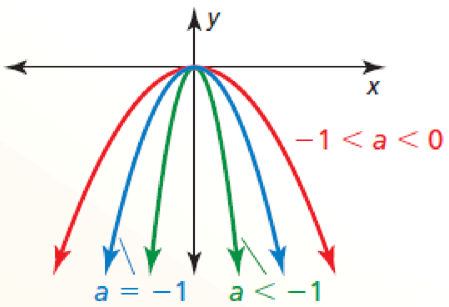
Graphing $f(x) = ax^2$ When $a > 0$

- 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 $f(x) = x^2$.



Graph $g(x) = 2x^2$. Compare the graph to the graph of $f(x) = x^2$.

Graph $h(x) = -\frac{1}{3}x^2$. Compare the graph to the graph of $f(x) = x^2$.

Graph the function. Compare the graph to the graph of $f(x) = x^2$.

3. $g(x) = 5x^2$

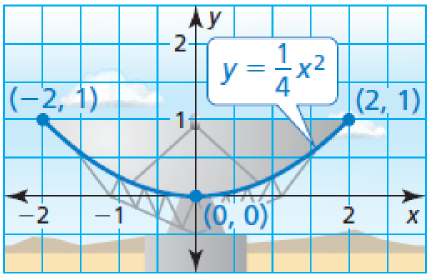
4. $h(x) = \frac{1}{3}x^2$

5. $n(x) = \frac{3}{2}x^2$

6. $p(x) = -3x^2$

7. $q(x) = -0.1x^2$

8. $g(x) = -\frac{1}{4}x^2$



The diagram at the left shows the cross section of a satellite dish, where *x* and *y* are measured in meters. Find the width and depth of the dish.

9. The cross section of a spotlight can be modeled by the graph of $y = 0.5x^2$, where x and y are measured in inches and $-2 \le x \le 2$. Find the width and depth of the spotlight.

• **Exit Ticket:** Describe the differences between the graphs of $y = -3x^2$ and $y = \frac{1}{3}x^2$.