

2.1

Transformations of Quadratic Functions

For use with Exploration 2.1

Essential Question How do the constants a , h , and k affect the graph of the quadratic function $g(x) = a(x - h)^2 + k$?

1 EXPLORATION: Identifying Graphs of Quadratic Functions

Work with a partner. Match each quadratic function with its graph. Explain your reasoning. Then use a graphing calculator to verify that your answer is correct.

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

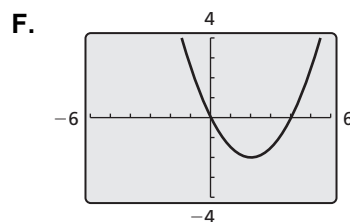
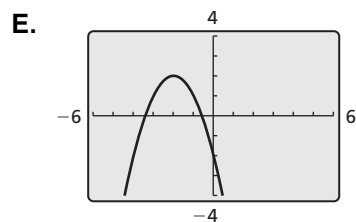
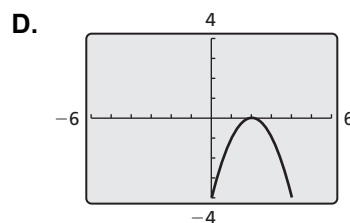
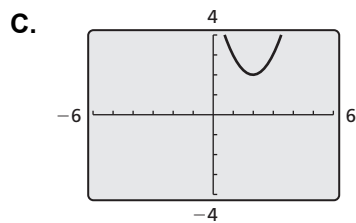
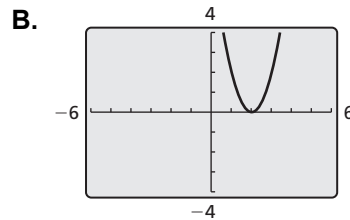
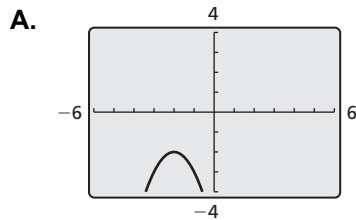
b. $g(x) = (x - 2)^2 + 2$

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

d. $g(x) = 0.5(x - 2)^2 - 2$

e. $g(x) = 2(x - 2)^2$

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

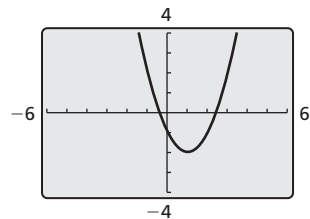


2.1 Transformations of Quadratic Functions (continued)**Communicate Your Answer**

2. How do the constants a , h , and k affect the graph of the quadratic function

$$g(x) = a(x - h)^2 + k?$$

3. Write the equation of the quadratic function whose graph is shown. Explain your reasoning. Then use a graphing calculator to verify that your equation is correct.



2.1**Notetaking with Vocabulary**

For use after Lesson 2.1

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

quadratic function

parabola

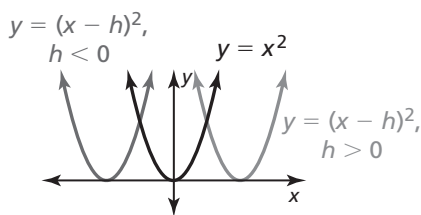
vertex of a parabola

vertex form

Core Concepts**Horizontal Translations**

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

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

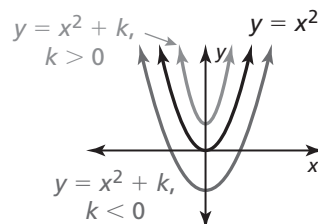


- shifts left when $h < 0$
- shifts right when $h > 0$

Vertical Translations

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

$$f(x) + k = x^2 + k$$



- shifts down when $k < 0$
- shifts up when $k > 0$

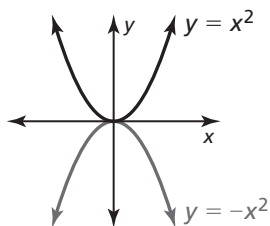
Notes:

2.1 Notetaking with Vocabulary (continued)

Reflections in the x-Axis

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

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

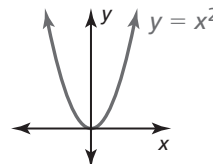


flips over the x -axis

Reflections in the y-Axis

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

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

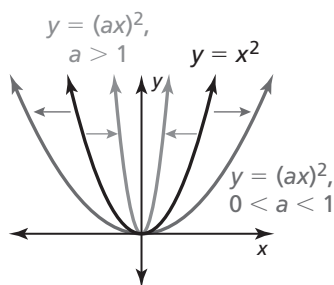


$y = x^2$ is its own reflection in the y -axis.

Horizontal Stretches and Shrinks

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

$$f(ax) = (ax)^2$$

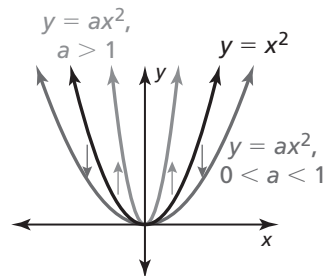


- horizontal stretch (away from y -axis) when $0 < a < 1$
- horizontal shrink (toward y -axis) when $a > 1$

Vertical Stretches and Shrinks

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

$$a \cdot f(x) = ax^2$$



- vertical stretch (away from x -axis) when $a > 1$
- vertical shrink (toward x -axis) when $0 < a < 1$

Notes:

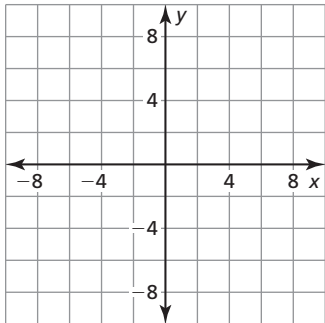
2.1 Notetaking with Vocabulary (continued)

Extra Practice

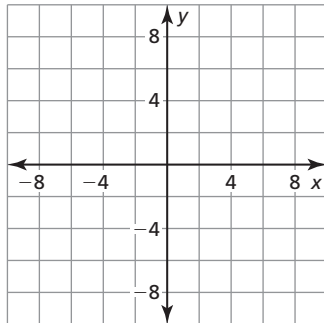
In Exercises 1–6, describe the transformation of $f(x) = x^2$ represented by g .

Then graph the function.

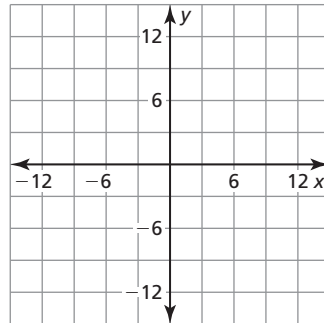
1. $g(x) = x^2 + 4$



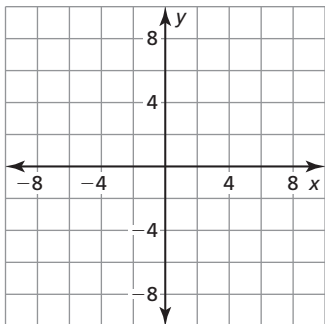
2. $g(x) = (x - 1)^2 - 3$



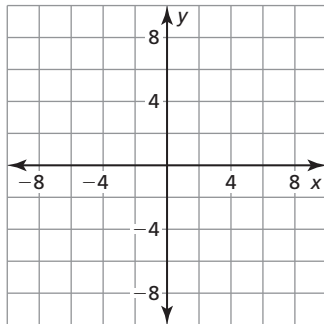
3. $g(x) = -(x + 9)^2$



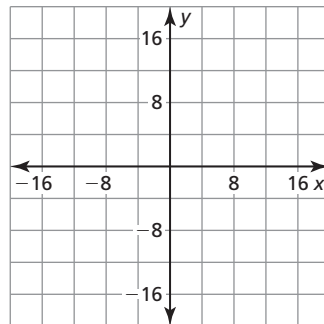
4. $g(x) = x^2 - 7$



5. $g(x) = \frac{1}{3}x^2 - 6$



6. $g(x) = (-4x)^2$



7. Consider the function $f(x) = -10(x - 5)^2 + 7$. Describe the transformation of the graph of the parent quadratic function. Then identify the vertex.