

Chapter 5  
Rational Exponents and Radical Functions

Section 5-3  
Graphing Radical Functions

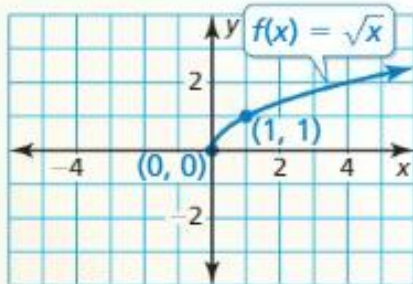
## Graphing Radical Functions

A **radical function** contains a radical expression with the independent variable in the radicand. When the radical is a square root, the function is called a *square root function*. When the radical is a cube root, the function is called a *cube root function*.

### Core Concept

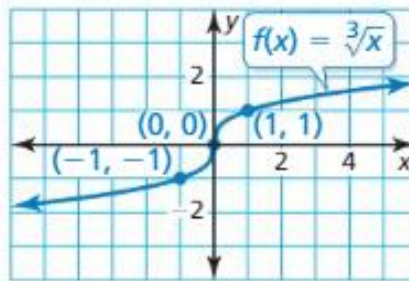
#### Parent Functions for Square Root and Cube Root Functions

The parent function for the family of square root functions is  $f(x) = \sqrt{x}$ .



Domain:  $x \geq 0$ , Range:  $y \geq 0$

The parent function for the family of cube root functions is  $f(x) = \sqrt[3]{x}$ .



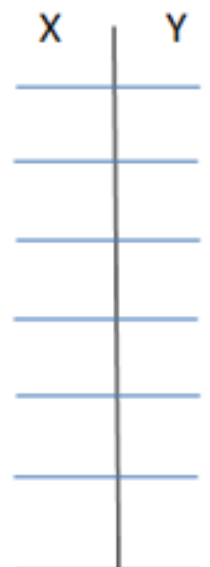
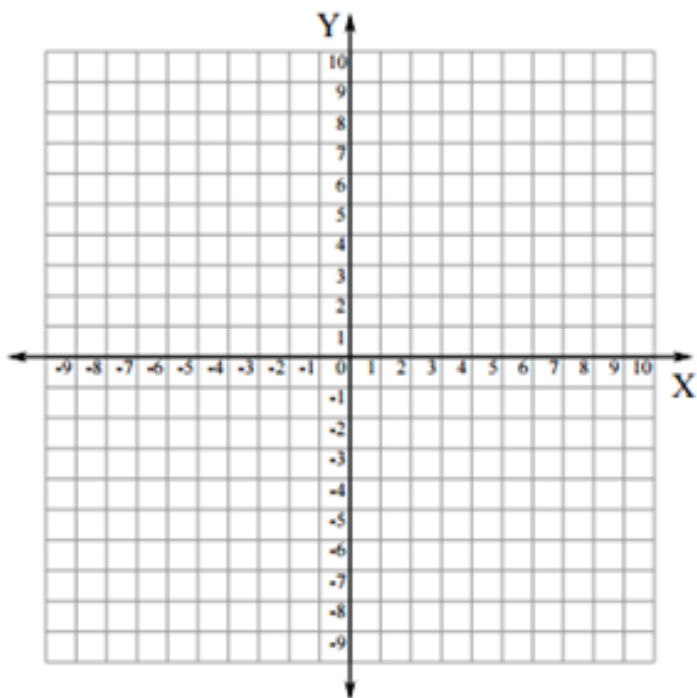
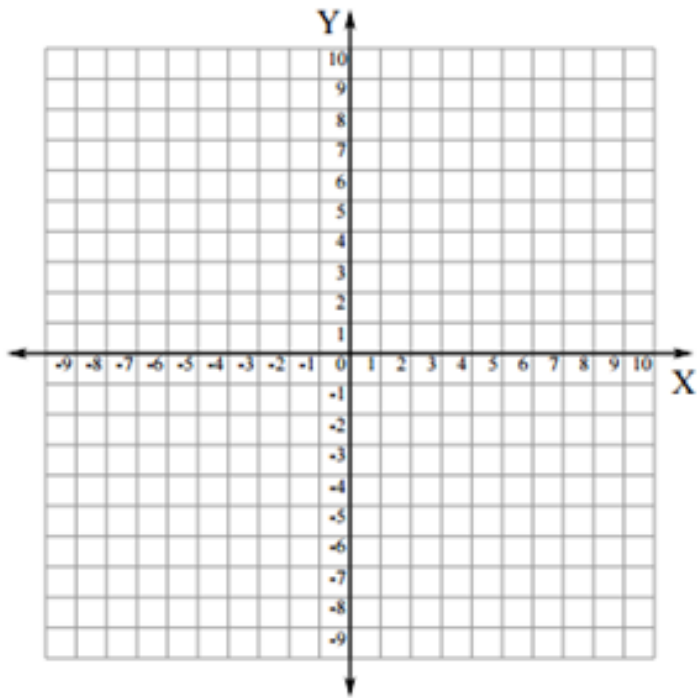
Domain and range: All real numbers

In Example 1, notice that the graph of  $f$  is a horizontal stretch of the graph of the parent square root function. The graph of  $g$  is a vertical stretch and a reflection in the  $x$ -axis of the graph of the parent cube root function. You can transform graphs of radical functions in the same way you transformed graphs of functions previously.

### EXAMPLE 1 Graphing Radical Functions

Graph each function. Identify the domain and range of each function.

- $f(x) = \sqrt{\frac{1}{4}x}$
- $g(x) = -3\sqrt[3]{x}$

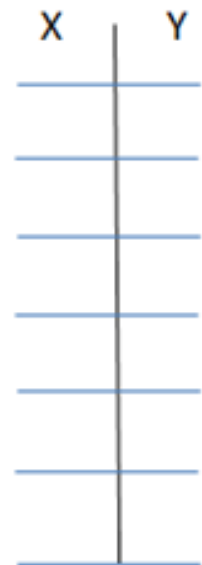
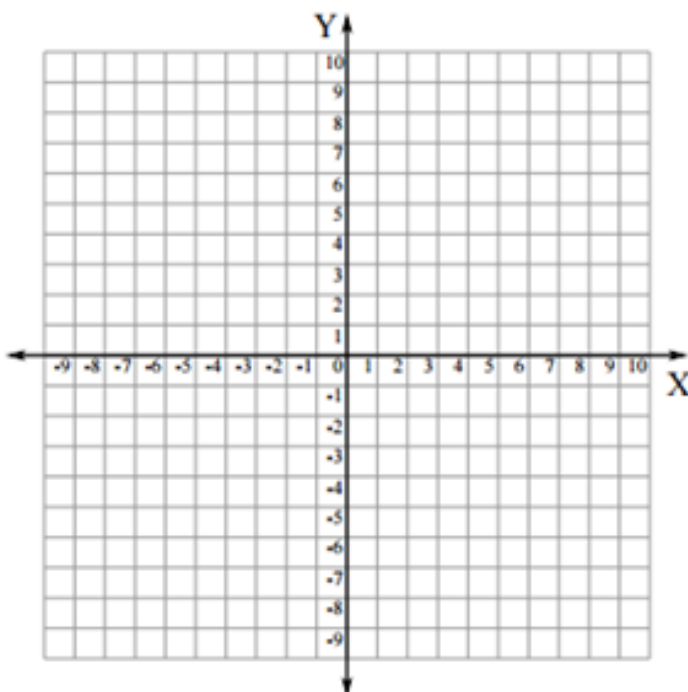
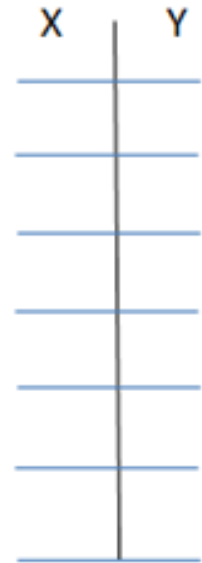
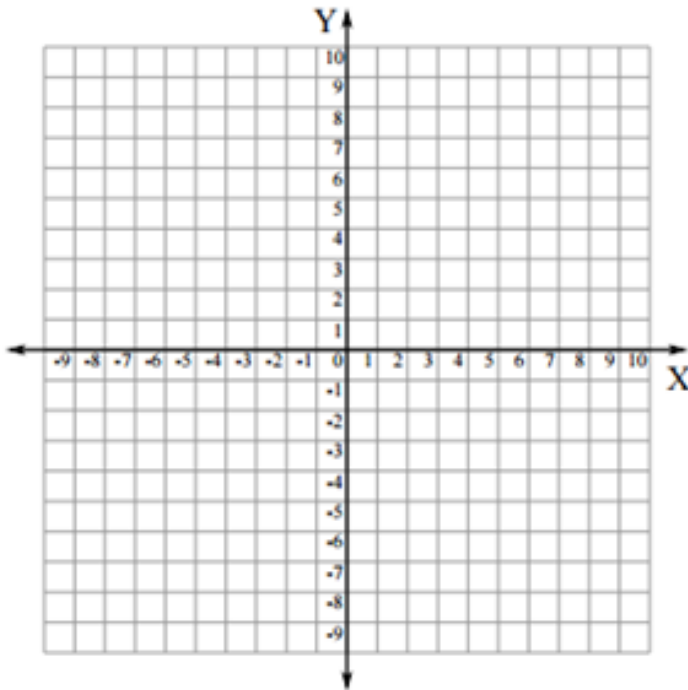


**EXAMPLE 2****Transforming Radical Functions**

Describe the transformation of  $f$  represented by  $g$ . Then graph each function.

a.  $f(x) = \sqrt{x}$ ,  $g(x) = \sqrt{x - 3} + 4$

b.  $f(x) = \sqrt[3]{x}$ ,  $g(x) = \sqrt[3]{-8x}$



## Writing Transformations of Radical Functions



### EXAMPLE 3

#### Modeling with Mathematics



Self-Portrait of  
NASA's Mars Rover Curiosity

The function  $E(d) = 0.25\sqrt{d}$  approximates the number of seconds it takes a dropped object to fall  $d$  feet on Earth. The function  $M(d) = 1.6 \cdot E(d)$  approximates the number of seconds it takes a dropped object to fall  $d$  feet on Mars. Write a rule for  $M$ . How long does it take a dropped object to fall 64 feet on Mars?

### EXAMPLE 4

#### Writing a Transformed Radical Function

Let the graph of  $g$  be a horizontal shrink by a factor of  $\frac{1}{6}$  followed by a translation 3 units to the left of the graph of  $f(x) = \sqrt[3]{x}$ . Write a rule for  $g$ .

In Example 4, is the transformed function the same when you perform the translation followed by the horizontal shrink? Explain your reasoning.

## Graphing Parabolas and Circles

To graph parabolas and circles using a graphing calculator, first solve their equations for  $y$  to obtain radical functions. Then graph the functions.

### **EXAMPLE 5** Graphing a Parabola (Horizontal Axis of Symmetry)

Use a graphing calculator to graph  $\frac{1}{2}y^2 = x$ . Identify the vertex and the direction that the parabola opens.

### **EXAMPLE 6** Graphing a Circle (Center at the Origin)

Use a graphing calculator to graph  $x^2 + y^2 = 16$ . Identify the radius and the intercepts.