Chapter 5
Rational Exponents and Radical Functions

Section 5-3
Graphing Radical Functions

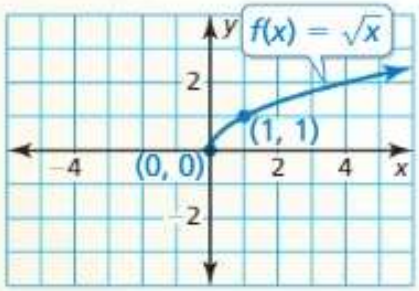
Graphing Radical Functions

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

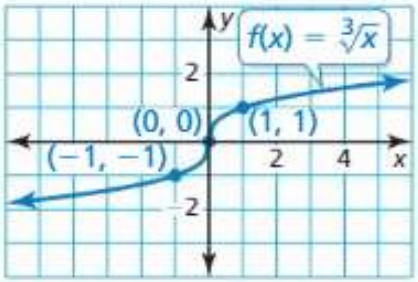
Parent Functions for Square Root and Cube Root Functions

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

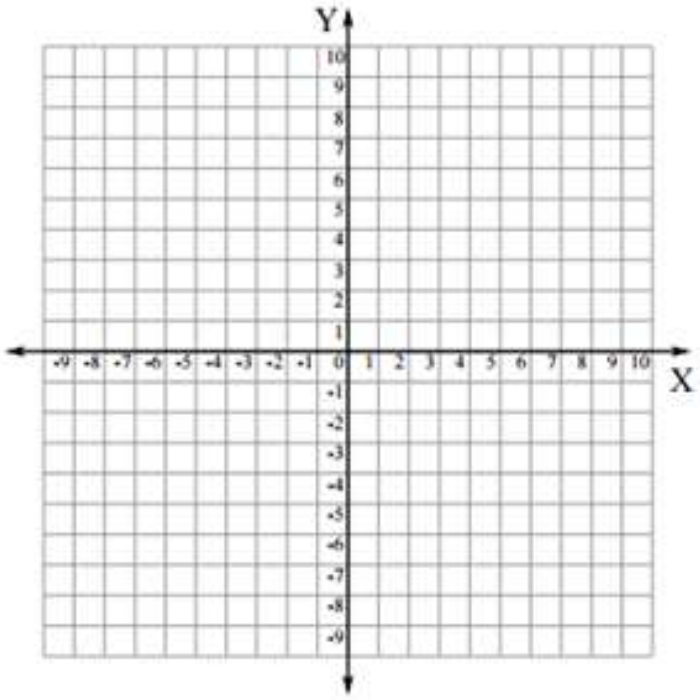
In Example 1, notice that the graph of f is a horizontal stretch of the graph of the parent square root function. The graph of g is a vertical stretch and a reflection in the x-axis of the graph of the parent cube root function. You can transform graphs of radical functions in the same way you transformed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

EXAMPLE 1 Graphing Radical Functions

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

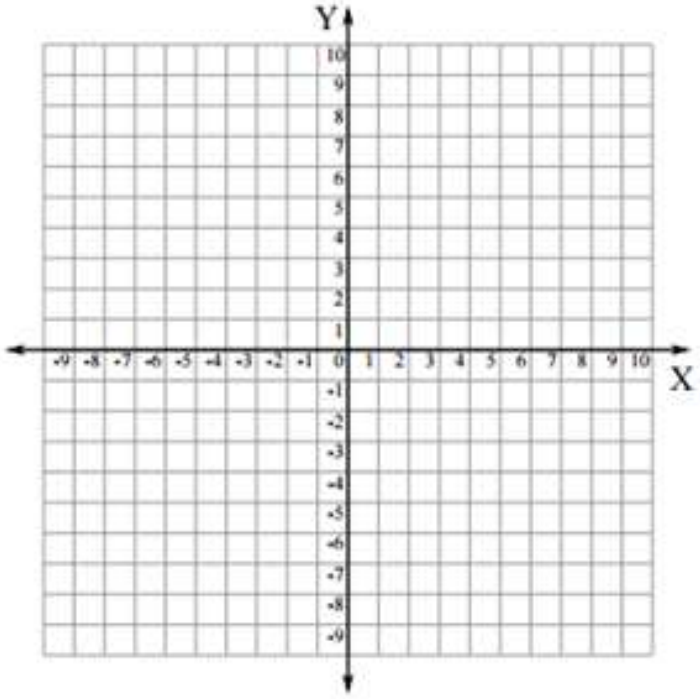
a. $f(x) = \sqrt{\frac{1}{4}x}$

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



X	Y

X	Y



X	Y

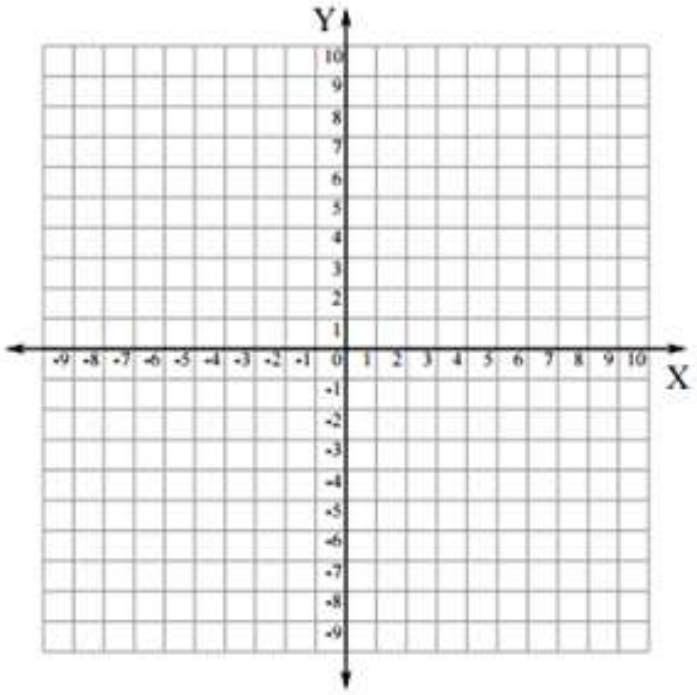
X	Y

EXAMPLE 2 Transforming Radical Functions

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

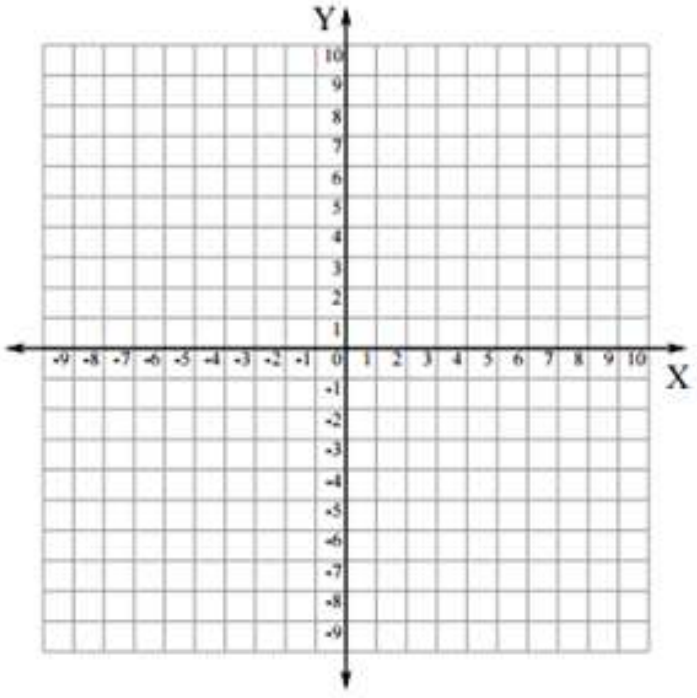
a. $f(x) = \sqrt{x}$, $g(x) = \sqrt{x - 3} + 4$

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



X	Y

X	Y



X	Y

X	Y

Writing Transformations of Radical Functions

Tutorial

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.

5. Use a graphing calculator to graph $-4y^2 = x + 1$. Identify the vertex and the direction that the parabola opens.

6. Use a graphing calculator to graph $x^2 + y^2 = 25$. Identify the radius and the intercepts.