Warm Up:

Simplify the expression. Assume that all variables are positive.

$$\sqrt[4]{\frac{x^8}{3}} = \frac{\sqrt[4]{x^8}}{\sqrt[4]{3}} = \frac{x^{8/4}}{3^{1/4}} = \frac{x^2}{3^{1/4}}$$

Get out a half sheet of paper

"Never give up, failure and rejection are only the first steps in succeeding."

-Jim Valvano

8-7 Radical Functions

Objectives

Graph radical functions and inequalities.

Transform radical functions by changing parameters.

8-7 Radical Functions

Vocabulary

radical function

square-root function

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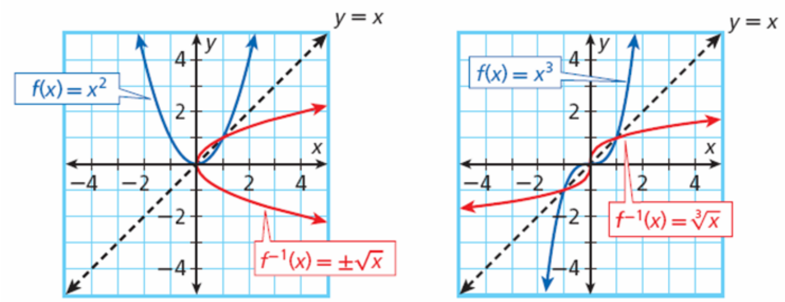
8-7 Radical Functions

Recall that exponential and logarithmic functions are inverse functions. Quadratic and cubic functions have inverses as well. The graphs below show the inverses of the quadratic parent function and cubic parent function.



8-7 Radical Functions

Notice that the inverses of $f(x) = x^2$ is not a function because it fails the vertical line test. However, if we limit the domain of $f(x) = x^2$ to $x \geq 0$, its inverse is the function $f^{-1}(x) = \sqrt{x}$.

A **radical function** is a function whose rule is a radical expression. A **square-root function** is a radical function involving $\sqrt{x}$. The square-root parent function is $f(x) = \sqrt{x}$. The cube-root parent function is $f(x) = \sqrt[3]{x}$.

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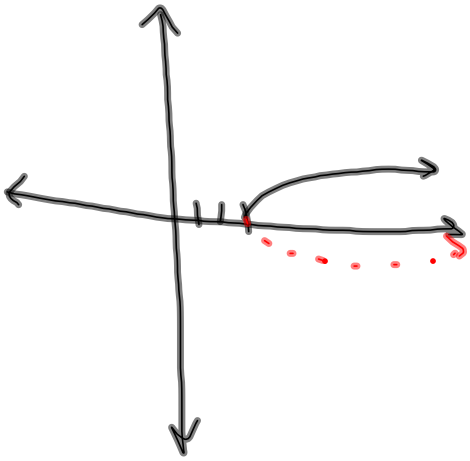
Graph each function and identify its domain and range.

$f(x) = \sqrt{x-3}$

D: $x \geq 3$

R: $y \geq 0$



Graph each function and identify its domain and range.

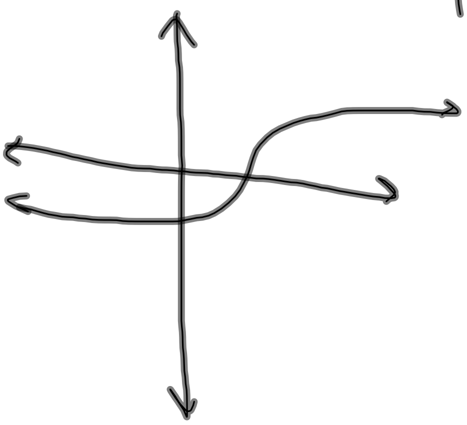
$f(x) = 2\sqrt[3]{x-2}$

$\wedge(1/3)$

$y = 2(x-2)^{1/3}$

D: $\mathbb{R}$

R: $\mathbb{R}$



Graph each function and identify its domain and range.

$f(x) = \sqrt[3]{x}$

The graphs of radical functions can be transformed by using methods similar to those used to transform linear, quadratic, polynomial, and exponential functions. This lesson will focus on transformations of square-root functions.

8-7 Radical Functions

Transformations of the Square-Root Parent Function $f(x) = \sqrt{x}$

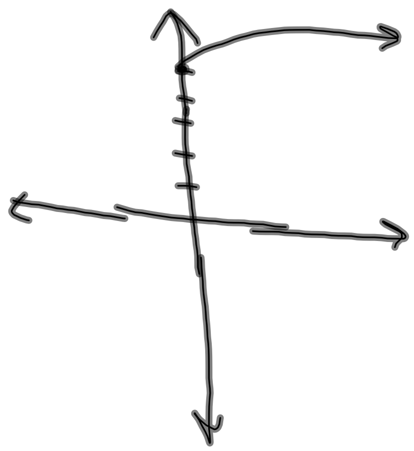
Transformation	$f(x)$ Notation	Examples
Vertical translation	$f(x) + k$	$y = \sqrt{x} + 3$ 3 units up $y = \sqrt{x} - 4$ 4 units down
Horizontal translation	$f(x - h)$	$y = \sqrt{x - 2}$ 2 units right $y = \sqrt{x + 1}$ 1 unit left
Vertical stretch/ compression	$af(x)$	$y = 6\sqrt{x}$ vertical stretch by 6 $y = \frac{1}{2}\sqrt{x}$ vertical compression by $\frac{1}{2}$
Horizontal stretch/ compression	$f\left(\frac{1}{b}x\right)$	$y = \sqrt{\frac{1}{5}x}$ horizontal stretch by 5 $y = \sqrt{3x}$ horizontal compression by $\frac{1}{3}$
Reflection	$-f(x)$ $f(-x)$	$y = -\sqrt{x}$ across x-axis $y = \sqrt{-x}$ across y-axis

Once again we are transforming functions. All the rules are the same. Be sure to watch out for horizontal stretches, you need to multiply x by 1/factor...

Using the graph of $f(x) = \sqrt{x}$ as a guide, describe the transformation and graph the function.

$g(x) = \sqrt{x} + 5$

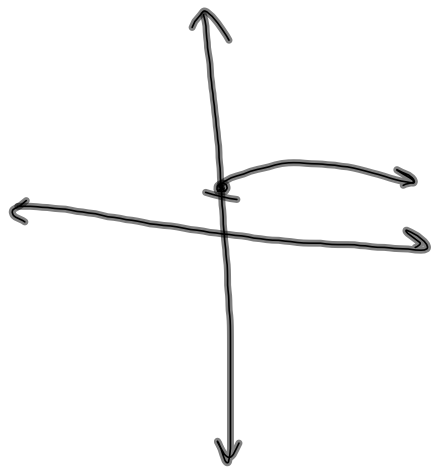
Up 5



Using the graph of $f(x)= \sqrt{x}$ as a guide, describe the transformation and graph the function.

$g(x) = \sqrt{x} + 1$

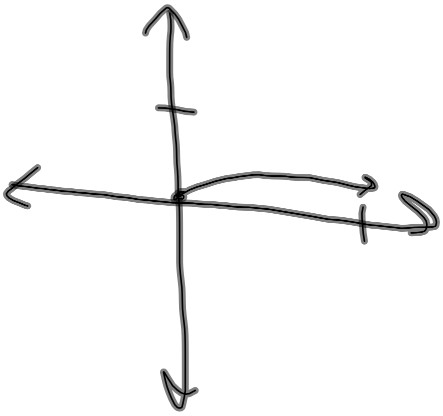
Up 1



Using the graph of $f(x) = \sqrt{x}$ as a guide, describe the transformation and graph the function.

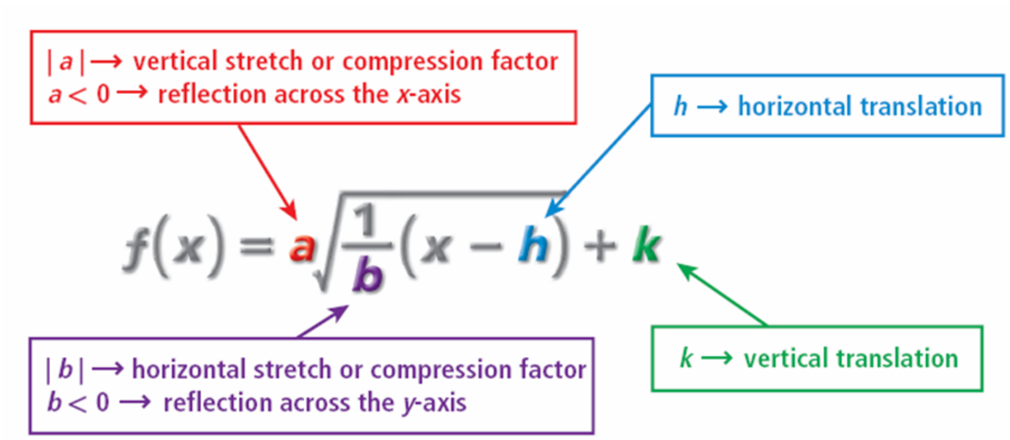
$g(x) = \frac{1}{2}\sqrt{x}$

Vertical factor ½



8-7 Radical Functions

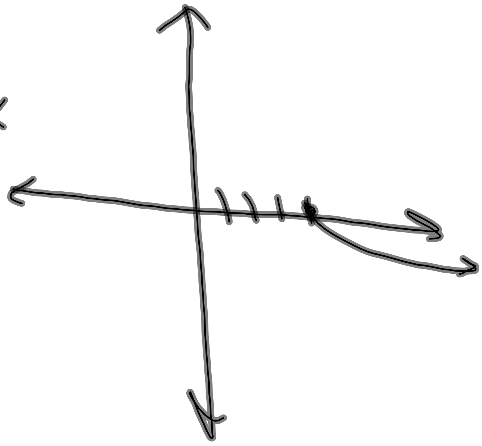
Transformations of square-root functions are summarized below.



Using the graph of $f(x)=\sqrt{x}$ **as a guide, describe the transformation and graph the function** $g(x)=-\sqrt{x-4}$.

R 4

Ref over x

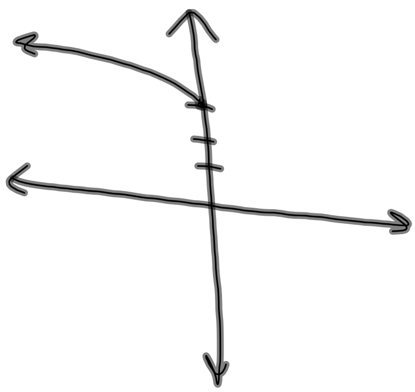


Using the graph of $f(x)=\sqrt{x}$ **as a guide, describe the transformation and graph the function.**

$g(x)=\sqrt{-x}+3$

Ref across y

up 3



Using the graph of $f(x) = \sqrt{x}$ as a guide, describe the transformation and graph the function.

$g(x) = -3\sqrt{x} - 1$

Use the description to write the square-root function *g*. The parent function $f(x) = \sqrt{x}$ is reflected across the *x*-axis, compressed vertically by a factor of $\frac{1}{5}$, and translated down 5 units.

$-\frac{1}{5}\sqrt{x} - 5$

Use the description to write the square-root function *g*.

The parent function $f(x) = \sqrt{x}$ is reflected across the x-axis, stretched vertically by a factor of 2, and translated 1 unit up.

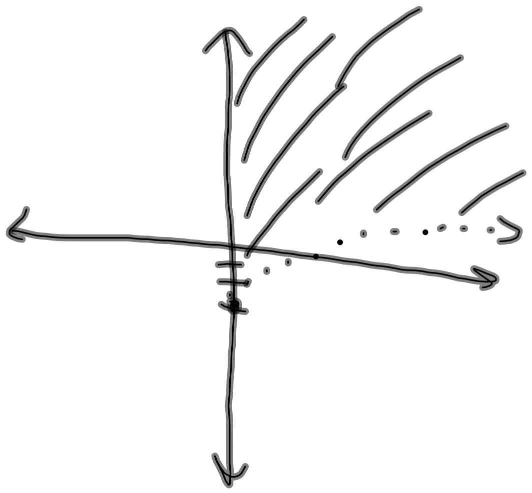
$-2\sqrt{x} + 1$

In addition to graphing radical functions, you can also graph radical inequalities. Use the same procedure you used for graphing linear and quadratic inequalities.

$<$ $>$ - - - -

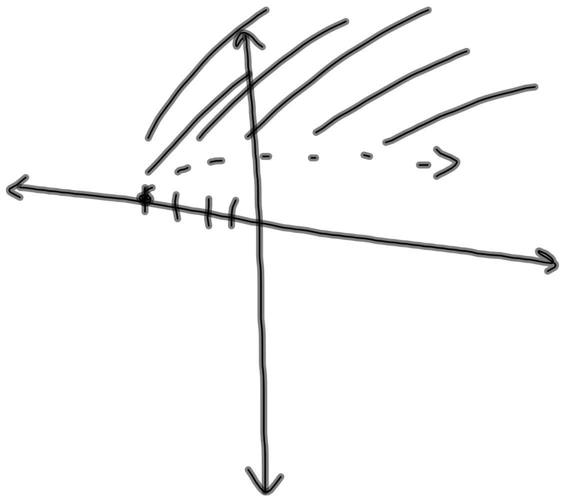
$\leq$ $\geq$ ——

Graph the inequality $y > 2\sqrt{x} - 3$.



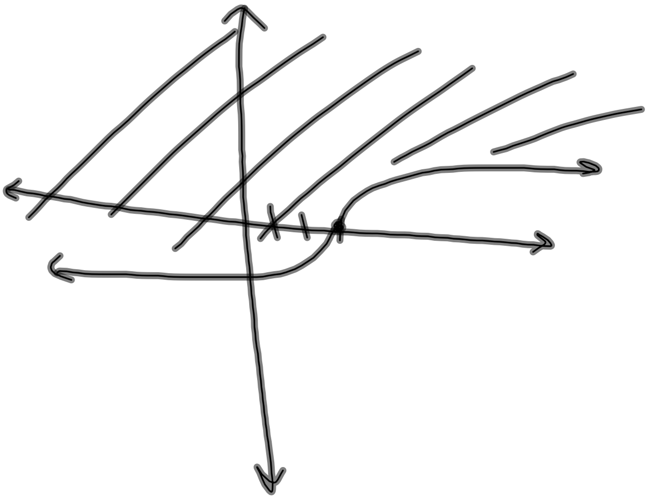
Graph the inequality.

$y > \sqrt{x+4}$



Graph the inequality.

$y \geq \sqrt[3]{x-3}$



Homework:

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