LESSON 5. 3a

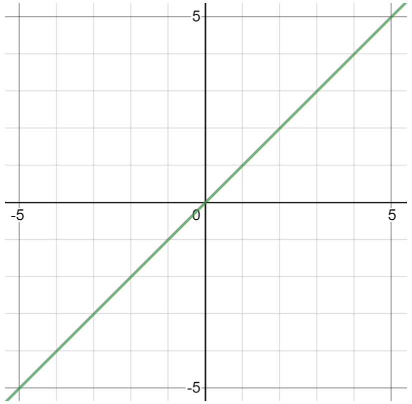
Transforms of Radical Functions

Today you will:

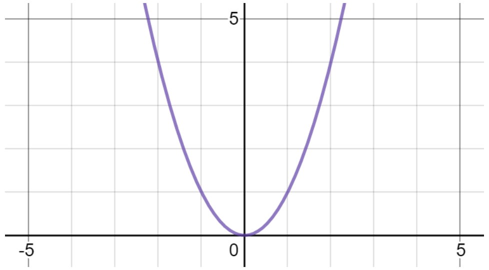
- Apply our knowledge of function transforms to radical functions.
- Apply our knowledge of quick graphing to graph radical functions.
- Practice using English to describe math processes and equations

Basic shapes of functions

$y = x$

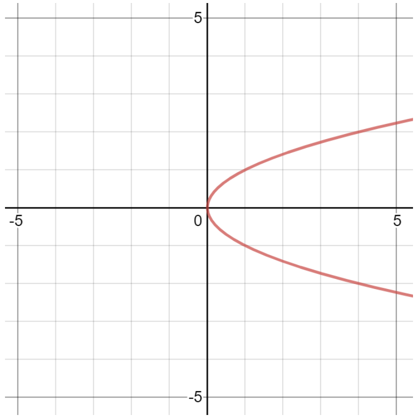


$y = x^2$

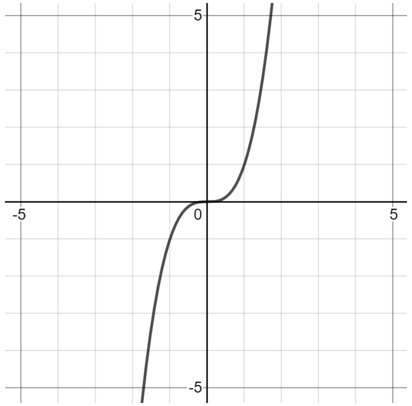


even power

$x = y^2$

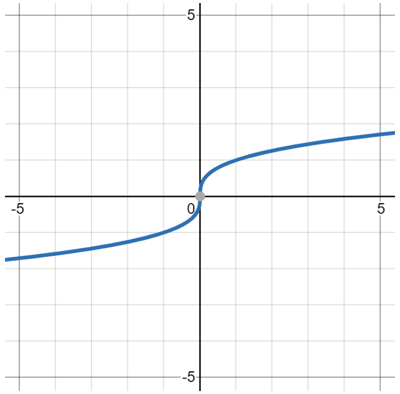


$y = x^3$



odd power

$x = y^3$



Key attributes for quick graphing a function

- Shape (U or S)
  - U – even power (parabola)
  - S – odd power (cubic)

- Vertex/turning point
  - Vertex for parabola
  - Turning point for cubic

- Opening direction (up, down, left, right)
  - Up/down for y=
  - Left/right for x=

- Intercepts
  - X-intercepts (a, o) … when y = 0
  - Y-intercepts (0, a) … when x = 0

Tranformations of Functions

Transformation	$f(x)$ Notation	Examples	
Horizontal Translation Graph shifts left or right.	$f(x-h)$	$g(x)=\sqrt{x-2}$ $g(x)=\sqrt{x+3}$	2 units right 3 units left
Vertical Translation Graph shifts up or down.	$f(x)+k$	$g(x)=\sqrt{x}+7$ $g(x)=\sqrt{x}-1$	7 units up 1 unit down
Reflection Graph flips over x- or y-axis.	$f(-x)$ $-f(x)$	$g(x)=\sqrt{-x}$ $g(x)=-\sqrt{x}$	in the y-axis in the x-axis
Horizontal Stretch or Shrink Graph stretches away from or shrinks toward y-axis.	$f(ax)$	$g(x)=\sqrt{3x}$ $g(x)=\sqrt{\frac{1}{2}x}$	shrink by a factor of $\frac{1}{3}$ stretch by a factor of 2
Vertical Stretch or Shrink Graph stretches away from or shrinks toward x-axis.	$a \cdot f(x)$	$g(x)=4\sqrt{x}$ $g(x)=\frac{1}{5}\sqrt{x}$	stretch by a factor of 4 shrink by a factor of $\frac{1}{5}$

Typical problem types with transformations…

1. Describe how a function has been transformed from the parent function
   - Compare the function to its parent
   - Can look at the graph
   - Can look at the function equations themselves

2. Apply transformations to a function
   - Do them in order.   Order matters!
   - Do them *****ONE AT A TIME*****

3. Quick graph a function
   - Use the key attributes

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

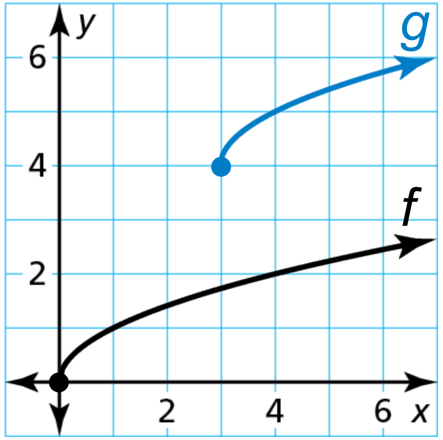
a. $f(x) = \sqrt{x}$, $g(x) = \sqrt{x - 3} + 4$

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

SOLUTION

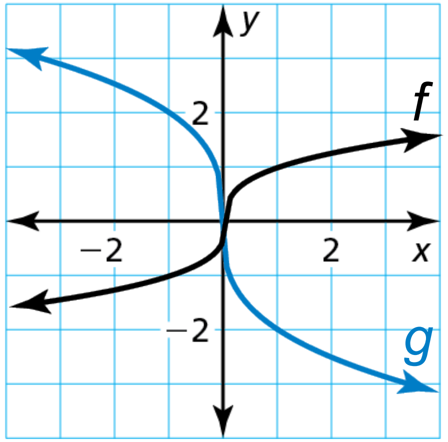
a. Notice that the function is of the form $g(x) = \sqrt{x - h} + k$, where $h = 3$ and $k = 4$.

So, the graph of g is a translation 3 units right and 4 units up of the graph of f.



b. Notice that the function is of the form $g(x) = \sqrt[3]{ax}$, where $a = -8$.

So, the graph of g is a horizontal shrink by a factor of $\frac{1}{8}$ and a reflection in the y-axis of the graph of f.



LOOKING FOR STRUCTURE

In Example 2(b), you can use the Product Property of Radicals to write $g(x) = -2\sqrt[3]{x}$. So, you can also describe the graph of g as a vertical stretch by a factor of 2 and a reflection in the x-axis of the graph of f.

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.

SOLUTION

Step 1 First write a function h that represents the horizontal shrink of f.

$h(x) = f(6x)$ — Multiply the input by $1 \div \frac{1}{6} = 6$.

$= \sqrt[3]{6x}$ — Replace x with $6x$ in $f(x)$.

Step 2 Then write a function g that represents the translation of h.

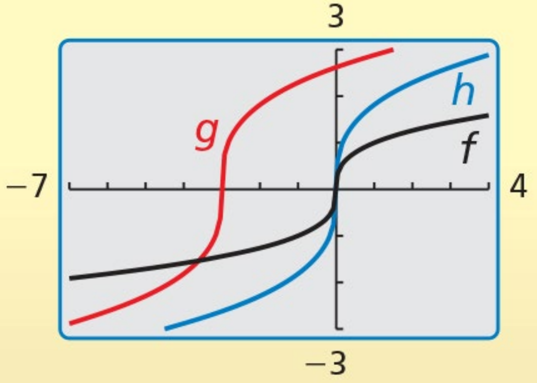
$g(x) = h(x + 3)$ — Subtract -3, or add 3, to the input.

$= \sqrt[3]{6(x + 3)}$ — Replace x with $x + 3$ in $h(x)$.

$= \sqrt[3]{6x + 18}$ — Distributive Property

The transformed function is $g(x) = \sqrt[3]{6x + 18}$.

Check



Homework

Pg 256, #19-28, 41-50