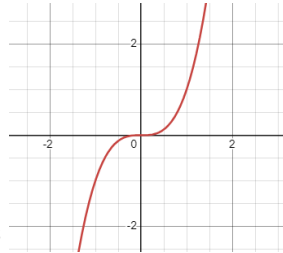9/3/2024

Transformations (continued... library of functions, combining transformations)
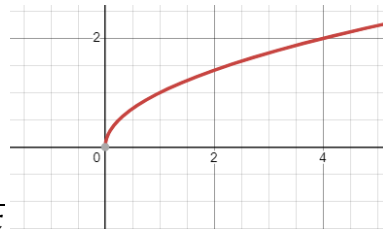Analyzing Graphs of functions and piecewise functions

Transformations in a library of basic functions
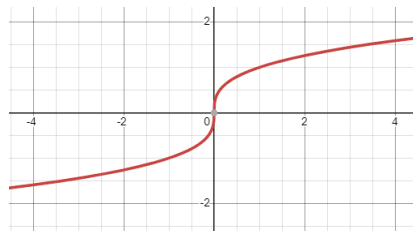Identity function: $y = x$
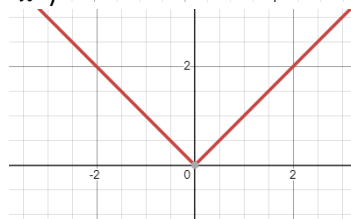Square function: $y = x^2$

Cubic function: $y = x^3$

Square root function: $y = \sqrt{x}$

Cube root function: $y = \sqrt[3]{x}$ $(y = x^{\frac{1}{3}})$

Absolute value function: $y = |x|$

Later in the course we'll add $y = e^x, y = \log(x), y = \ln(x)$, in 162, you'll add trig functions like y=sin(x), etc.

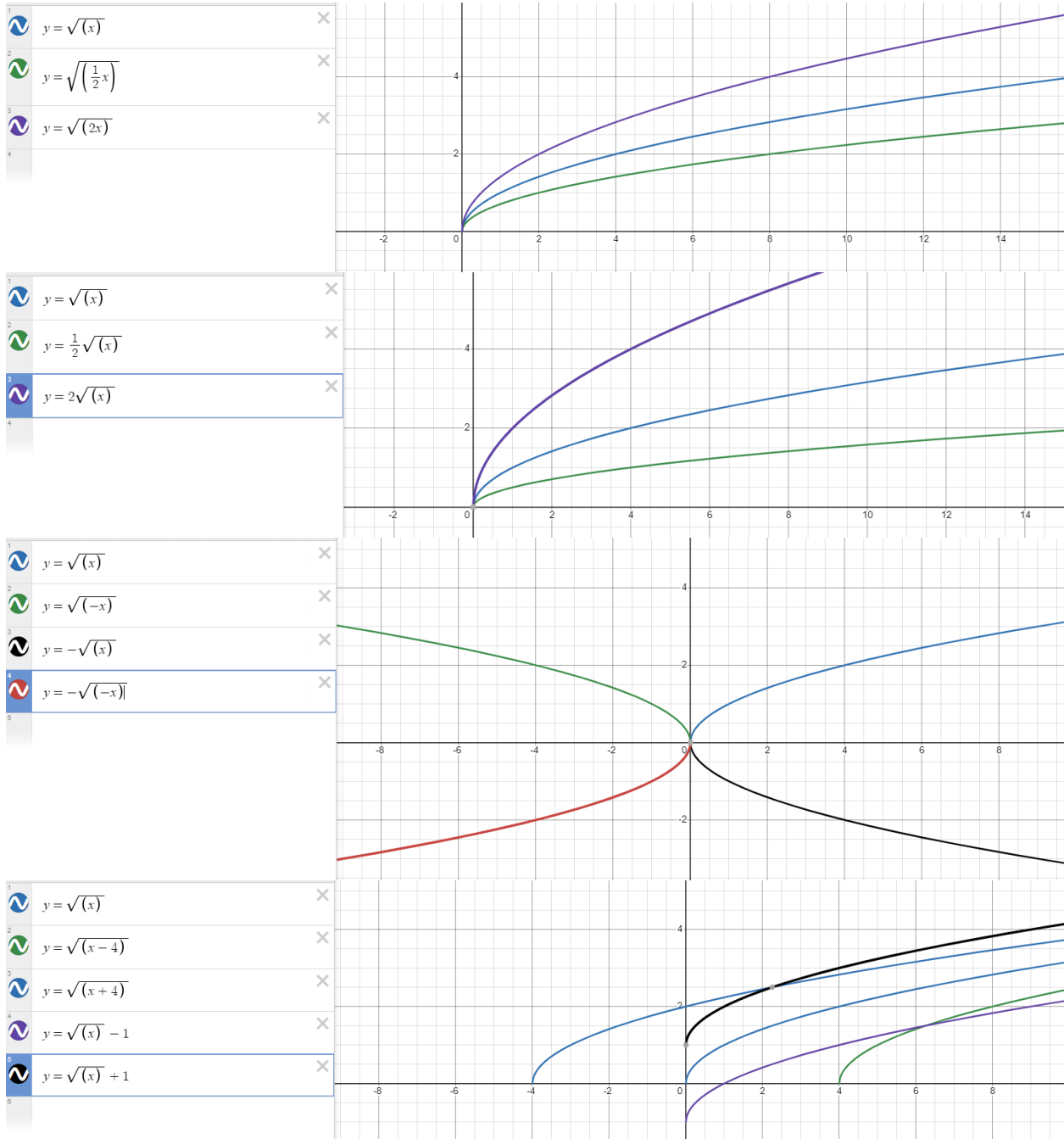Three types of transformations: scaling (stretching and compressing), reflecting, shifting (sliding side to side or up/down).

In general, you apply the transformations in the following order: 1) horizontal scaling/reflecting, 2) horizontal shifting, 3) vertical scaling/reflecting, 4) vertical shifting.

$$f(x) \rightarrow f(ax) \rightarrow f\big(a(x-h)\big) \rightarrow bf\big(a(x-h)\big) \rightarrow bf\big(a(x-h)\big) + k$$

Inside the function things do the opposite of what you expect, -h is a rightward shift, +h is a leftward shift. But outside the function, +k is upward, and -k is downward.

Likewise, the scaling factor 0<a<1 will stretch inside but outside it will compress. Vice versa, a>1 inside the function notation will compress, and outside the function will stretch.

$y = \sqrt{(x)}$

$y = \sqrt{\left(\frac{1}{2}x\right)}$

$y = \sqrt{(2x)}$

$y = \sqrt{(x)}$

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

$y = 2\sqrt{(x)}$

$y = \sqrt{(x)}$

$y = \sqrt{(-x)}$

$y = -\sqrt{(x)}$

$y = -\sqrt{(-x)}|$

$y = \sqrt{(x)}$

$y = \sqrt{(x-4)}$

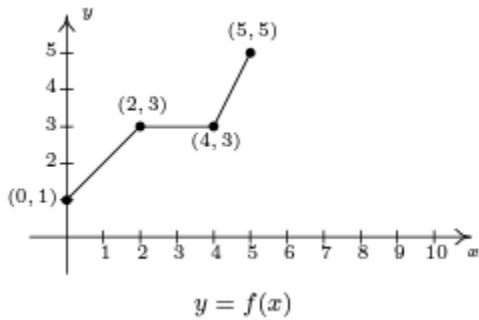$y = \sqrt{(x+4)}$

$y = \sqrt{(x)} - 1$

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

Apply the following transformation to the base square root graph:
1) Horizontal reflection
2) Horizontal shift of 2 (right)

3) Vertical stretch of 3
4) Vertical shift of -5 (down 5)

$$y = 3f\big(-(x-2)\big) - 5 = 3\sqrt{-(x-2)} - 5 = 3\sqrt{2-x} - 5$$

1 $y = \sqrt{(x)}$

2 $y = \sqrt{(-x)}$

3 $y = \sqrt{(-(x-2))}$

4 $y = 3\sqrt{(2-x)}$
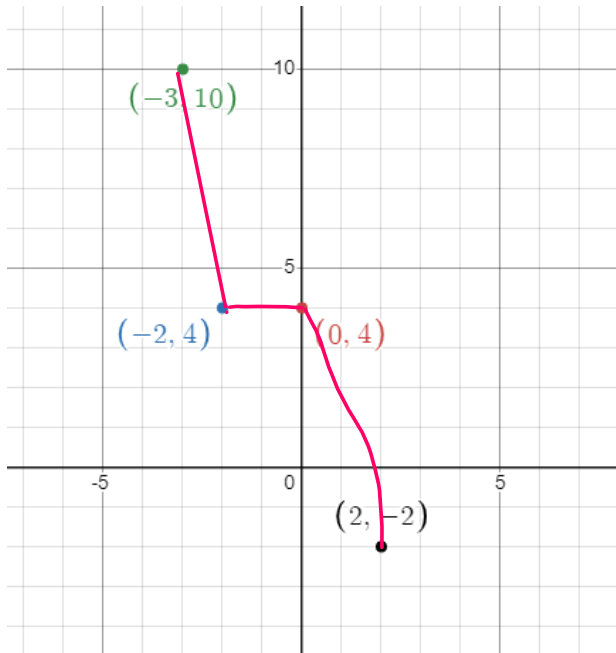
5 $y = 3\sqrt{(2-x)} - 5$

6

powered by

$y = f(x)$

Apply the following transformation to the piecewise graph:
1) Horizontal reflection
2) Horizontal shift of 2 (right)
3) Vertical stretch of 3
4) Vertical shift of -5 (down 5)

$$y = 3f\big(-(x-2)\big) - 5$$

Original	Horizontal reflection	Horizontal shift	Vertical stretch	Vertical shift
(0,1)	(0,1)	(2,1)	(2,3)	(2,-2)
(2,3)	(-2,3)	(0,3)	(0,9)	(0,4)
(4,3)	(-4,3)	(-2,3)	(-2,9)	(-2,4)
(5,5)	(-5,5)	(-3,5)	(-3,15)	(-3,10)

A lot of section 2.1 and 2.2 will be done via graphs.
https://www.desmos.com/calculator
https://www.graphfree.com/

Review 2.1 for the equations of line, formula for the slope
Practice from 2.2 graphing piecewise functions
Properties of graphs like domain and range, max, min, where its increasing, decreasing, etc.