

# Radical Functions

$a$  - vertical stretch/compression  
reflection over x-axis  $a < 0$

$a > 1$  (skinny) stretch  
 $0 < a < 1$  (fat) compression

$$f(x) = a\sqrt{x-h} + k$$

up and down  
Vertical Translation

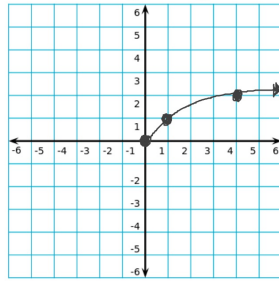
left and right  
Horizontal Translation  
sign change!

parent function  
 $f(x) = \sqrt{x}$

x	$\sqrt{x}$	y
-1	$\sqrt{-1}$	i
0	$\sqrt{0}$	0
1	$\sqrt{1}$	1
4	$\sqrt{4}$	2

Point of Origin: (h, k)

We cannot graph imaginary numbers on the coordinate plane, therefore, the x values have a stopping point (point of origin).



# Domain and Range

domain: all possible x values within the function  
range: all possible y values within the function

$$y = 3\sqrt{x+2} - 1$$

1)  $a = 3$   $h = -2$   $k = -1$

2) Transformations:

•  $a = 3$  vert. stretch factor of 3

•  $h = -2$  moves left 2

•  $k = -1$  moves down 1

3) Domain:

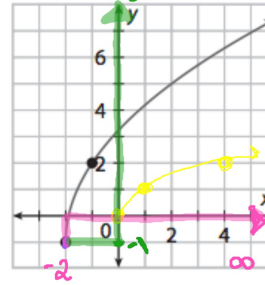
set notation:  $\{x \mid x \geq -2\}$

interval notation:  $[-2, \infty)$

4) Range:

set notation:  $\{y \mid y \geq -1\}$

interval notation:  $[-1, \infty)$



$$y = -0.5\sqrt{x-0.5} + 1$$

1)  $a = -0.5$   $h = 0.5$   $k = 1$

2) Transformations:

•  $a \rightarrow$  reflected over x-axis  
•  $\rightarrow$  vert. comp. factor .5  
•  $h \rightarrow$  right .5 units  
•  $k \rightarrow$  up 1

3) Domain:

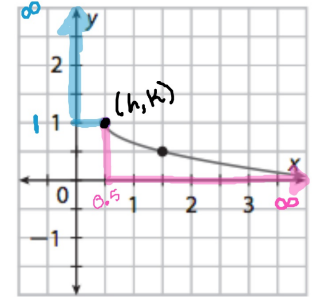
set notation:  $\{x \mid x \geq 0.5\}$

interval notation:  $[0.5, \infty)$

4) Range:

set notation:  $\{y \mid y \leq 1\}$

interval notation:  $(-\infty, 1]$



What is different about this function rule???

$$y = 3\sqrt{-x+3}$$



1)  $a = 3$   $h = 0$   $k = 3$

$b = -1$

2) Transformations:

•  $a \rightarrow$  stretched factor of 3

•  $k \rightarrow$  up 3

•  $b \rightarrow$  reflection over the y-axis

3) Domain:

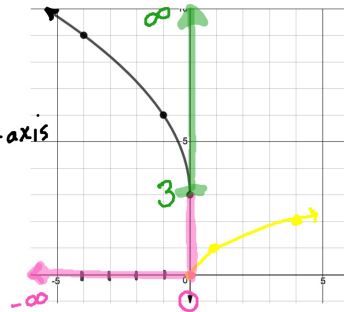
set notation:  $\{x \mid x \leq 0\}$

interval notation:  $(-\infty, 0]$

4) Range:

set notation:  $\{y \mid y \geq 3\}$

interval notation:  $[3, \infty)$



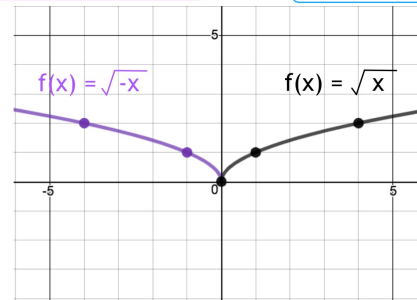
$a$  - vertical stretch/compression  
reflection over x-axis

Vertical Translation

Neg. #!  
 $b < 0$  reflection over the y-axis

$$f(x) = a\sqrt{b(x-h)} + k$$

Horizontal Translation



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

1)  $a = -1/2$   $h = 2$   $k = -1$

$b = -1$

2) Transformations:

•  $a \rightarrow$  comp. fact. 1/2 refl. of x-axis

•  $h \rightarrow$  right 2

•  $k \rightarrow$  down 1

•  $b \rightarrow$  reflect over y-axis

3) Domain:

set notation:  $\{x \mid x \leq 2\}$

interval notation:  $(-\infty, 2]$

4) Range:

set notation:  $\{y \mid y \leq -1\}$

interval notation:  $(-\infty, -1]$

