

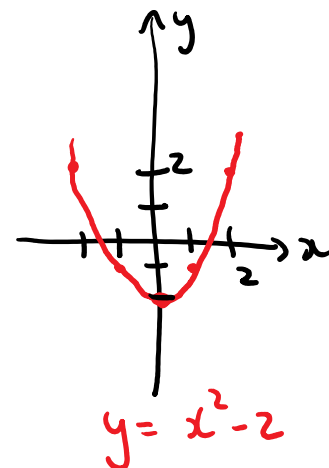
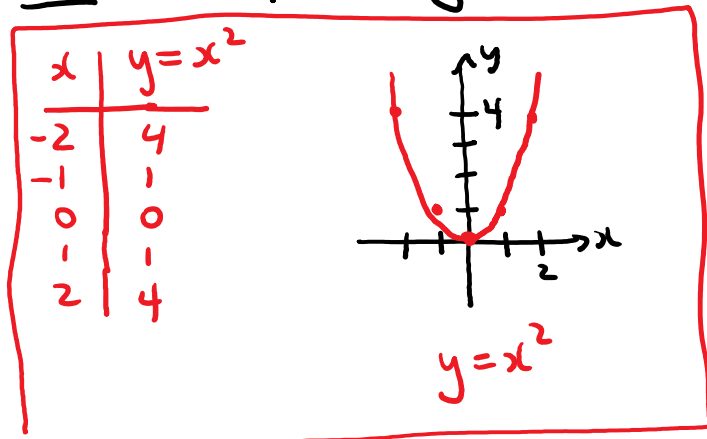
3.5 Graphing Transformations

Vertical Shift : Let $k > 0$

$y = f(x) + k$ is $y = f(x)$ shifted up by k units

$y = f(x) - k$ " down

Ex: Graph $y = x^2$ and $y = x^2 - 2$



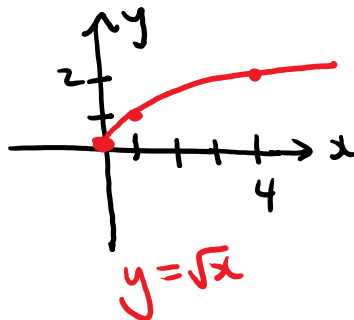
Horizontal Shift Let $h > 0$

$y = f(x+h)$ is $y = f(x)$ shifted left by h units

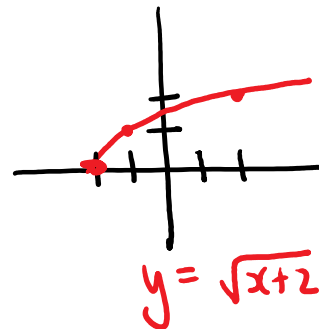
$y = f(x-h)$ " right

Ex: Graph $y = \sqrt{x}$ and $y = \sqrt{x+2}$

x	$y = \sqrt{x}$
0	0
1	1
4	2



Graph contains (0,0)



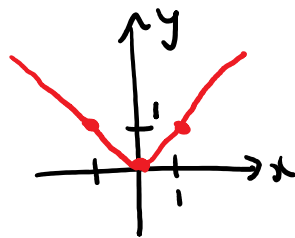
Graph contains (-2,0)

Comment: Replacing x with $x+2$ shifts the graph left 2 units

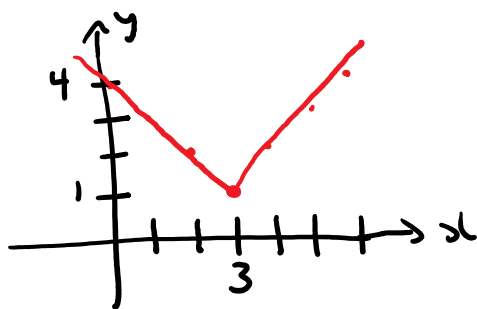
Ex: Graph $y = |x-3| + 1$ using transformations

$$y = |x|$$

x	$y = x $
-1	1
0	0
1	1



Transformation: Shift up 1 unit
Shift right 3 units



Follow-up: Domain and range of $y = |x-3| + 1$?

Domain:
(x-values) $-\infty < x < \infty$
all real #

Range:
(y-values) $[1, \infty)$
 $1 \leq y < \infty$
 $y \geq 1$

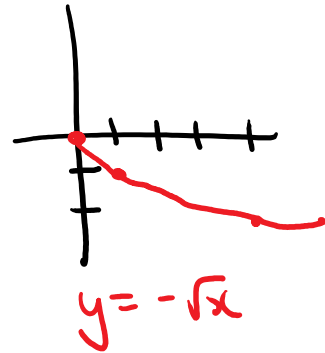
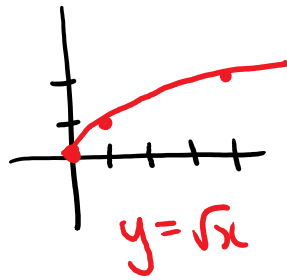
Reflections

$y = -f(x)$ is $y = f(x)$ reflected in x-axis (Vertical Reflection)

$y = f(-x)$ is $y = f(x)$ " y-axis (Horizontal Reflection)

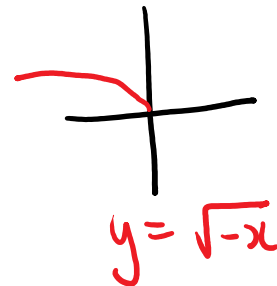
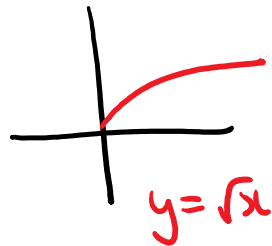
Ex: Graph $y = \sqrt{x}$ and $y = -\sqrt{x}$

x	$y = \sqrt{x}$
0	0
1	1
4	2



Reflection in x -axis
(Vertical Reflection)

Ex: Graph $y = \sqrt{x}$ and $y = \sqrt{-x}$



Horizontal Reflection
Reflection in y -axis

Ex: Describe in words how to transform $y = x^2$ to get the new function

a) $y = (x+4)^2$
Shift left 4 units

b) $y = -x^2$
 Vertical reflection
 (Reflect in x-axis)

c) $y = x^2 - 3$
 Shift down 3 units

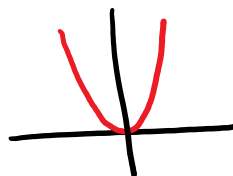
d) $y = (-x)^2$

Answer 1

Horizontal Reflection
 (Reflect in y-axis)

Answer 2

$y = (-x)^2$
 $y = x^2$
 Nothing



horizontal
 symmetry

