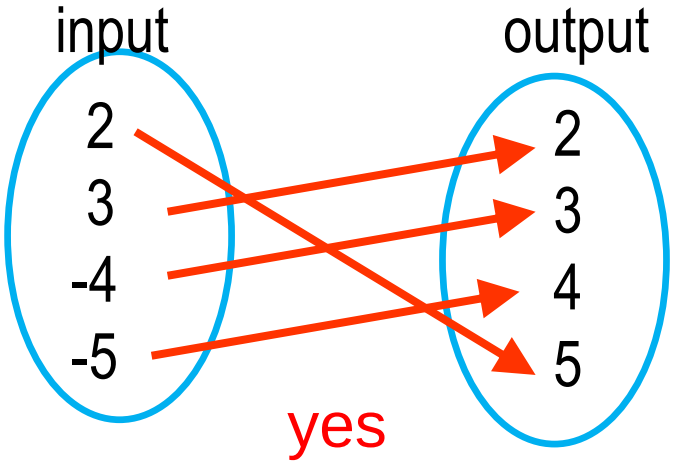
Math-2A

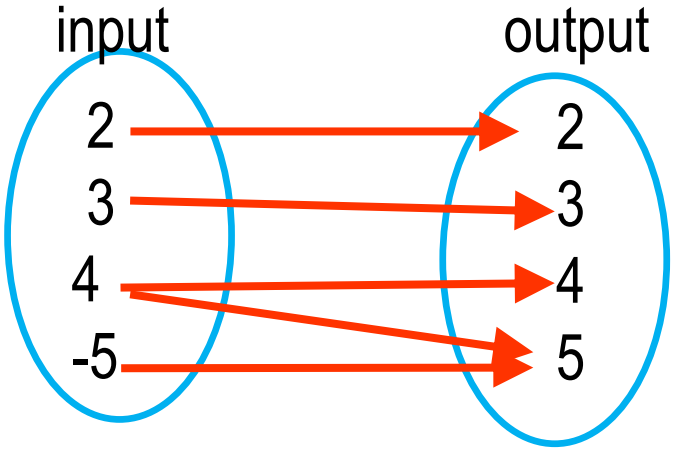
Lesson 7-8

Functions: Linear, Square, Square root, absolute value, piece-wise defined

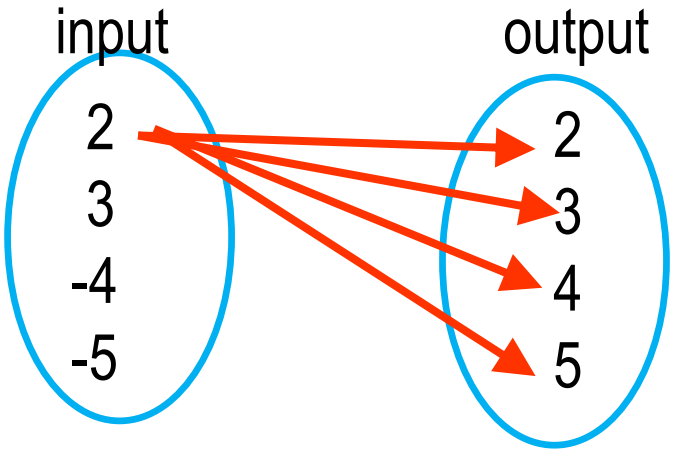
Is it a function?



yes



Relation but NOT a function since input value ‘4’ has 2 outputs.



No: input value ‘2’ has more than one output

There are at least 6 ways to show a relation between input and output values.

Ordered Pairs: (2, 4), (3, 2), (-4, 3)

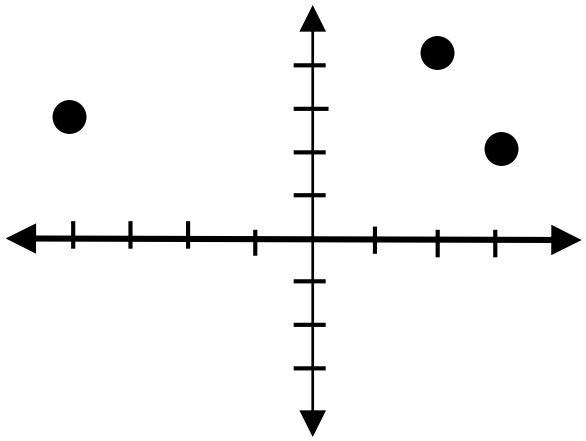
Data table:

x	2	3	-4
y	4	2	3

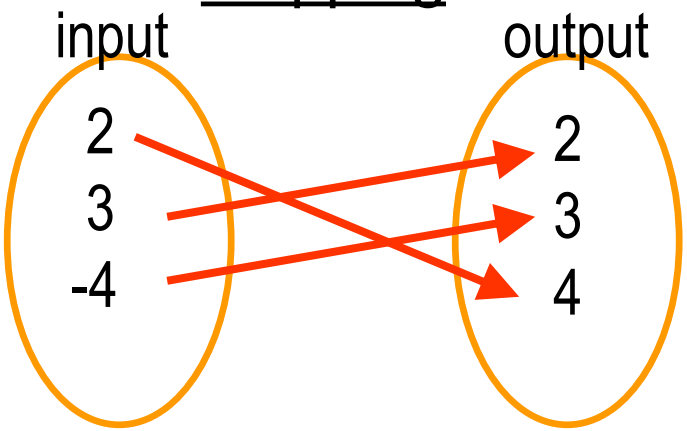
Equation: $y = 2x + 1$

Function notation: $f(2) = 4$

Graph:



Mapping



Are all of these representations the same?

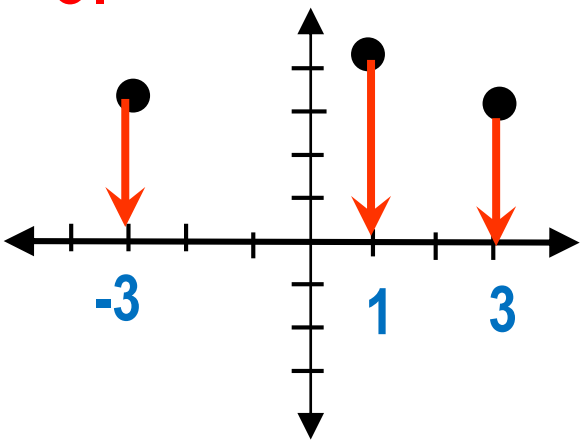
Identify the Domain

1. (2, 4), (3, 5), (-4, 2)

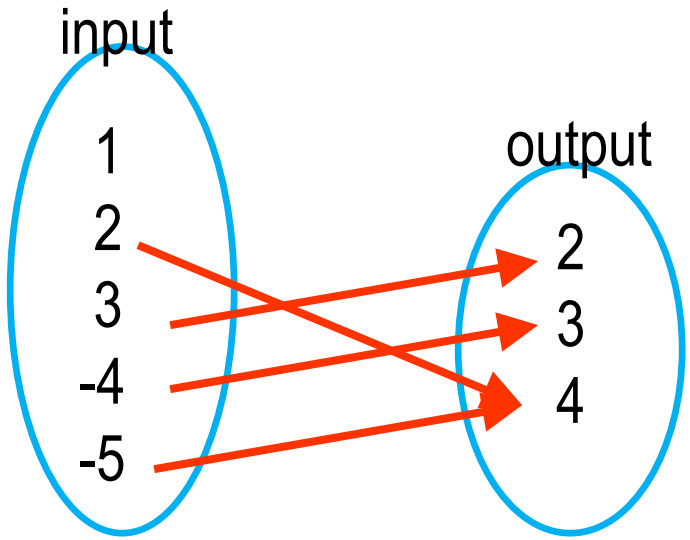
2.

x	6	9	-2
y	4	7	3

3.



4. 2, 3, -4, -5



We are performing operations on the input value ‘x’ to get the output value ‘y’.

In the equation, “x” is just place holder for the values that we “plug in” (substitute) into the equation in place of “x”.

$$y = 2x - 1$$

We replace ‘x’ (the place-holder) with a parentheses. Then we substitute into the parentheses the input value then simplify.

$$y = 2(\quad) - 1$$

x	0	1	2
y	-1	1	3

$$y = 2(0) - 1 \qquad y = -1$$

$$y = 2(1) - 1 \qquad y = 1$$

$$y = 2(2) - 1 \qquad y = 3$$

Graph the points, draw the line.

Equation → table

Using the equation form of the function, fill in the missing values in the table to convert the equation into a table of values.

$$y = 3x + 4$$

x	0	1	2
y	4	7	10

Table → Equation

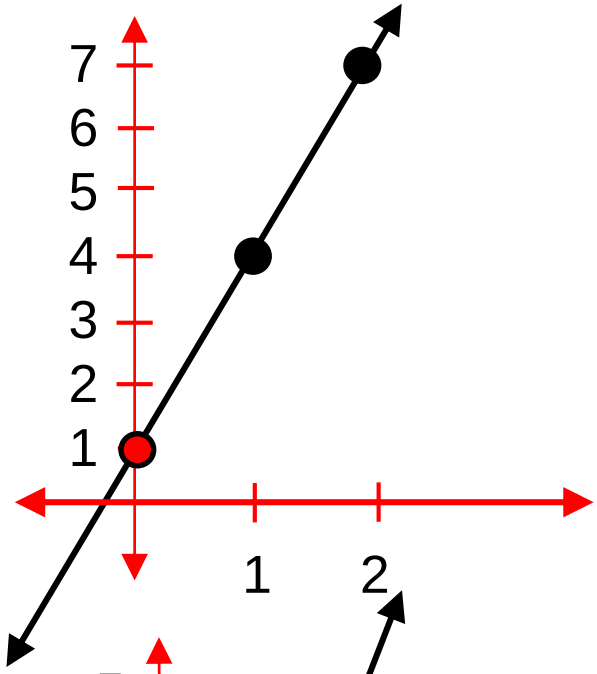
$$y = 4x - 2$$

x	0	1	2
y	-2	2	6

Fill in the table then graph x-y pairs from the table.

$y = 3x + 1$

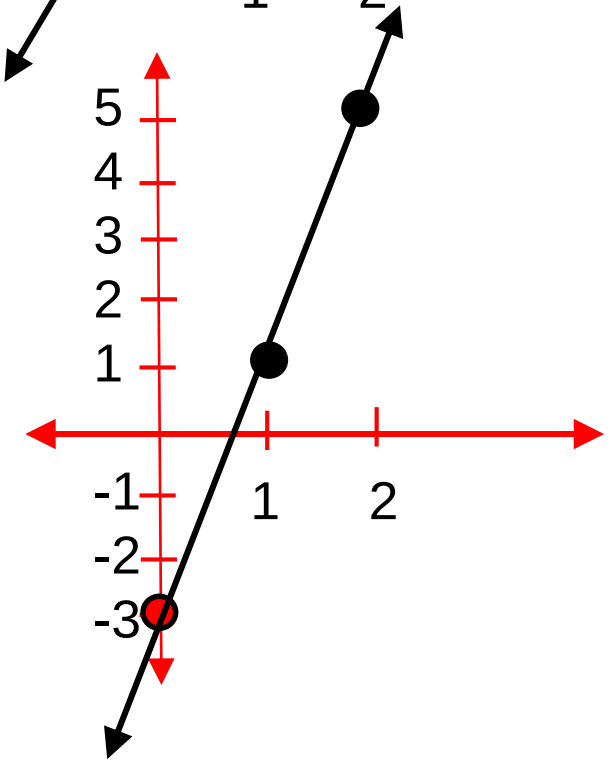
x	0	1	2
y	1	4	7



y-intercept: the x-y pair where a graph crosses the y-axis.

$y = 4x - 3$

x	0	1	2
y	−3	1	5



Solution of a two-variable equation: all x-y pairs that make the equation true.

Delta a Greek letter (that looks like a triangle) used in engineering and math to denote “change.”

Δx Means the change in ‘x’

Δy Means the change in ‘y’

$y = 3x - 5$

$\Delta x = 2 \quad \Delta x = 2$

x	0	2	4
y	-5	1	7

$\Delta y = 6 \quad \Delta y = 6$

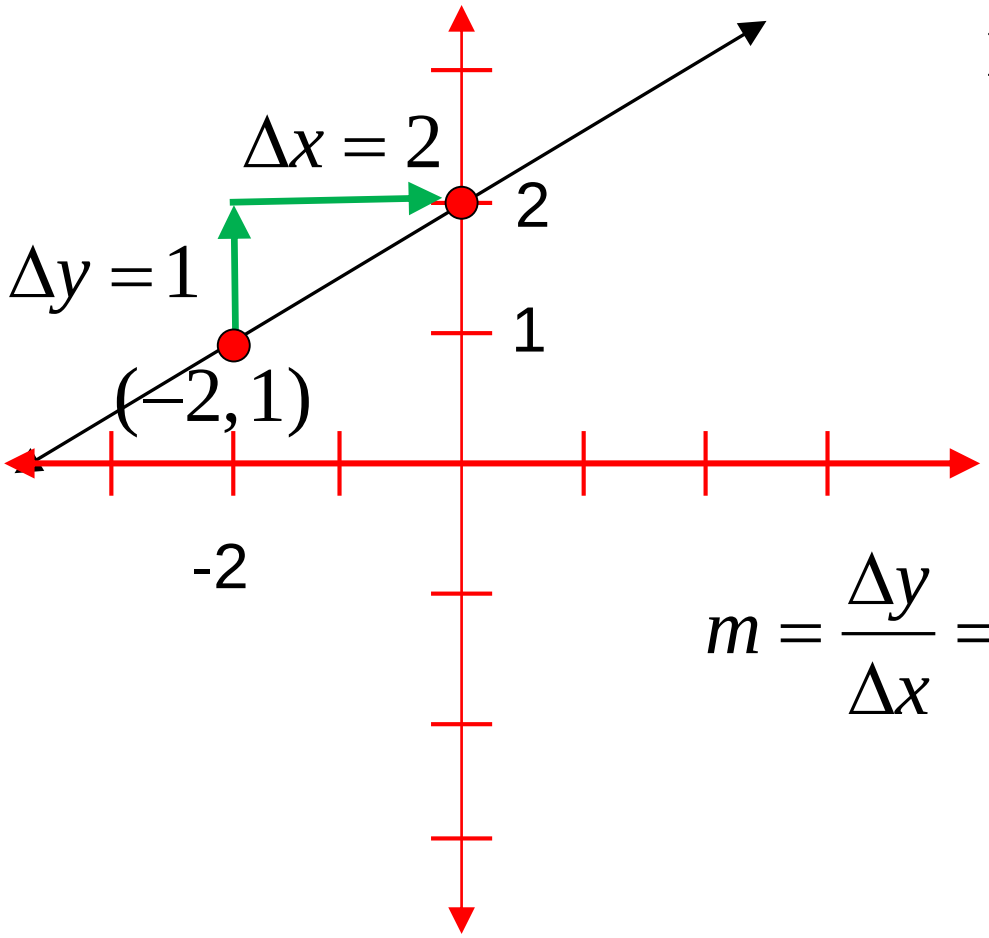
The coefficient of ‘x’ in the equation equals the change in ‘y’ of the table values divided by the change in ‘x’ of the table values.

$$3 = \frac{6}{2} = \frac{\Delta y}{\Delta x}$$

Graph → Equation $y = mx + b$

$b = 2$ $y = mx + 2$

$(x, y) = (-2, 1)$



$1 = m(-2) + 2$

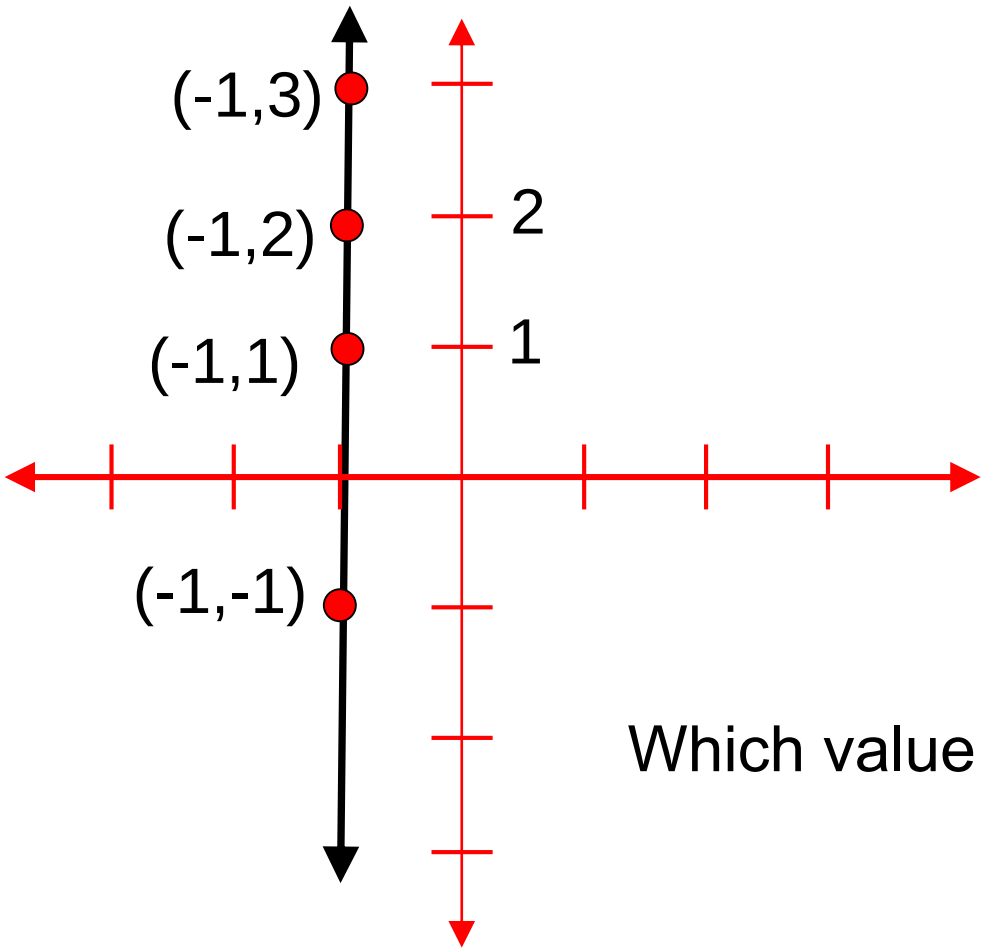
$-1 = m(-2)$

$m = \frac{-1}{-2} = \frac{1}{2}$

$m = \frac{\Delta y}{\Delta x} = \frac{1}{2}$

$y = \frac{1}{2}x + 2$

What is the equation of the line?



$y = -1$

or

$x = -1$

?

Which value (x or y) is always ‘-1’?

Hamburgers cost $5 and drinks cost $2.

If you can spend a total of $50, fill in the total number of hamburgers and drinks that you can buy.

Write an equation for this table.

$$D = \frac{-5}{2}H + 25$$

burgers	drinks
0	25
2	20
4	
6	
8	
10	

$$\text{Drinks} = \frac{50}{2}$$

$$\$ \text{ available for drinks} = \$50 - 2(\$5)$$

$$= \$40$$

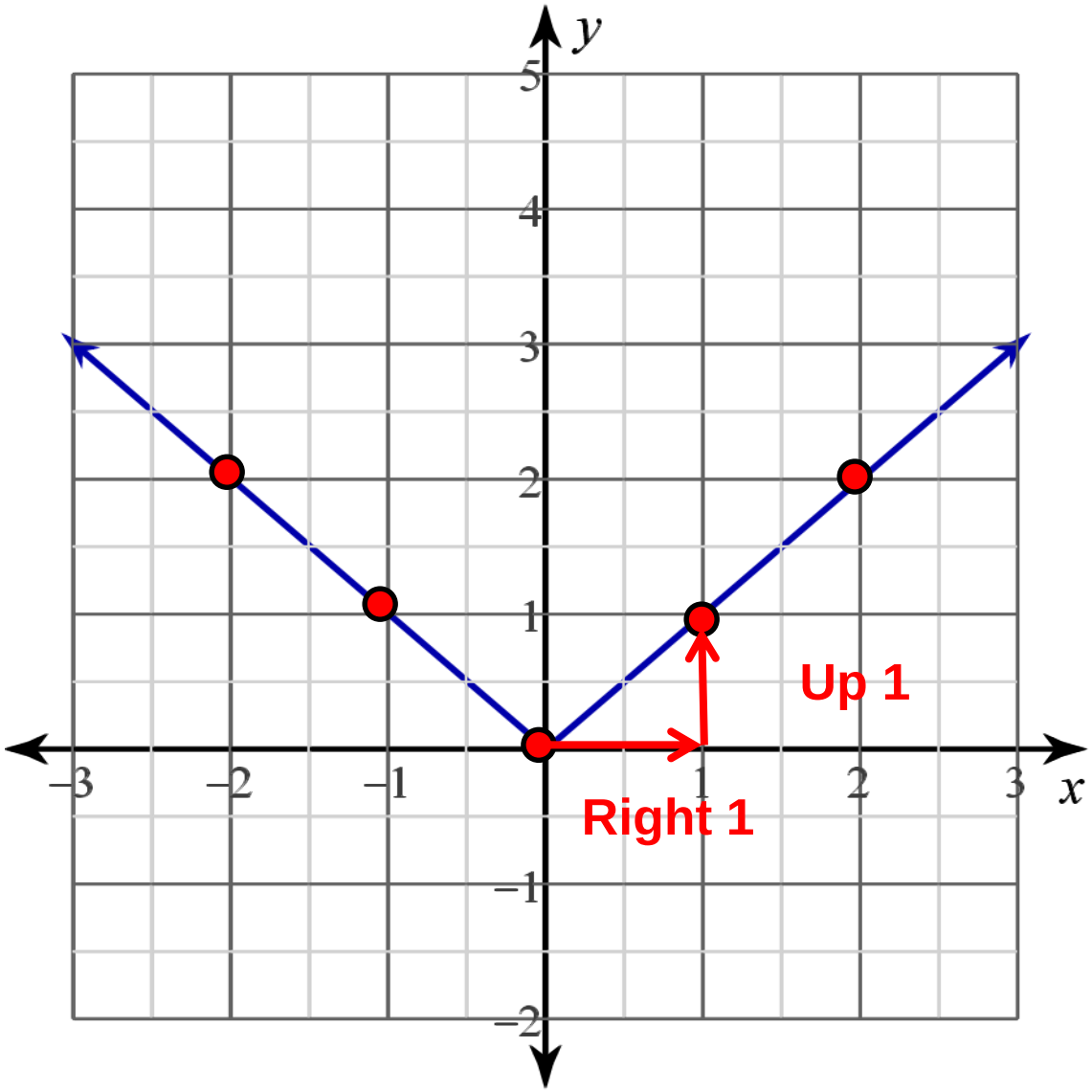
$$\text{Drinks} = \frac{40}{2}$$

Absolute Value Function

$$f(x) = |x|$$

Build a table of values for each equation for domain elements: -2, -1, 0, 1, 2.

x	y
-2	2
-1	1
0	0
1	1
2	2



$f(x) = |x|$

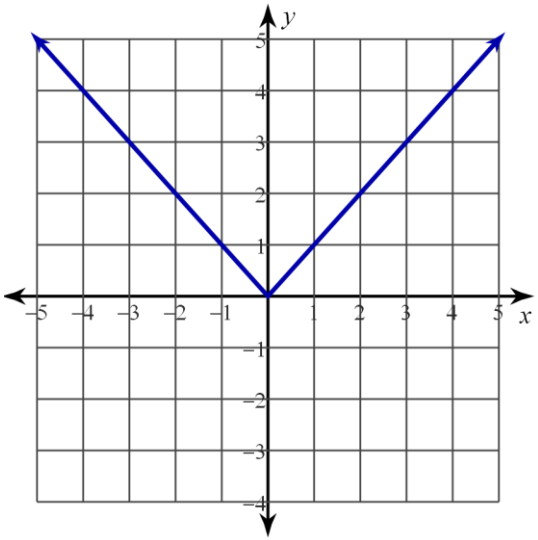
x	y
-2	2
-1	1
0	0
1	1
2	2

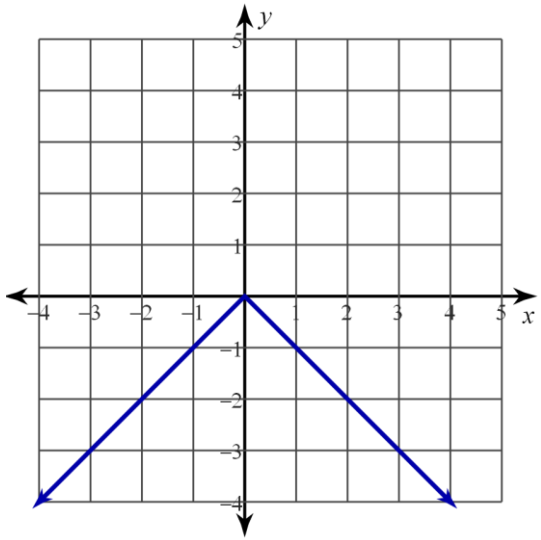
$g(x) = -|x|$

x-	y
-2	-2
-1	-1
0	0
1	-1
2	-2

Multiplying the parent function by -1 reflects it across the x-axis.

What is the vertex?





$f(x) = |x|$

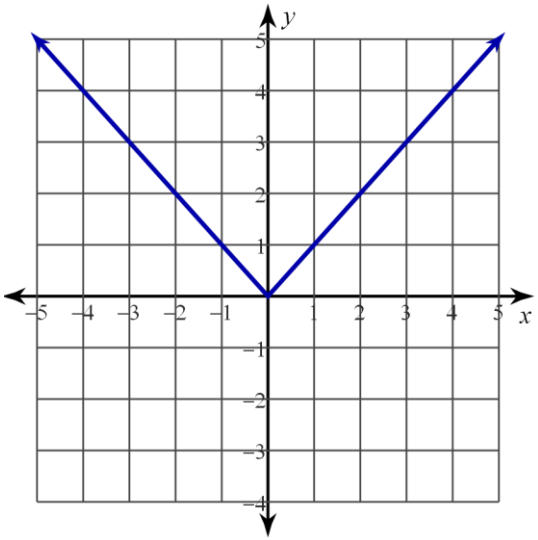
x	y
-2	2
-1	1
0	0
1	1
2	2

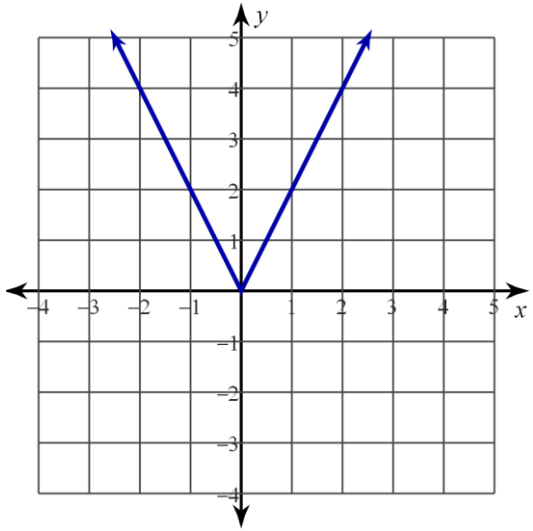
$g(x) = 2|x|$

x	y
-2	4
-1	2
0	0
1	2
2	4

Multiplying the parent function by 2 makes each y-value of the parent 2 times as big; VSF = 2

What is the vertex?





$f(x) = |x|$

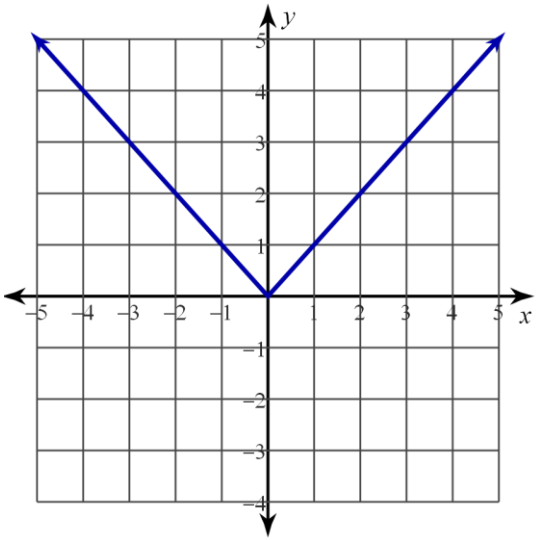
x	y
-2	2
-1	1
0	0
1	1
2	2

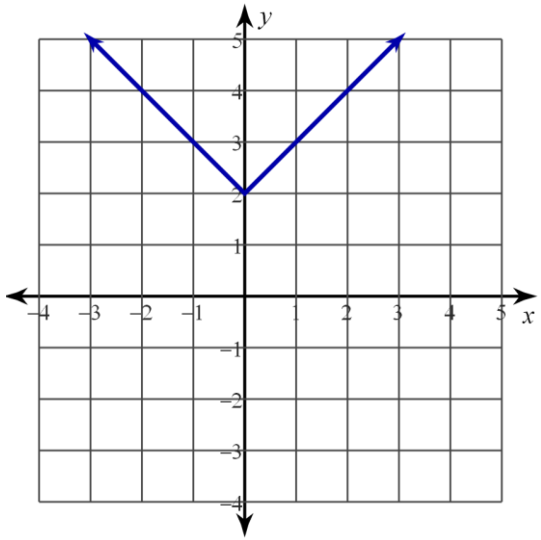
$g(x) = |x| + 2$

x	y
-2	4
-1	3
0	2
1	3
2	4

Adding 2 to the parent function causes the graph to translate ***up 2***

What is the vertex?





$f(x) = |x|$

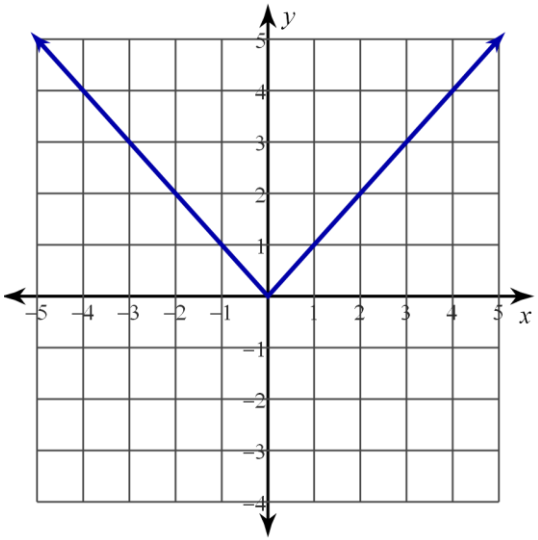
x	y
-2	2
-1	1
0	0
1	1
2	2

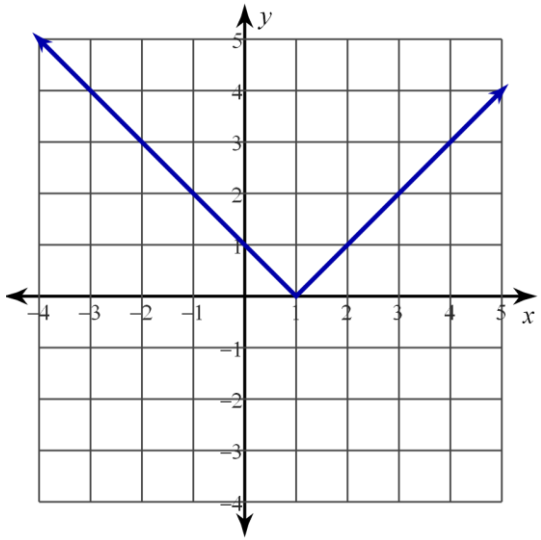
$g(x) = |x - 1|$

x	y
-2	3
-1	2
0	1
1	0
2	1

Replacing ‘x’ in the parent function with ‘x – 1’ causes the graph to translate ***right ‘1’***

What is the vertex?

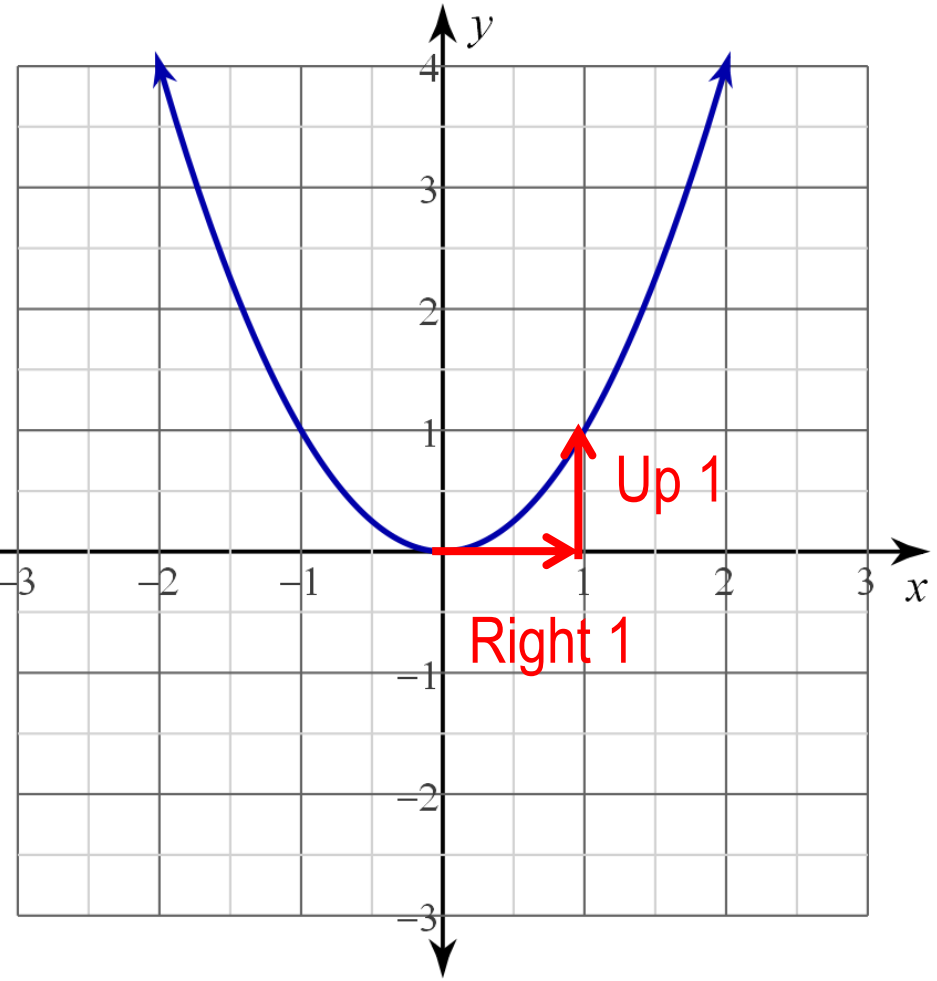


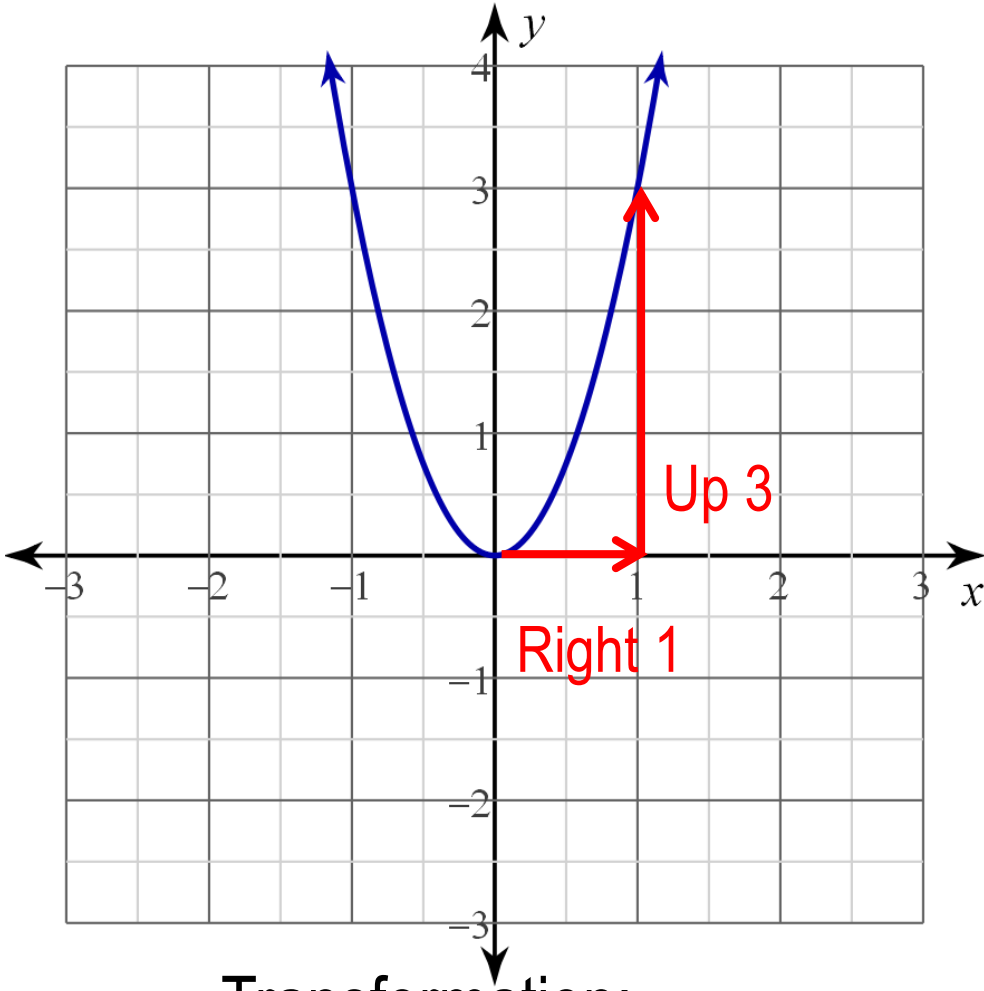


$y = x^2$

$y = 3x^2$

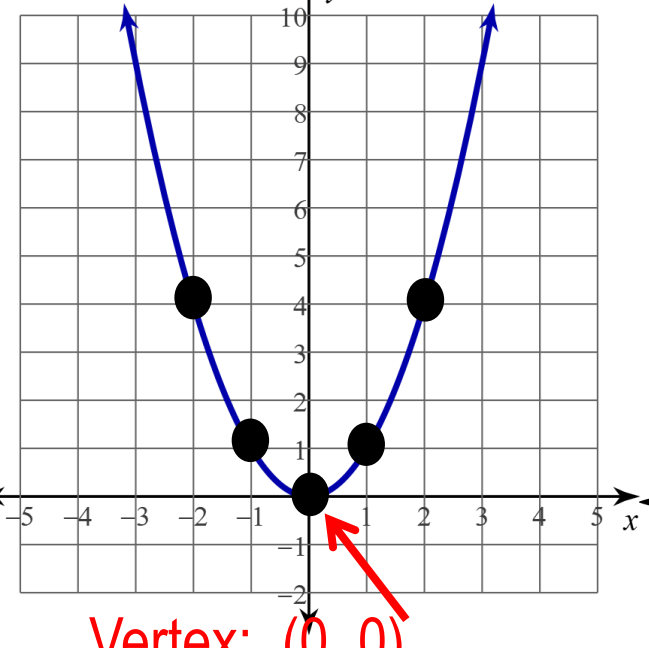
Multiplying the parent function by 3, makes it look "steeper"





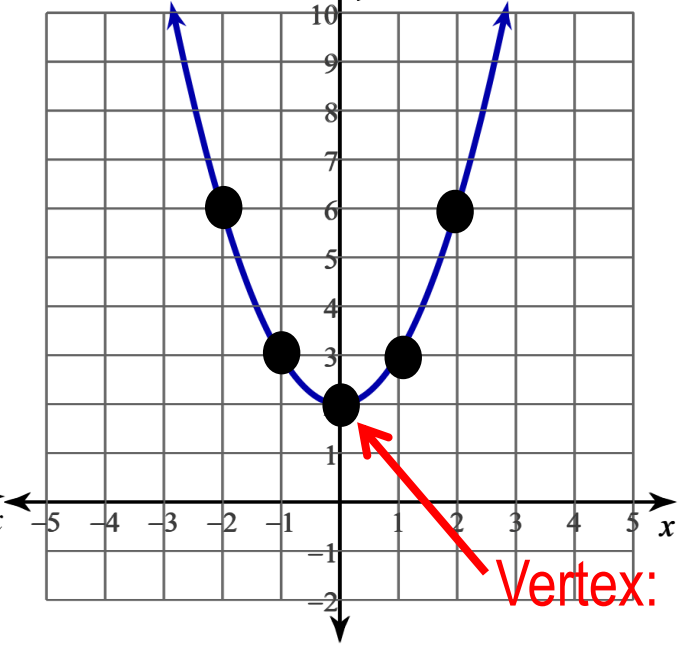
Parent: right 1
Up 1 from vertex.

Transformation:
vertically stretched by
a factor of 3.



$y = x^2$

x	y
-2	4
-1	1
0	0
1	1
2	4



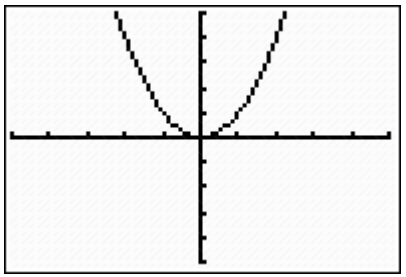
$y = x^2 + 2$

x	y
-2	6
-1	3
0	2
1	3
2	6

Graph: Parent function has been moved up 2.

Fill in the table for the other equation and graph the points.

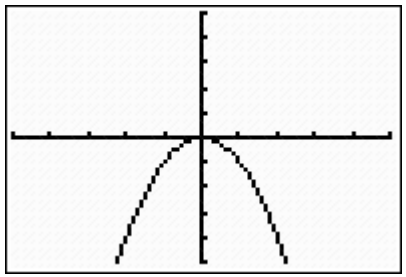
We say the function has been reflected across the x-axis.



$y = x^2$

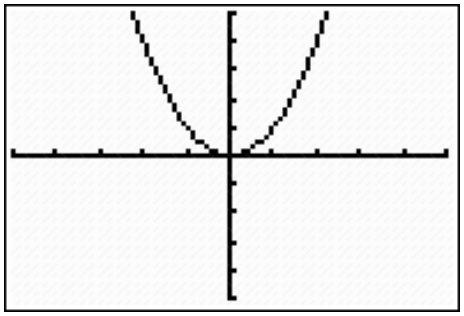
x	f(x)
-2	4
-1	1
0	0
1	1
2	4

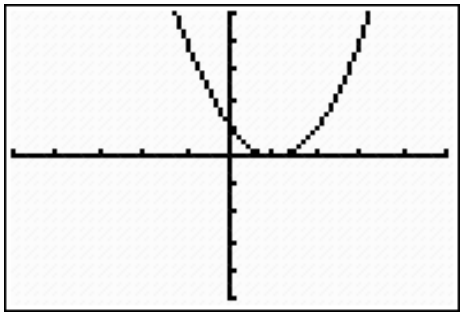
Multiplying the parent function by -1 actually changes the sign of every y-value of the parent function.



$y = -x^2$

x	f(x)
-2	-4
-1	-1
0	0
1	-1
2	-4





Fill in the 2nd table.

$f(x) = x^2$

x	f(x)
-2	4
-1	1
0	0
1	1
2	4

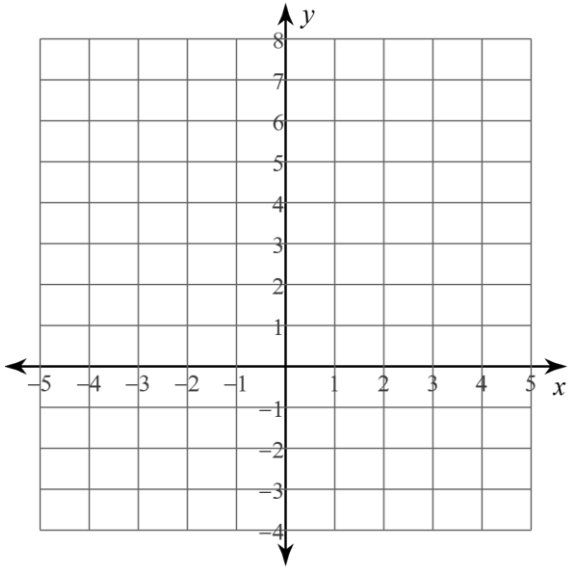
$g(x) = (x-1)^2$

x	g(x)
-2	9
-1	4
0	1
1	0
2	1
3	4

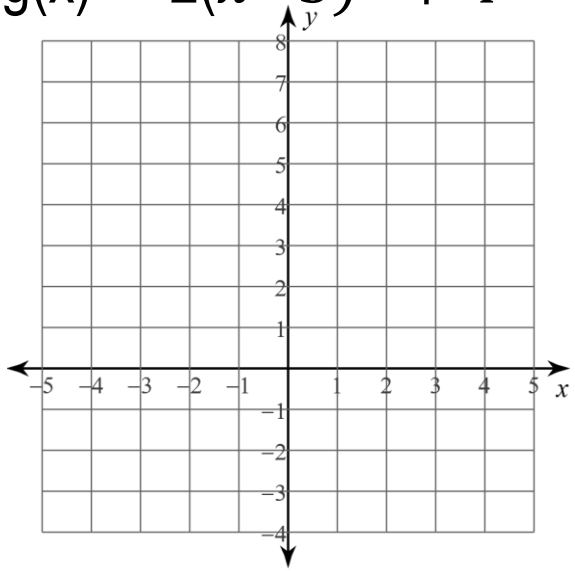
Replacing 'x' in the parent function with 'x – 1' causes the graph to translate *right '1'*

Interpret the transformation then graph the function

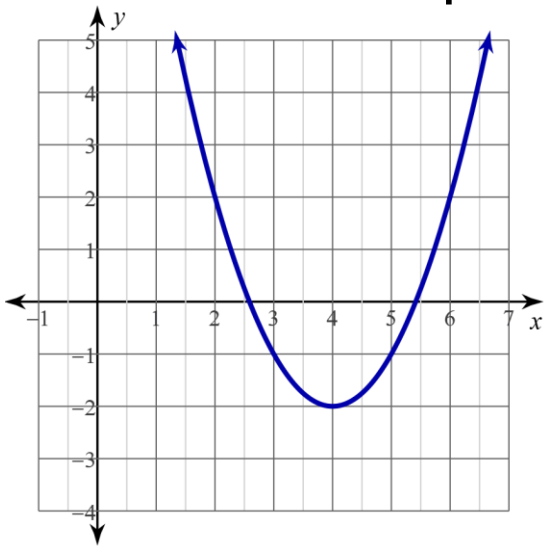
$k(x) = (x + 2)^2 - 3$

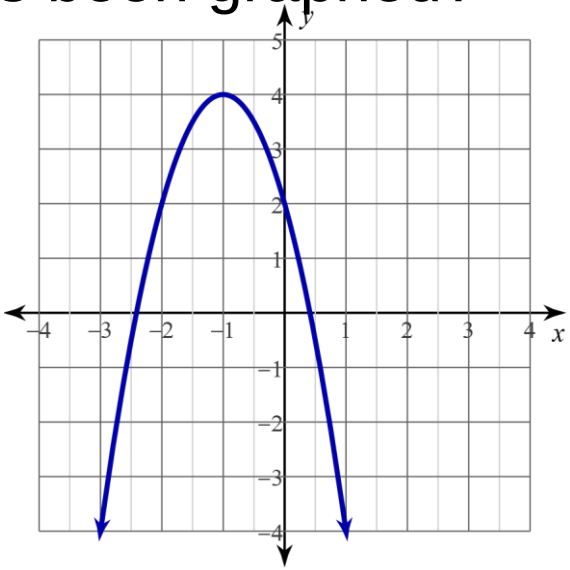


$g(x) = -2(x - 3)^2 + 4$



What is the equation that has been graphed?





Square Root Function $f(x) = \sqrt{x}$

Build a table of values for each equation for domain elements: 9, 4, 1, 0, -1

x	y
9	3
4	2
1	1
0	0
-1	??

$y = \sqrt{x}$

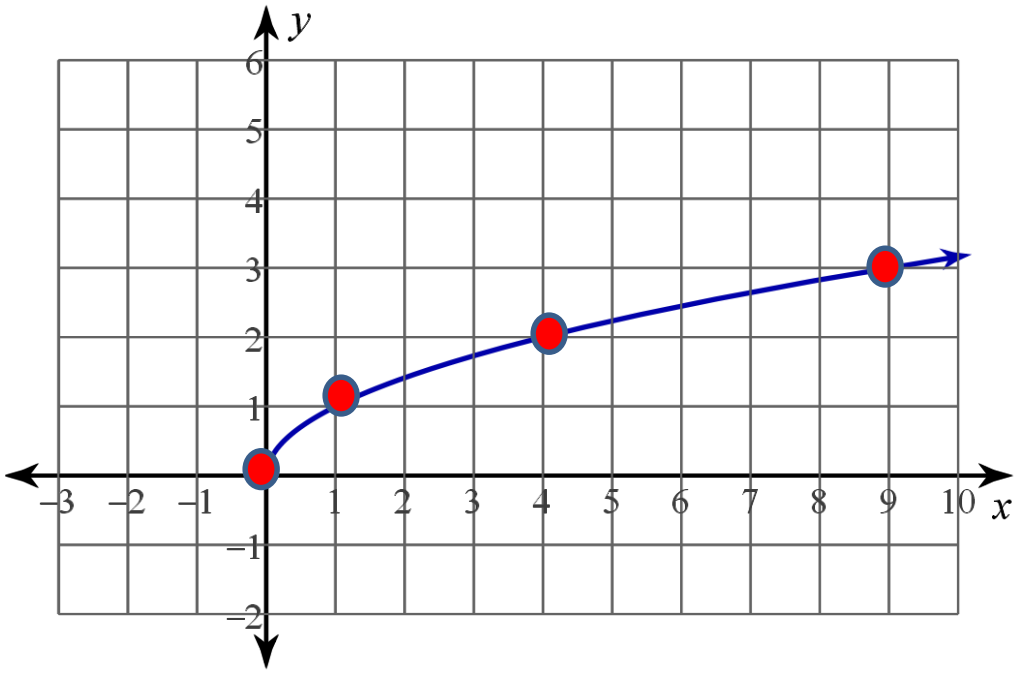
$y = \sqrt{9} = 3$

$y = \sqrt{4} = 2$

$y = \sqrt{1} = 1$

$y = \sqrt{0} = 0$

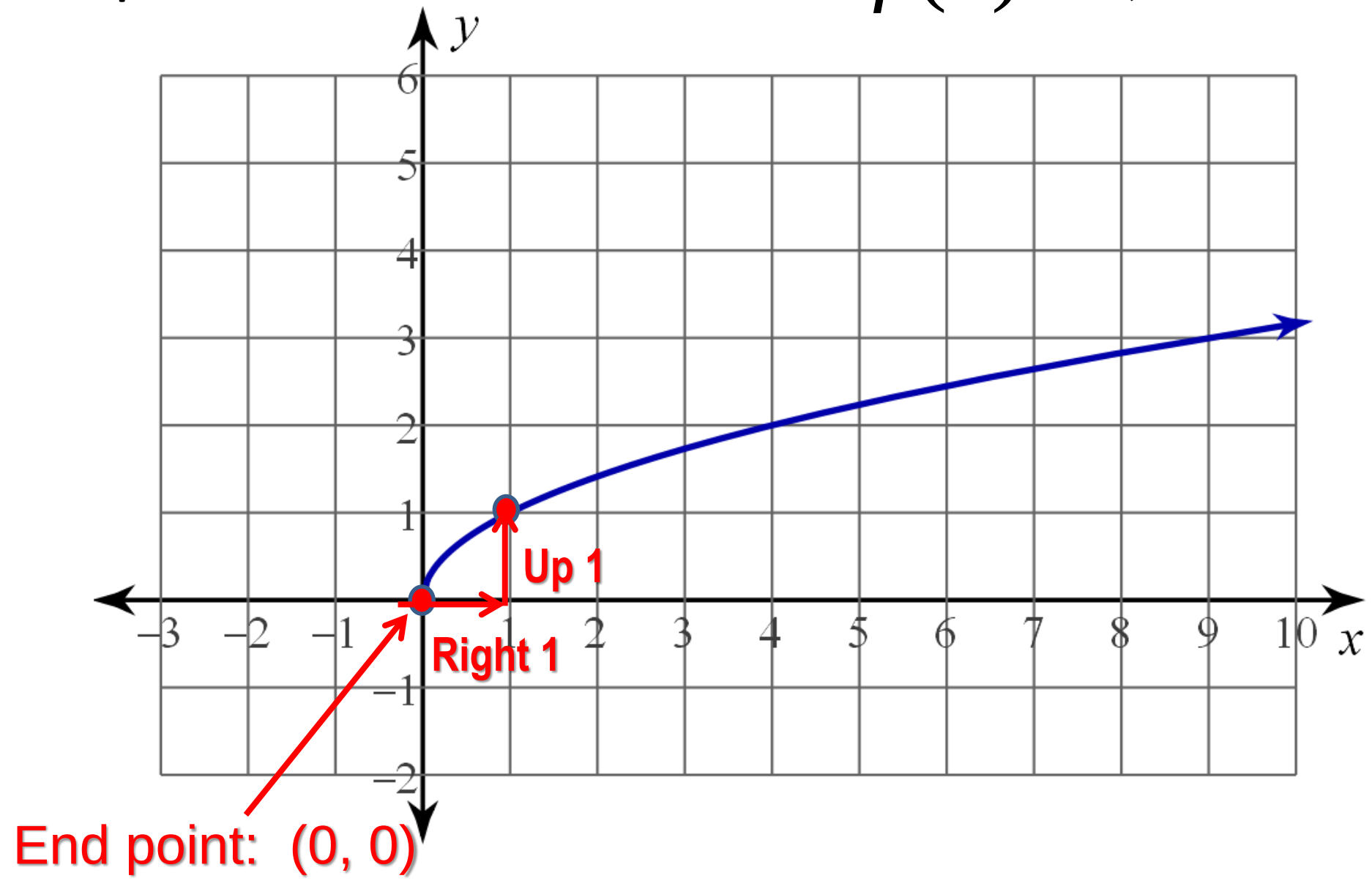
$y = \sqrt{-1} = i$



This is the first function, so far, that does NOT have all real numbers as the domain.

Square Root Function

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



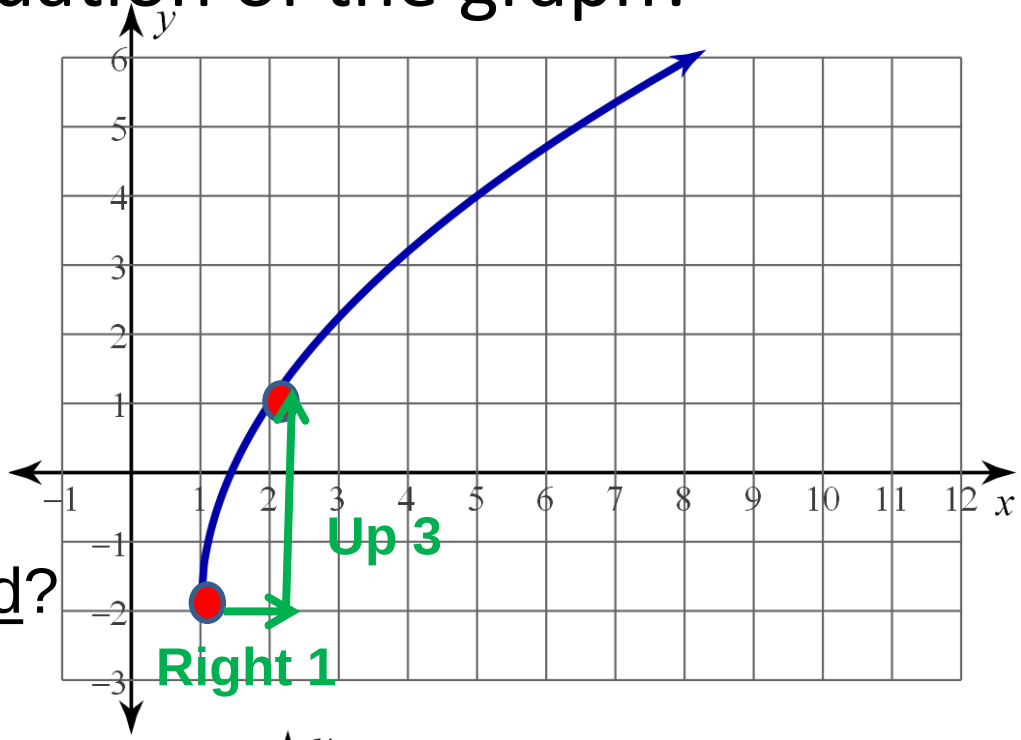
What is the equation of the graph?

$$y = (-1)a\sqrt{x-h}+k$$

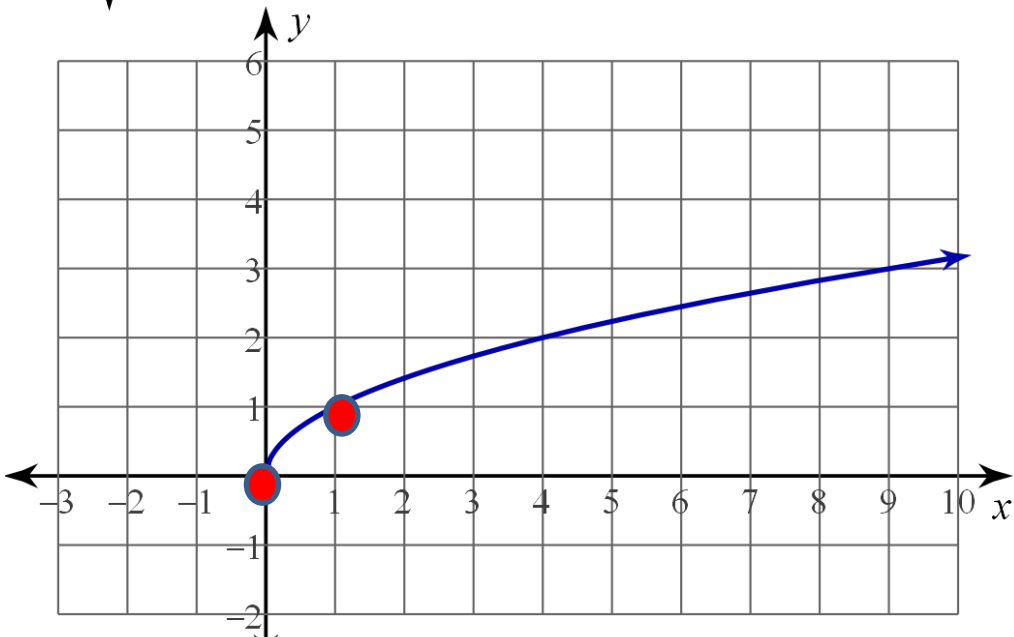
Endpoint: right 1, down 2

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

Has it been vertically stretched?



$$y = \sqrt{x}$$

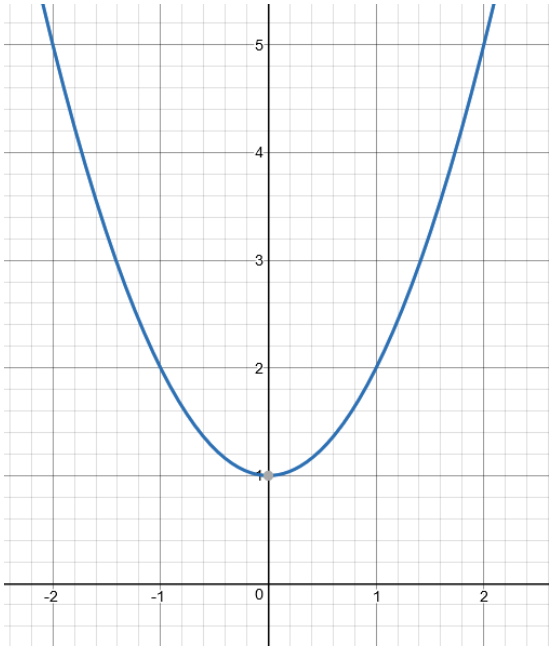


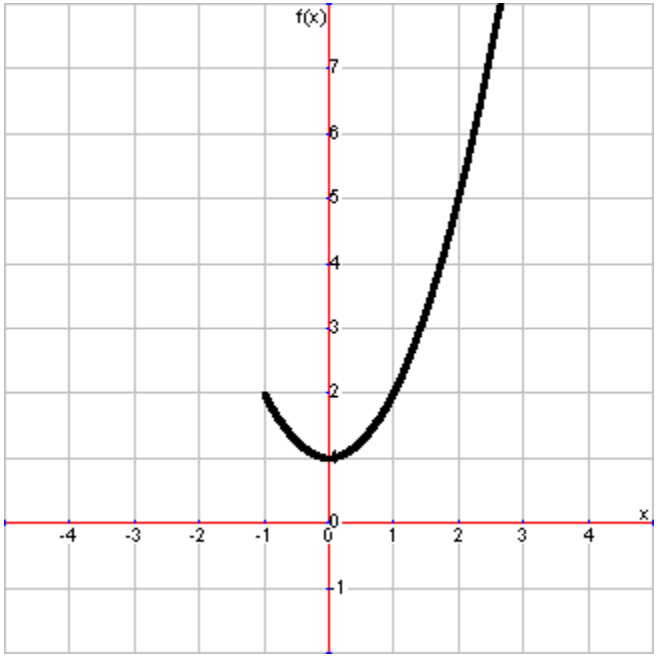
What is the domain of the graph?

$$x = [-1, \infty)$$

What is the equation of the graph?

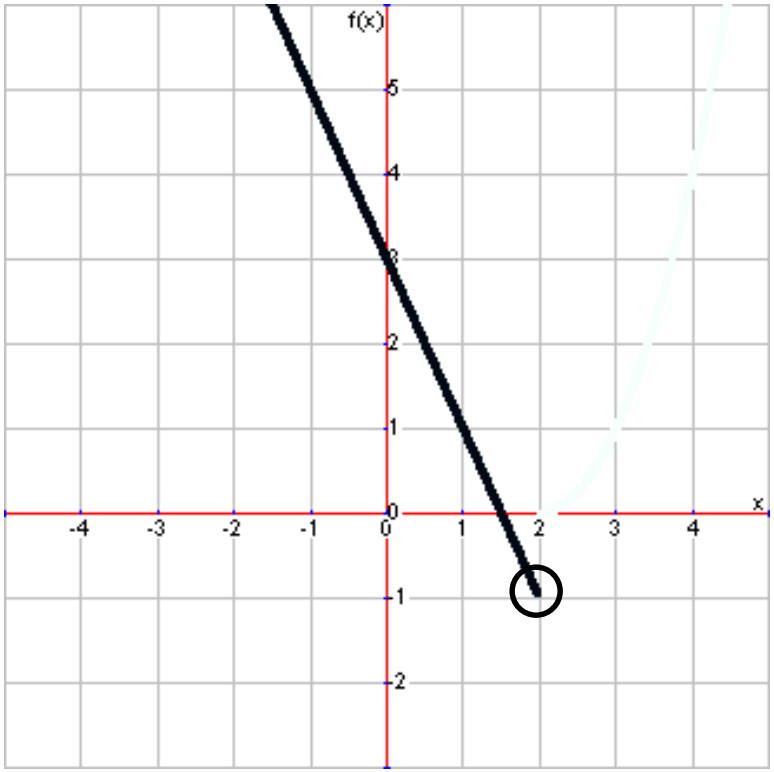
$$k(x) = x^2 + 1$$





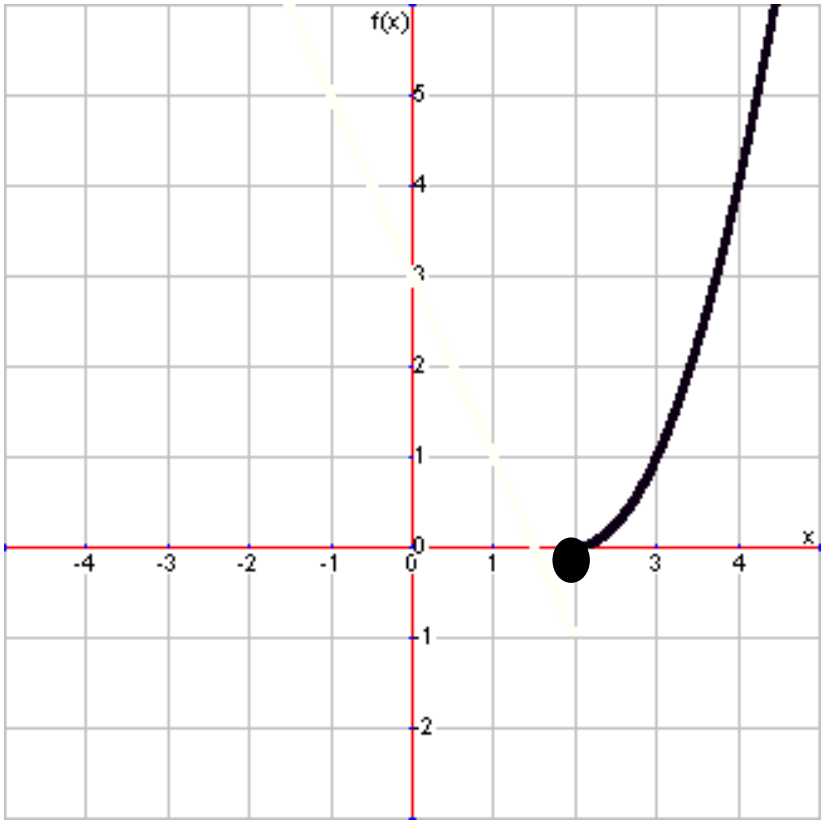
Write the equation of the graph above in set-builder notation.

$$y = x^2 + 1, \text{ for } x = [-1, \infty)$$



What is the equation of the graph?

$$f(x) = -2x + 3, \ for\ x = (-\infty, 2)$$



What is the equation of the graph?

$$g(x) = (x-2)^2,\ for\ x = [2, \infty)$$