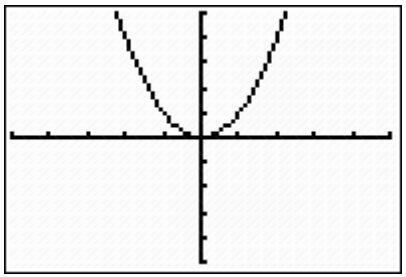
Math-3A
Lesson 1-4

The Absolute Value Function
And
The Square Root Function

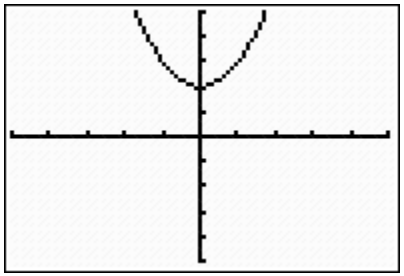
Describe how each function transforms the “parent” f(x).

$f(x) = x^2$



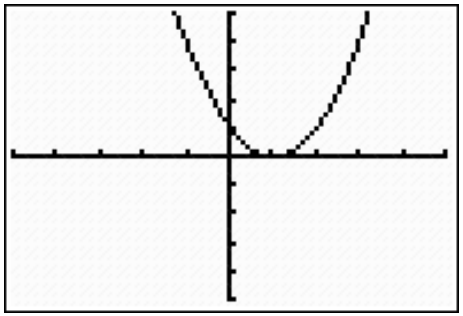
$g(x) = x^2 + 2$

f(x) up 2



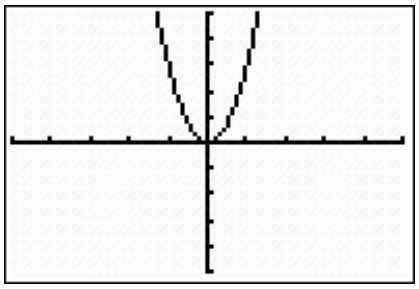
$h(x) = (x-1)^2$

f(x) right 1



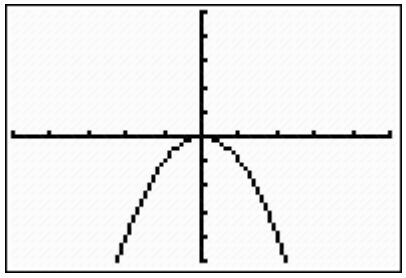
$j(x) = 3x^2$

f(x) VSF-3



$k(x) = -x^2$

f(x) reflected across the x-axis



Absolute Value Function

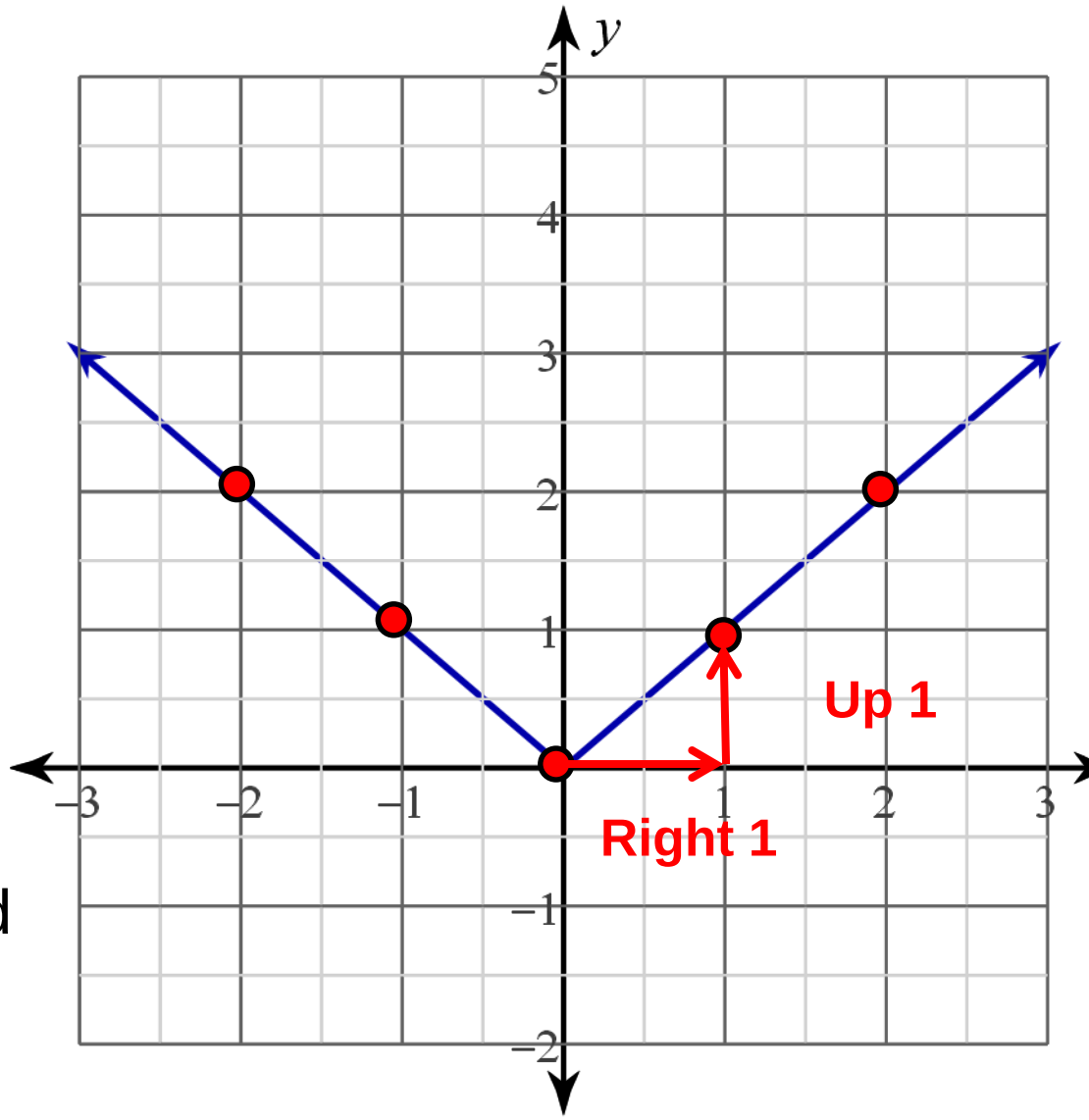
$$f(x) = |x|$$

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

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

$$y = |-2|$$

$|-2|$ means "what is the distance between -2 and zero?



<u>Just like the Quadratic Function</u>, the point (0, 0) is the vertex and there is a point in the position "right 1, up 1" (from the vertex).

$f(x) = |x|$

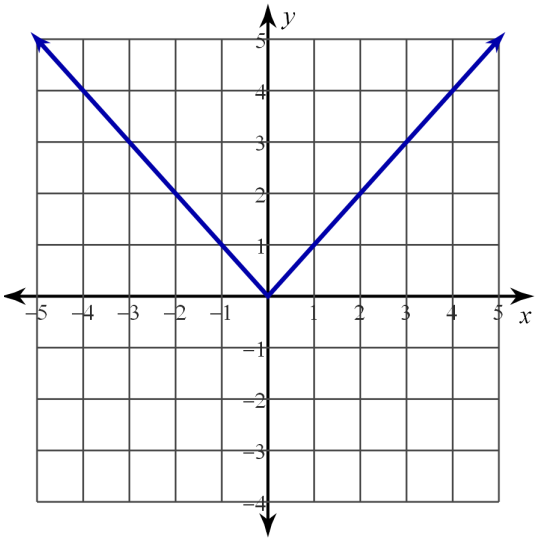
x	y
-2	2
-1	1
0	0
1	1
2	2

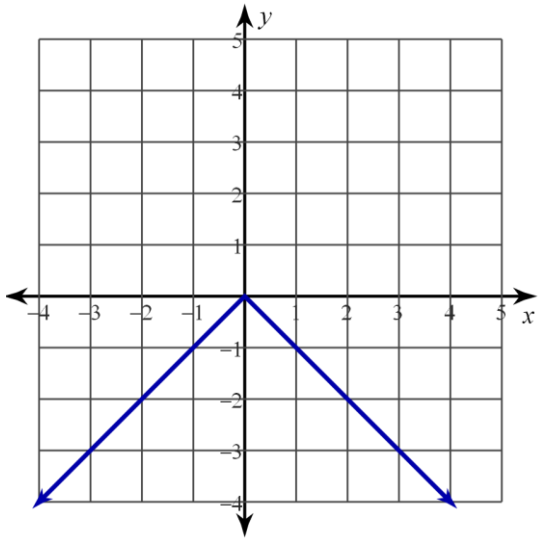
$g(x) = -|x|$

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?





$f(x) = |x|$

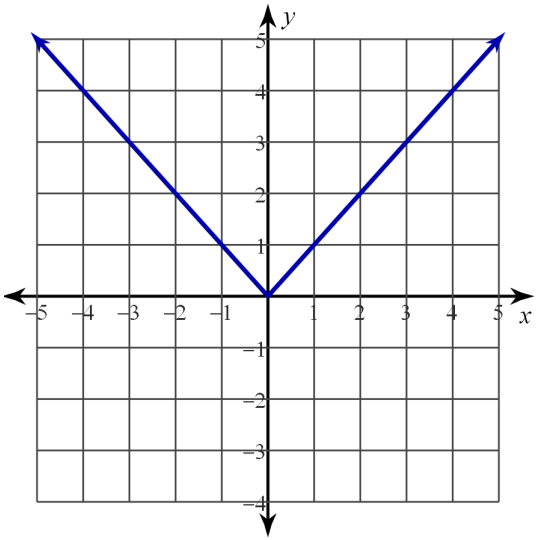
x	y
-2	2
-1	1
0	0
1	1
2	2

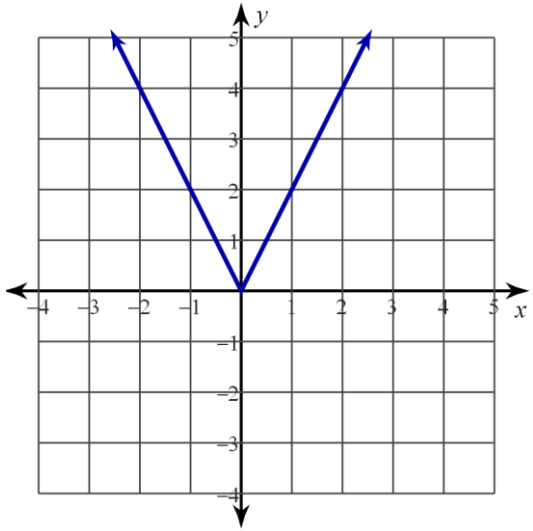
$g(x) = 2|x|$

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

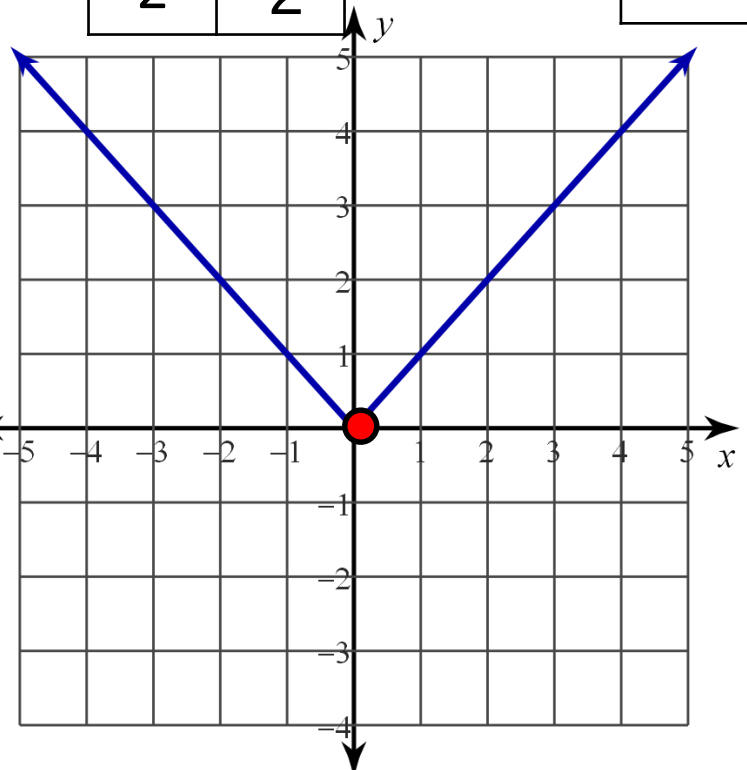
What is the vertex?





$f(x) = |x|$

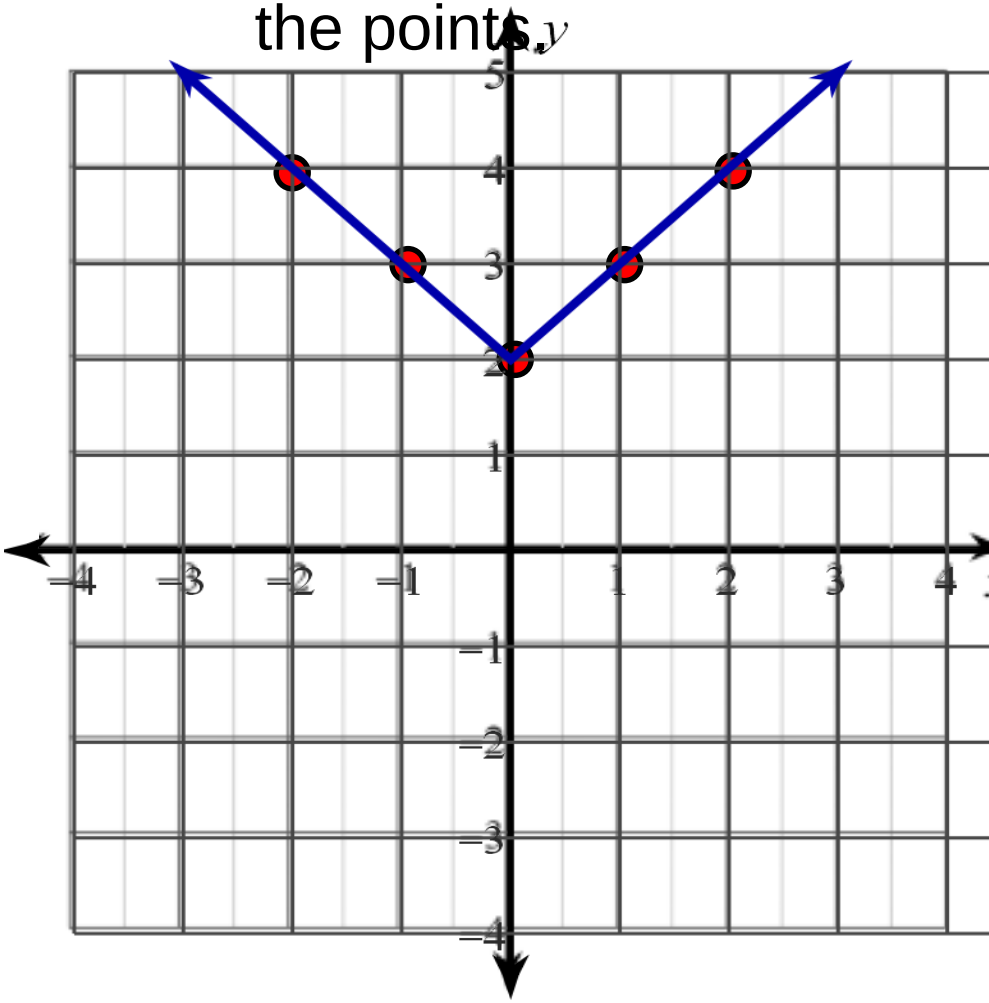
x	y
-2	2
-1	1
0	0
1	1
2	2



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

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

Fill in the table, graph the points.



<u>Adding 2 to the parent function</u> causes the graph to translate ***<u>up 2</u>***

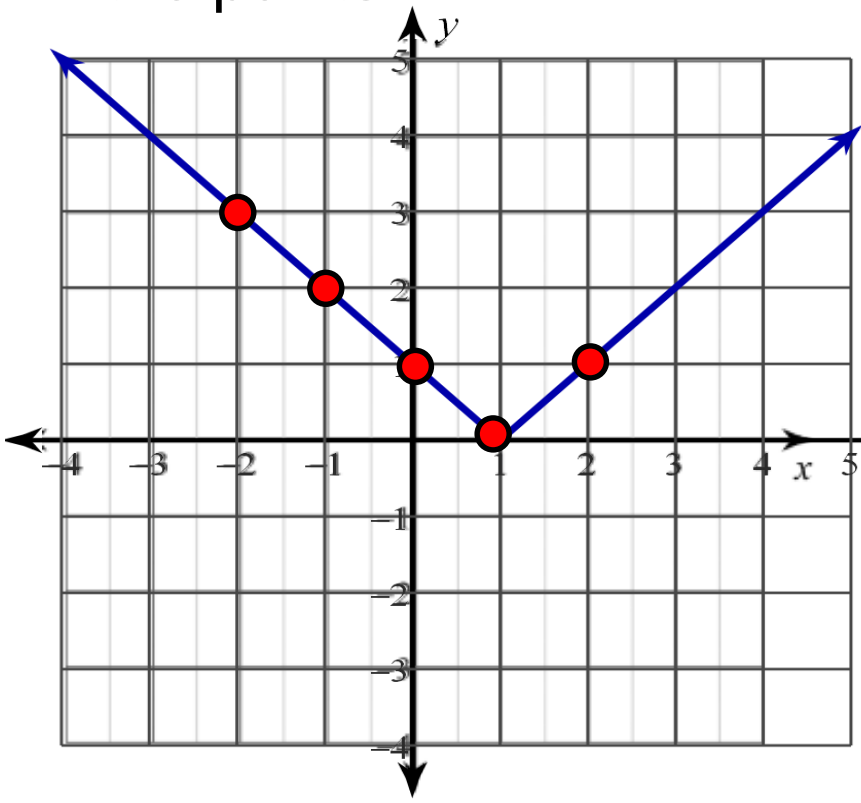
$f(x) = |x|$

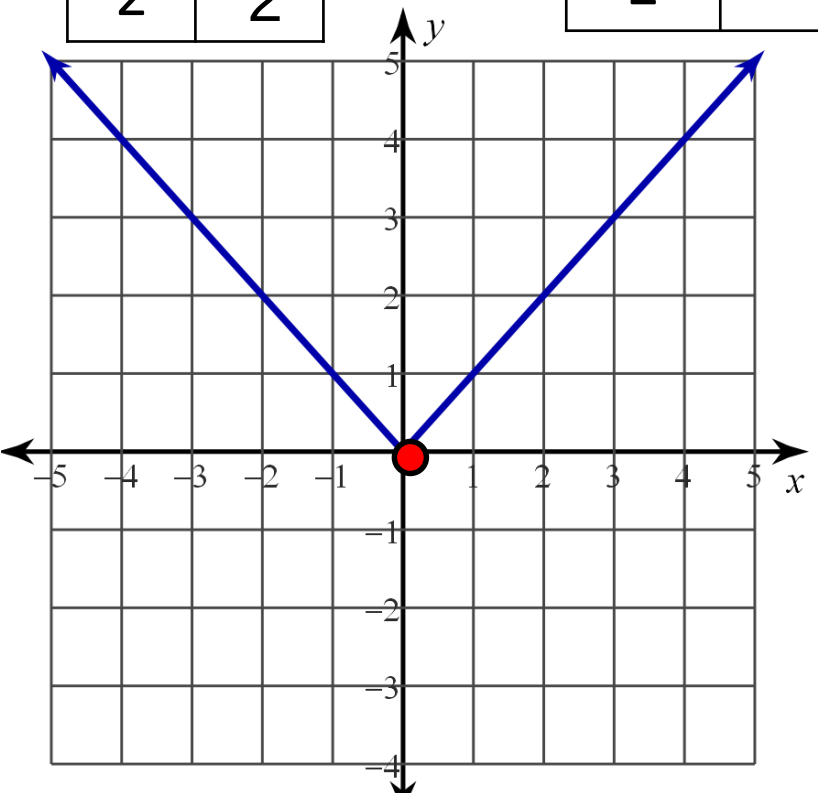
x	y
-2	2
-1	1
0	0
1	1
2	2

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

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

Fill in the table, graph the points.

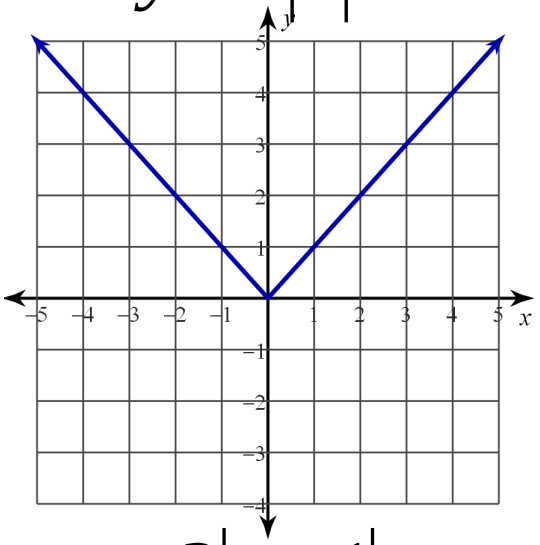




Replacing ‘x’ in the parent function with ‘(x – 1)’ causes the graph to translate ***right ‘1’***

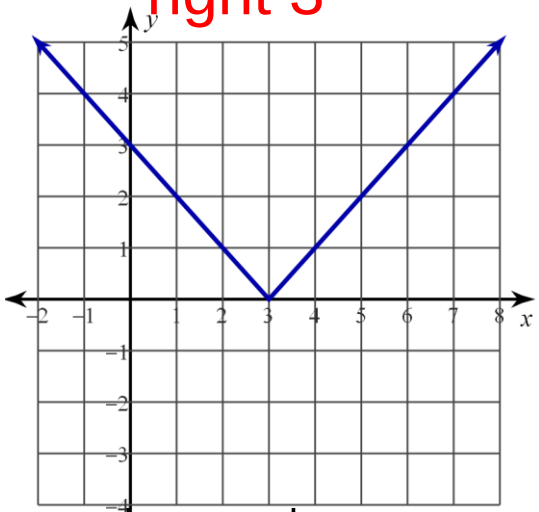
What is the transformation to the parent function?

$y = |x|$



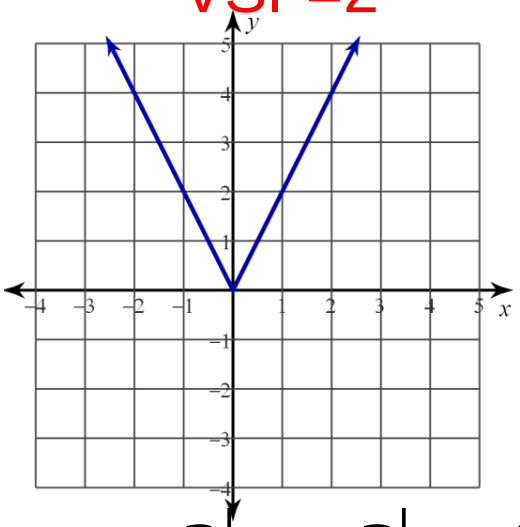
$y = |x - 3|$

right 3



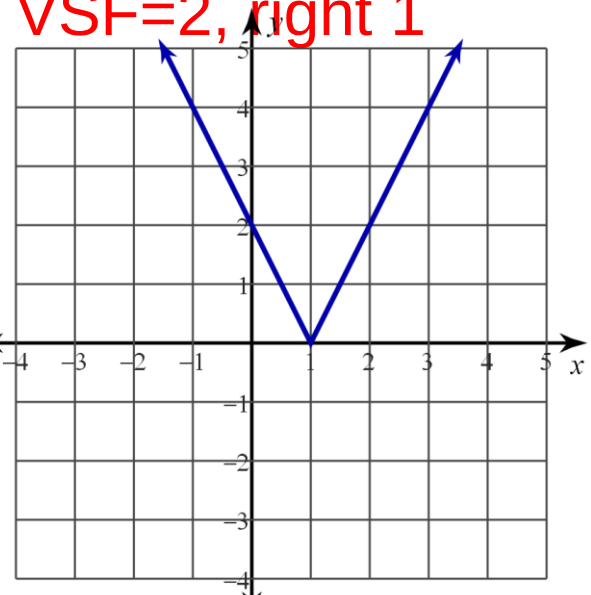
$y = 2|x|$

VSF=2



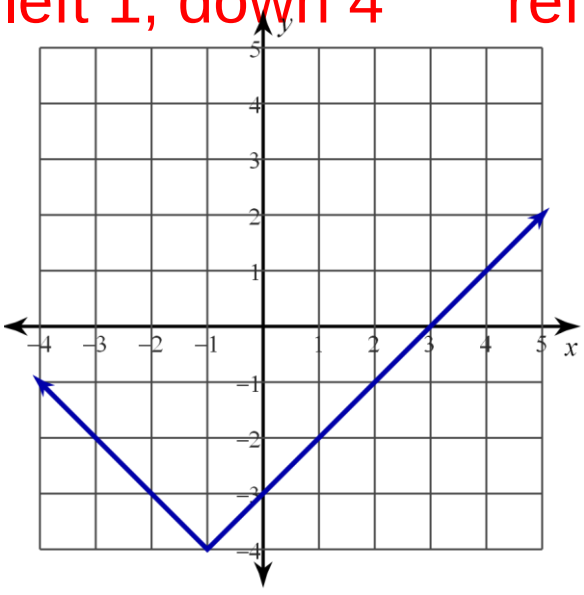
$y = 2|x - 1|$

VSF=2, right 1



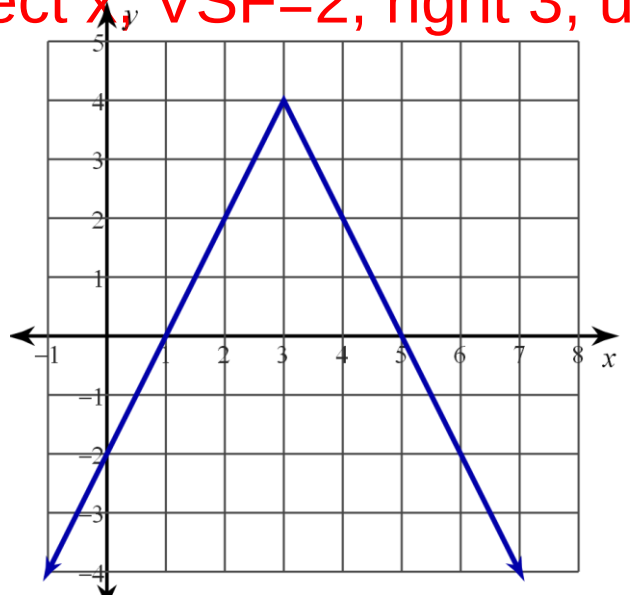
$y = |x + 1| - 4$

left 1, down 4

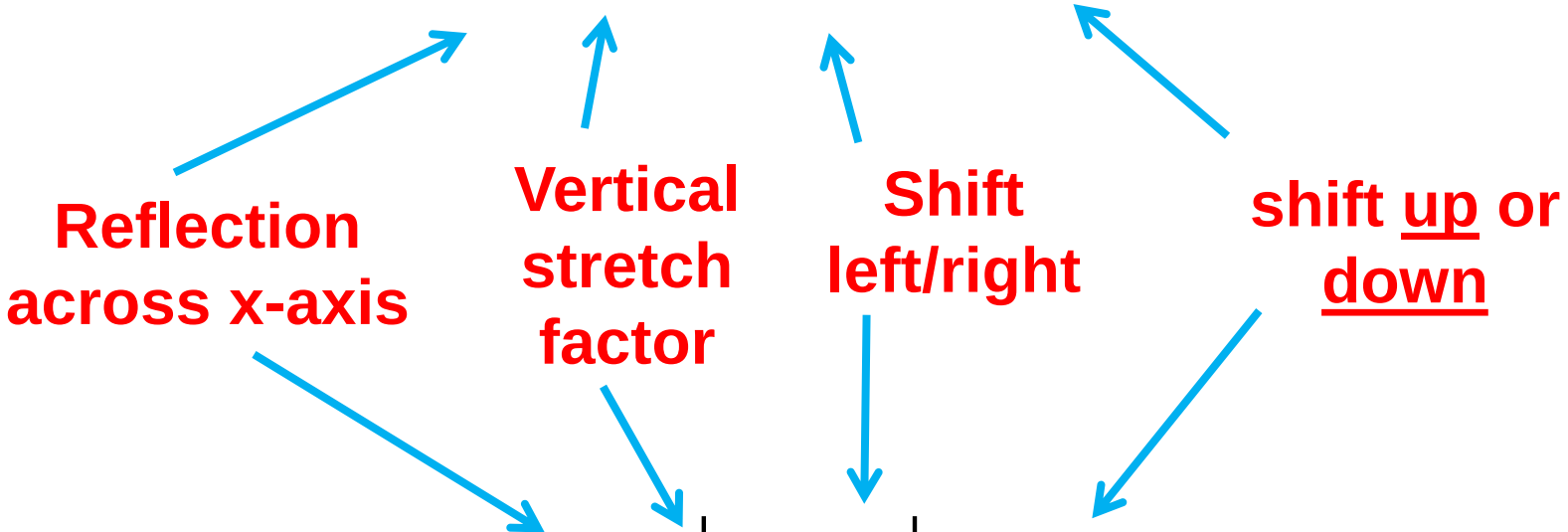


$y = -2|x - 3| + 4$

reflect x, VSF=2, right 3, up 4



$y = x^2$ $\qquad y = (-1)a(x-h)^2 + k$



$y = |x|$ $\qquad y = (-1)a|x-h| + k$

$y = 3(x+5)^2 - 2$

VSF=3,
left 5, down 2

$f(x) = -5|x-2| + 3$

reflected (x-axis)
VSF=5, right 2, up 3

What does adding or subtraction "k" do to the parent function?

$$f(x) = |x| + k$$

Vertical shift

What does adding or subtraction "h" do to the parent function?

$$f(x) = |x - h|$$

Horizontal shift

What does multiplying by 'a' do to the parent function?

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

Vertical stretch

What does multiplying by (-1) do to the parent function?

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

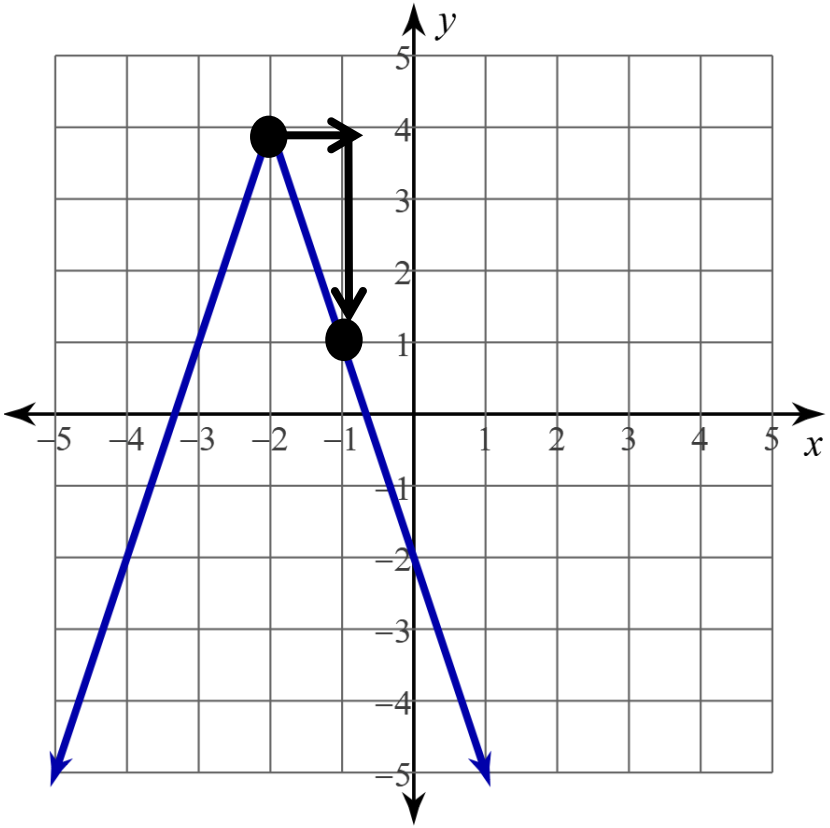
Reflection (x-axis)

What equation has been graphed? $f(x) = |x|$

1) Vertex has moved left 2 and up 4.

$g(x) = \_\_\_\_\_|x + 2| + 4$

2) Shape of the graph: *from the vertex* move right 1, down 3.



➔ Reflect x-axis, VSF=3.

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

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

Fill in the table, then graph the x-y pairs

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

$y = \sqrt{x}$

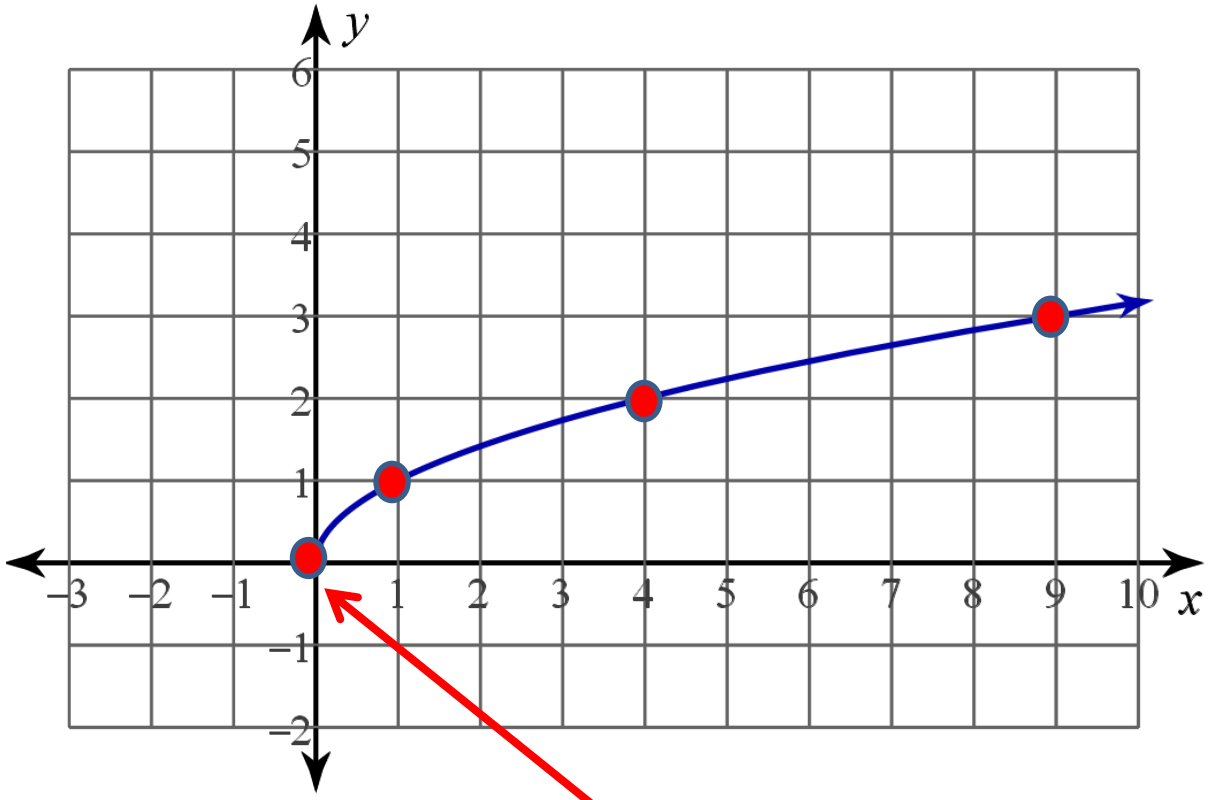
$y = \sqrt{9} = 3$

$y = \sqrt{4} = 2$

$y = \sqrt{1} = 1$

$y = \sqrt{0} = 0$

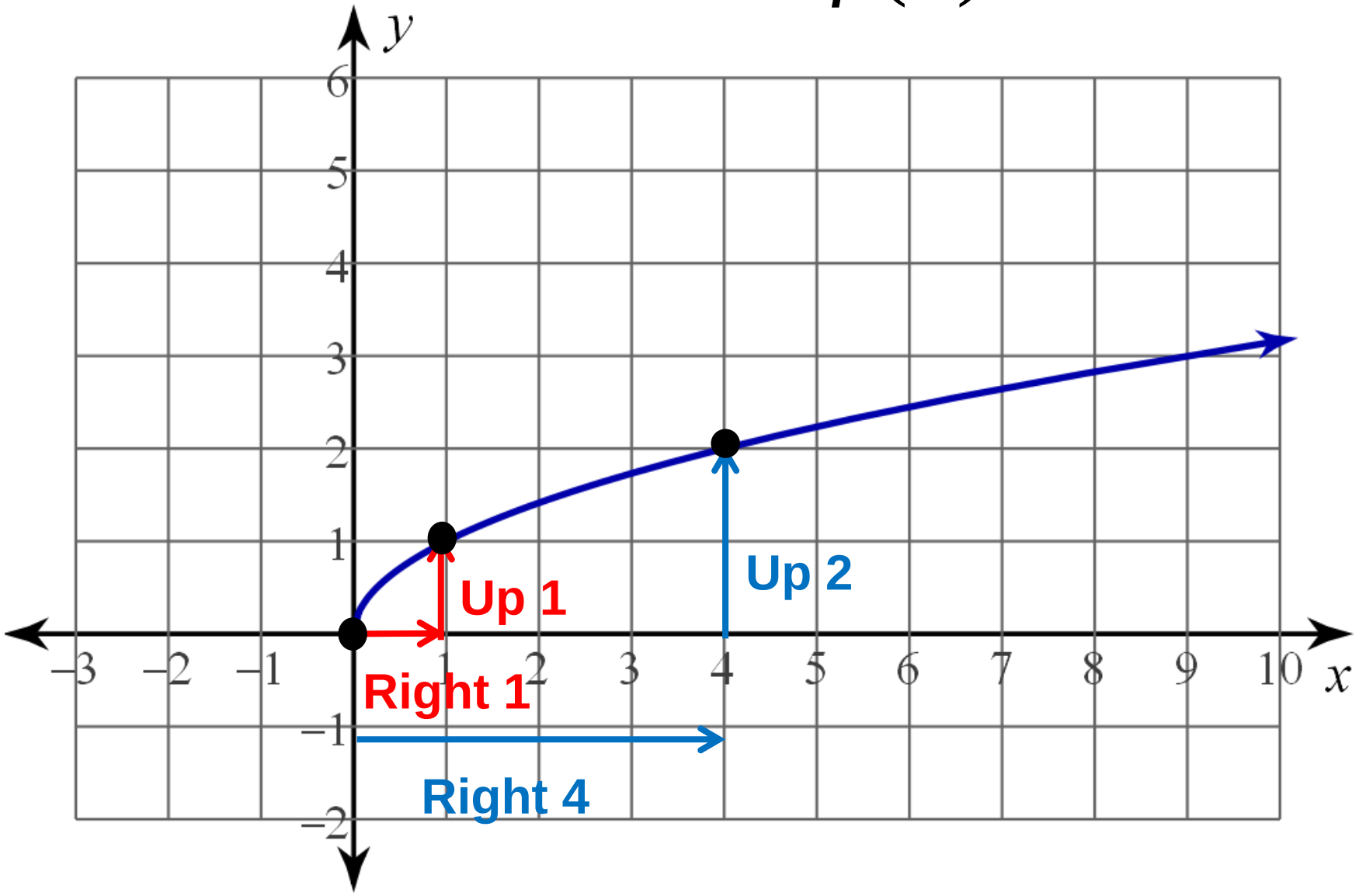
$y = \sqrt{-1} = i$



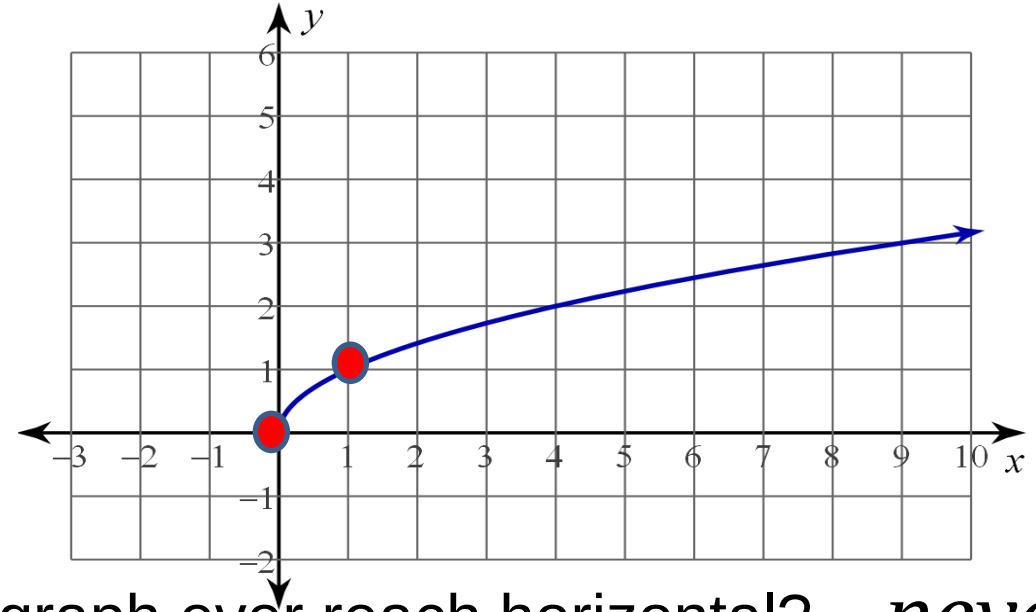
This is the first function, so far, that does NOT have all real numbers as the domain.

Shape of the graph

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



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



Does the graph ever reach horizontal? $never$

Domain of the graph? $x = [0, \infty)$

Range of the graph? $y = [0, \infty)$

Where is the function increasing? $f(x) \uparrow on: \ y = [0, \infty)$

Where is the function decreasing? $never$

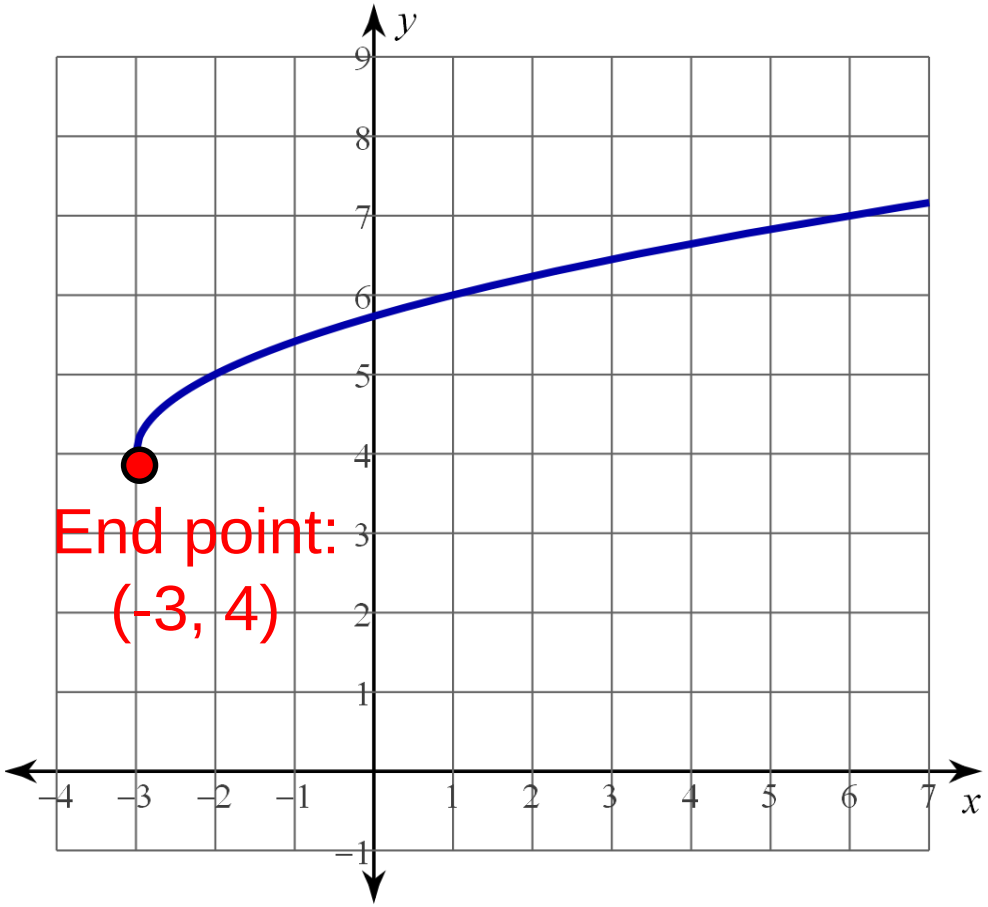
Where is the function positive? $f(x) > 0 \ on: \ y = [0, \infty)$

Where is the function negative? $never$

Describe the transformations to the parent function:

$y = 4 + \sqrt{x+3}$ $y = \sqrt{x+3} + 4$

Up 4, left 3



Domain?

$x = [-3, \infty)$

Range?

$y = [4, \infty)$

End point?

$(-3, 4)$

Describe the transformations to the parent function: $f(x) = \sqrt{x}$

Where is the endpoint of the graph?

$g(x) = \sqrt{x-2} + 4$

right 2, up 4

End point: (2, 4)

$g(x) = 4 + \sqrt{x-2}$

Up 4, right 2

$k(x) = -3 - 2\sqrt{x+1}$ Left 1, down 3, reflected (x-axis), VSF-2

End point: (-1, -3)

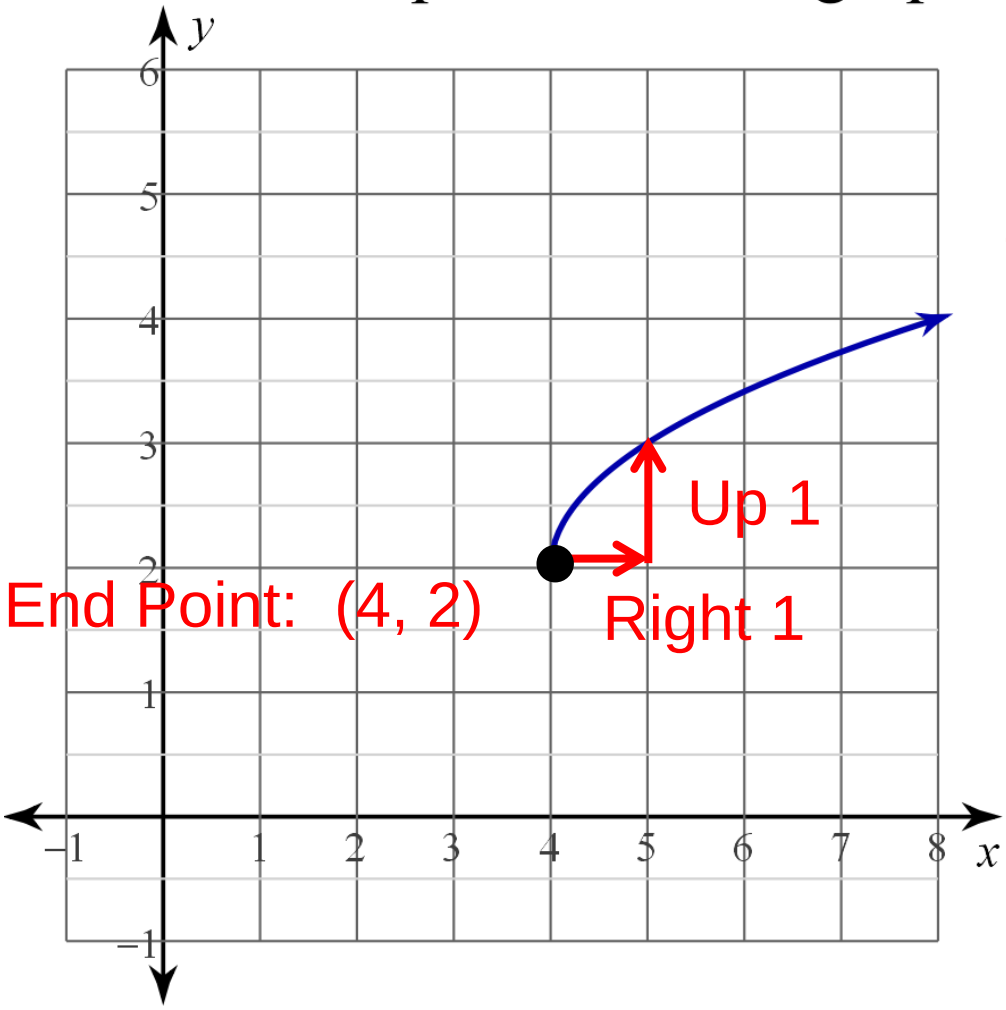
$h(x) = -5 + 2\sqrt{x}$ Down 5, VSF-2

End point: (0, -5)

$j(x) = 1 - 4\sqrt{x+2}$ Left 2, up 1, reflected (x-axis), VSF-4

End point: (-2, 1)

What is the equation of the graph?

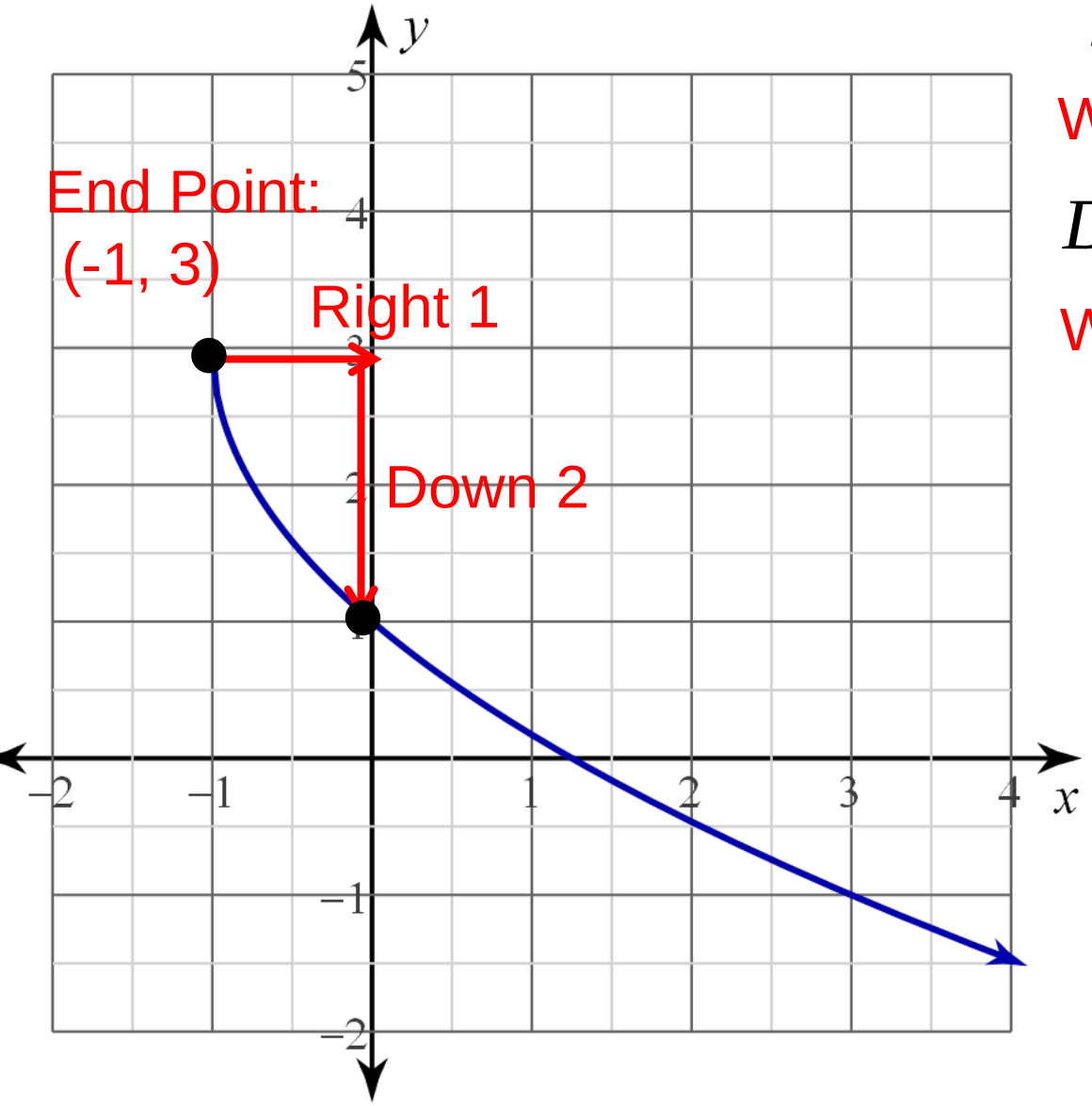


Parent has been transformed:
right 4, up 2, reflected (x-axis)

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

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

What is the equation of the graph?



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

What is the domain?

$$Domain: \quad x = [-1, \infty)$$

What is the Range?

$$range: \quad x = (-\infty, 6]$$

Let's generalize the transformations

$f(x) = x^2$ $\qquad$ $y = (-1)a(x-h)^2 + k$

Reflection across x-axis

vertical stretch factor

Translates left/right

translating up or down

$g(x) = |x|$ $\qquad$ $y = (-1)a|x-h| + k$

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