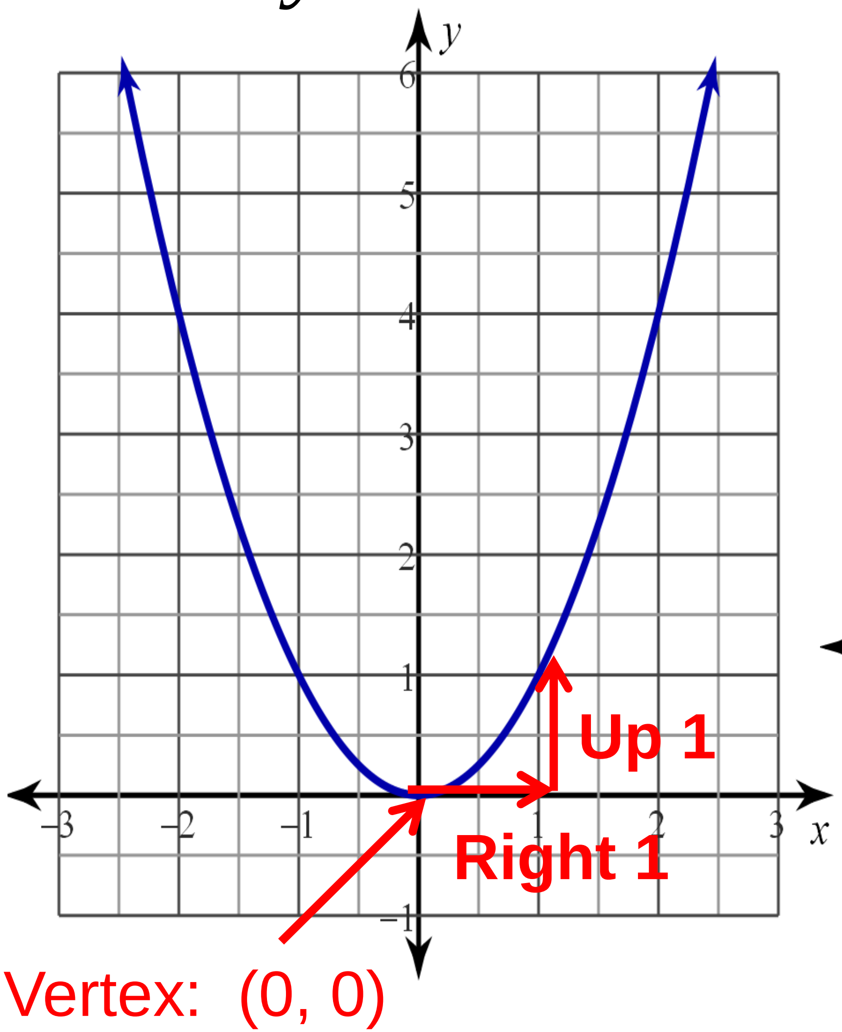
Math-2
Lesson 4-3

Square Root Function
and
The “Piece-wise Defined” Function

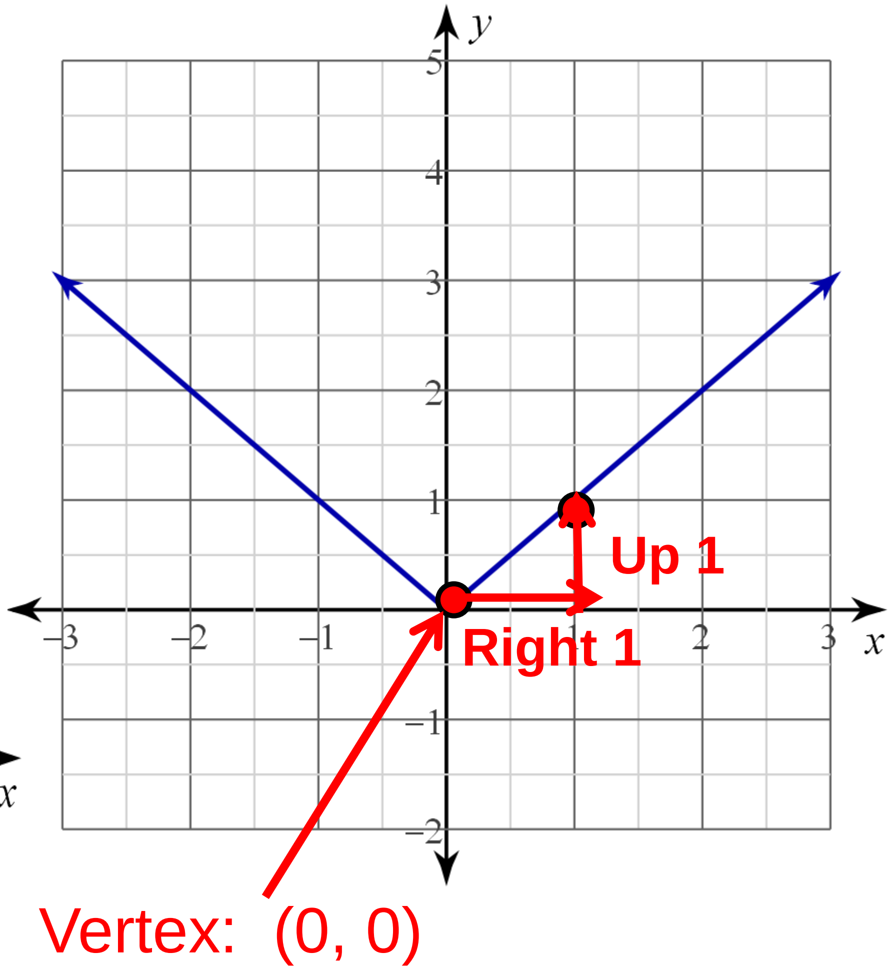
Square Function
(quadratic function)

$$y = x^2$$



Absolute Value Function

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



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	??

$y=\sqrt{x}$

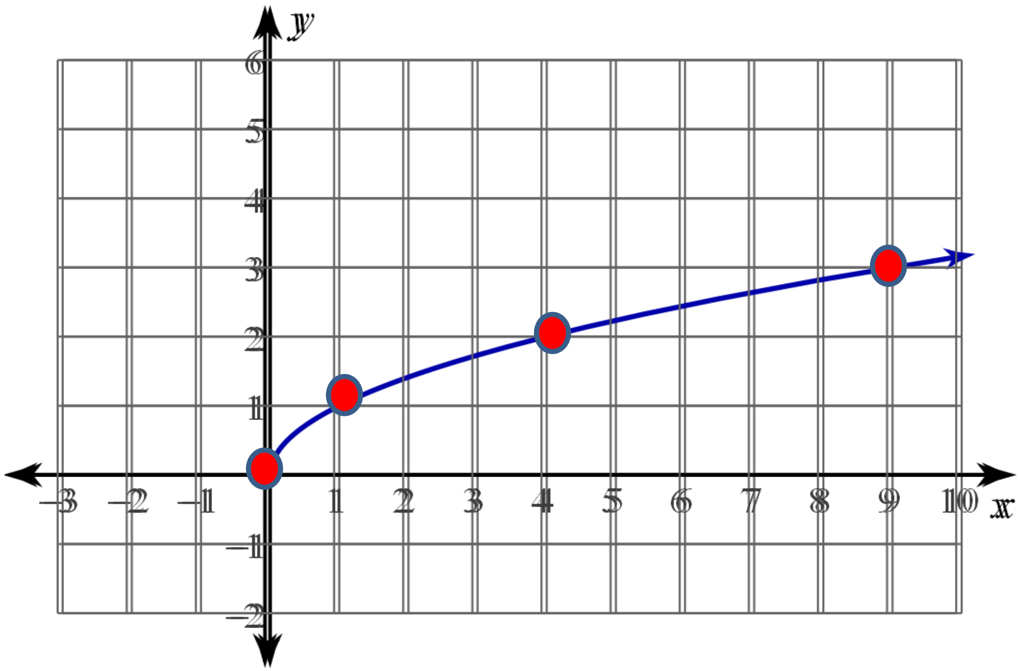
$y=\sqrt{9}=3$

$y=\sqrt{4}=2$

$y=\sqrt{1}=1$

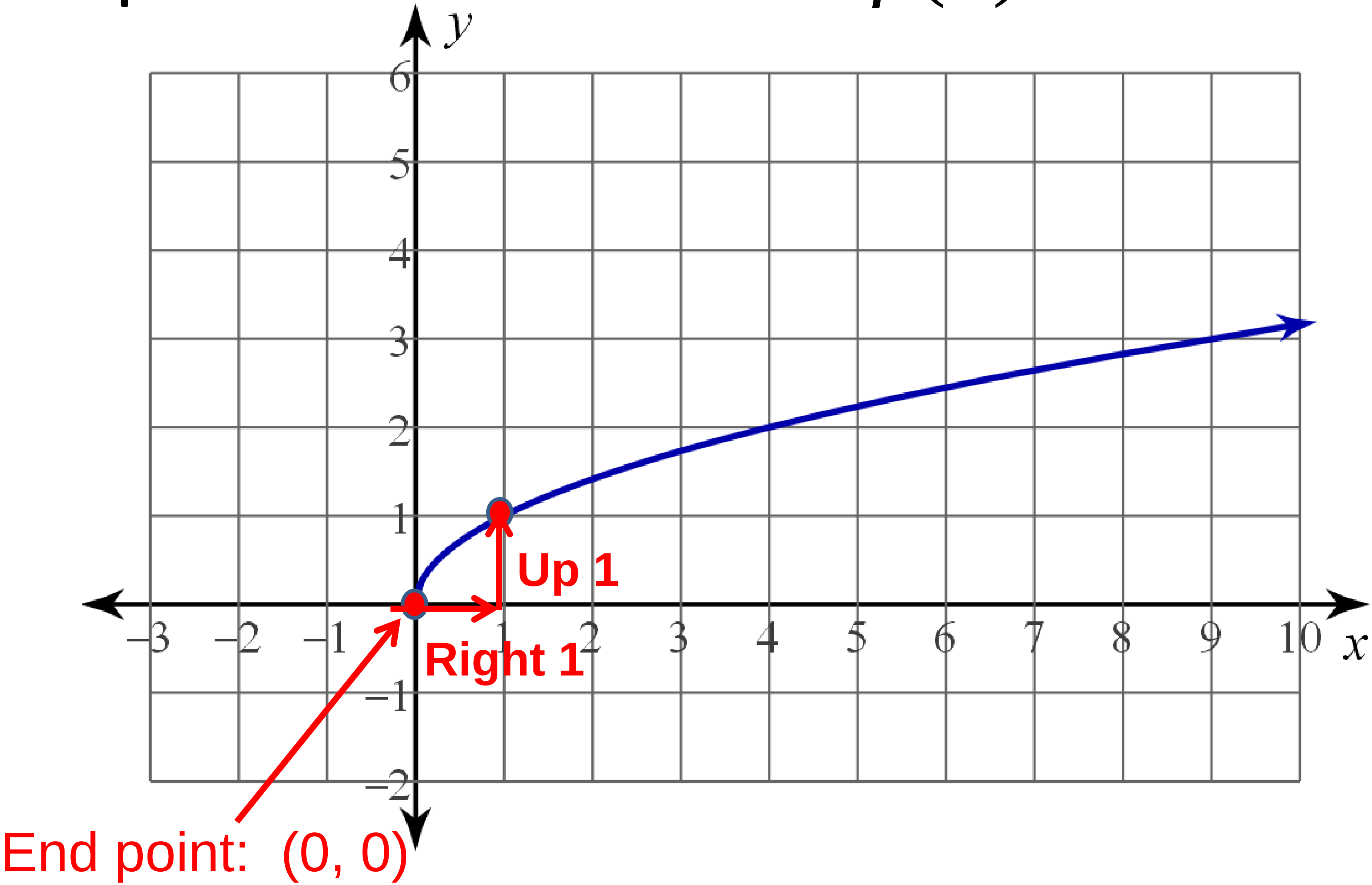
$y=\sqrt{0}=0$

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



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

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

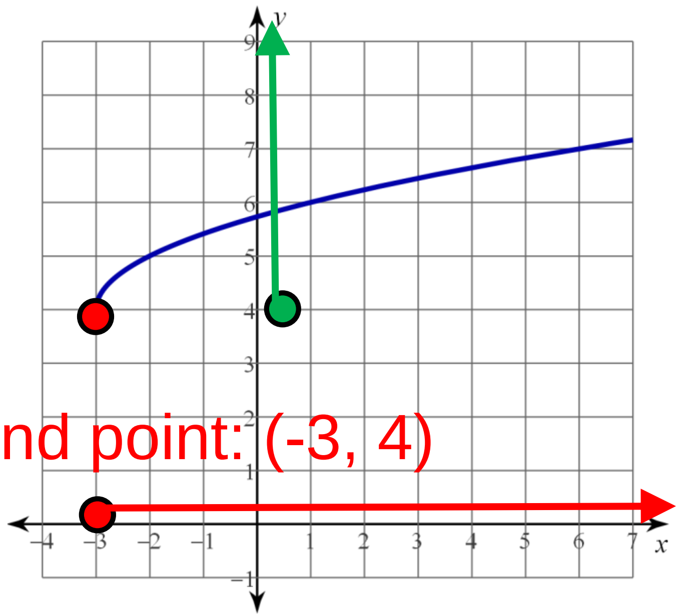


Describe the transformations to the parent function:

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

Up 4, left 3

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



What is the domain?

Hint: Find the endpoint. The x-value of the endpoint and every x-value to the right is in the domain.

$$x = [-3, \infty)$$

What is the range?

$$y = [4, \infty)$$

Hint: Find the endpoint. The y-value of the endpoint and every y-value above is in the range.

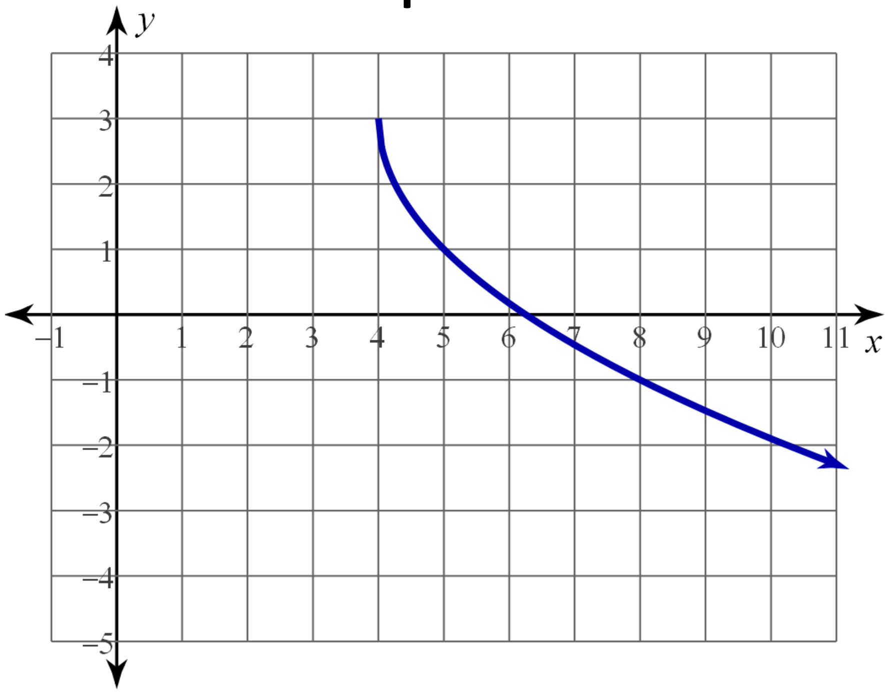
What is the equation of the graph?

Describe the transformations to the parent function:

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

reflected (x-axis), VSF=2, right 4, up 3

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



What is the domain?

$$x = [4, \infty)$$

Find endpoint: every x-value from the endpoint and to the right is in the domain.

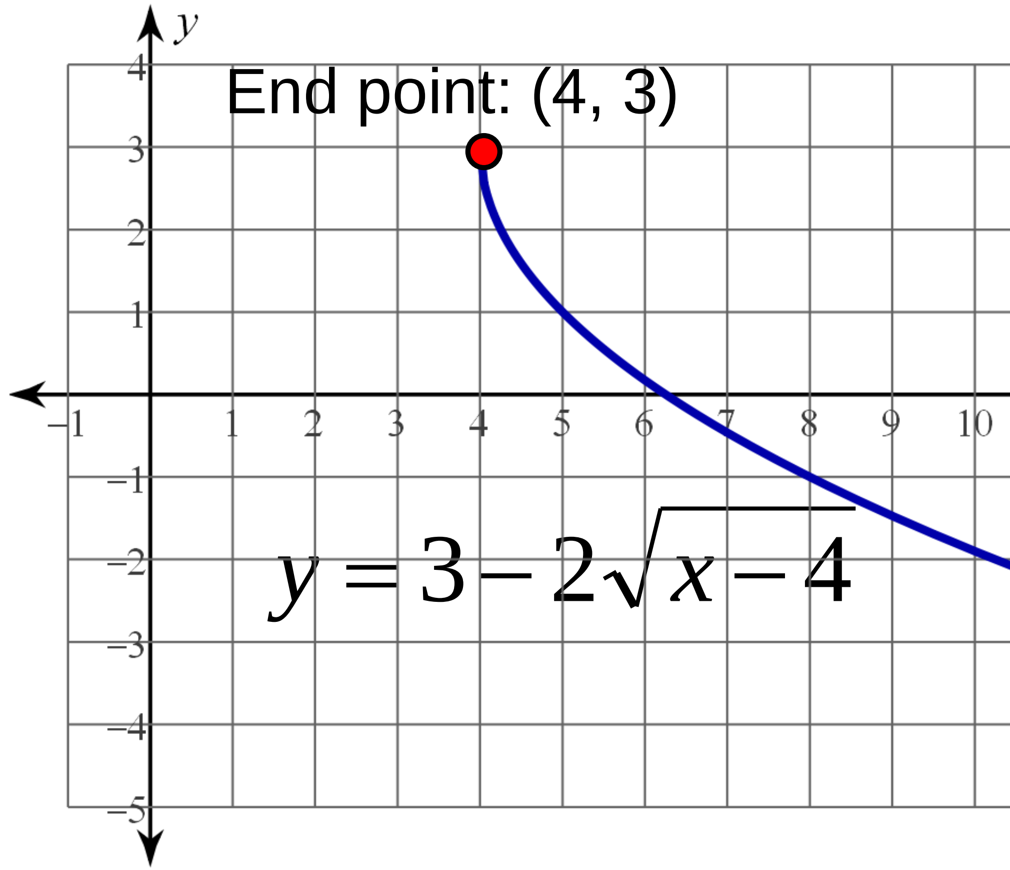
What is the range?

Find endpoint: every y-value from the endpoint and below is in the range.

$$y = (-\infty, 3]$$

Why is negative infinity the first term in the interval?

It is the minimum y-value in the range

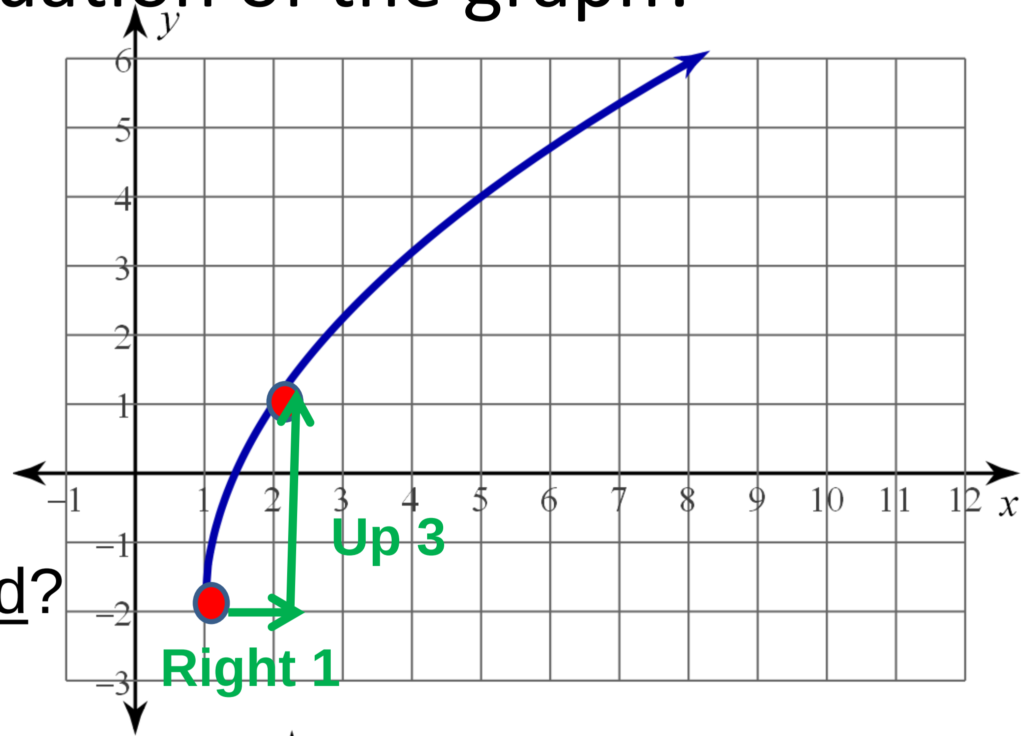


What is the equation of the graph?

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

<u>Endpoint</u>: right 1, down 2

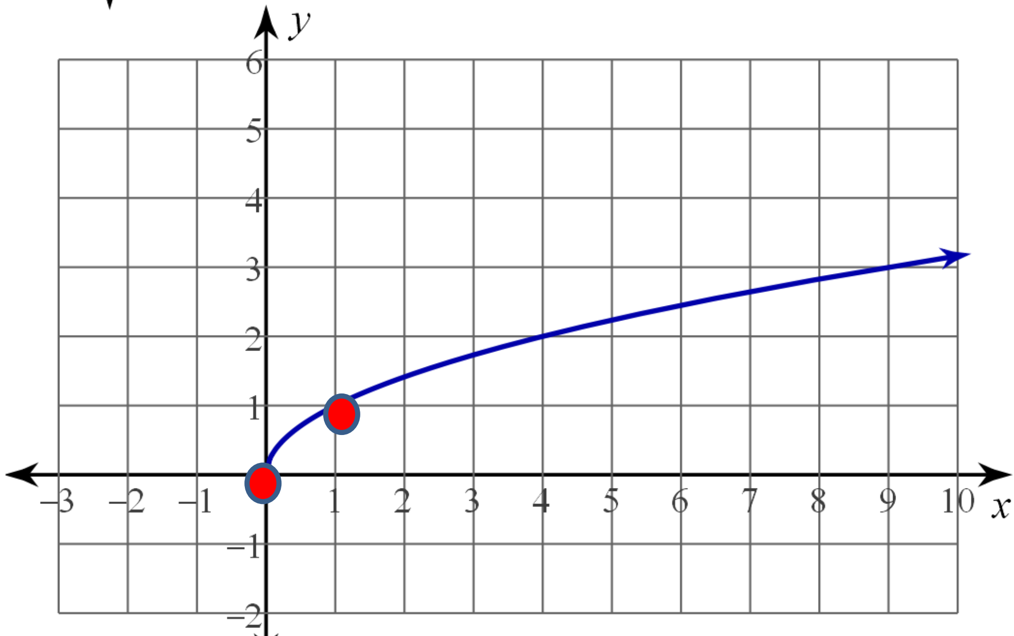
$$y = \sqrt{x-1} - 2$$



Has it been <u>vertically stretched</u>?

(<u>from endpoint)</u>: Right 1, up 3

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



What is the equation?

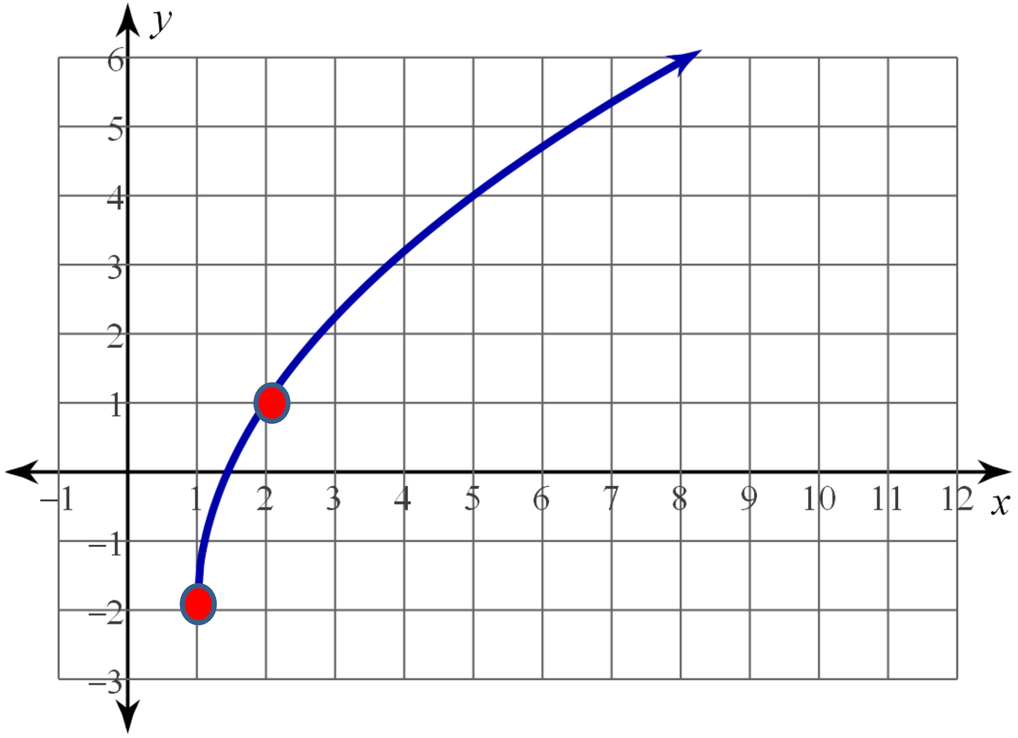
$$y = 3\sqrt{x-1} - 2$$

What is the domain?

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

What is the range?

$$y = [-2, \infty)$$



<u>Set-Builder Notation</u>: a way of writing an equation that also defines the input values to use.

$$f(x) = \{\underline{\quad\text{rule}\quad}, \text{ for } x = (\underline{\quad\text{Inputs}\quad}, \underline{\qquad})\}$$

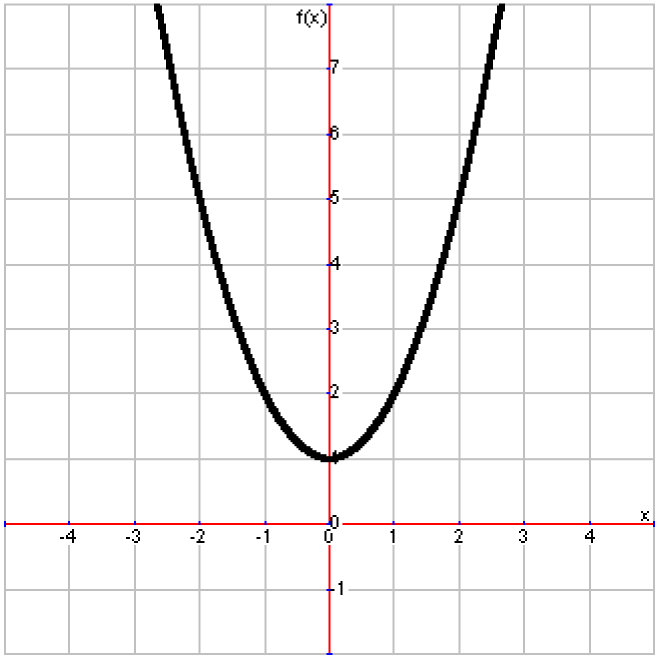
outputs

"French Brackets" → <u>set</u>

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

$$\text{Domain of } f(x): \{x = ???\}$$

$$\text{Domain}: \{x = (-\infty, \infty)\}$$



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

outputs rule Inputs

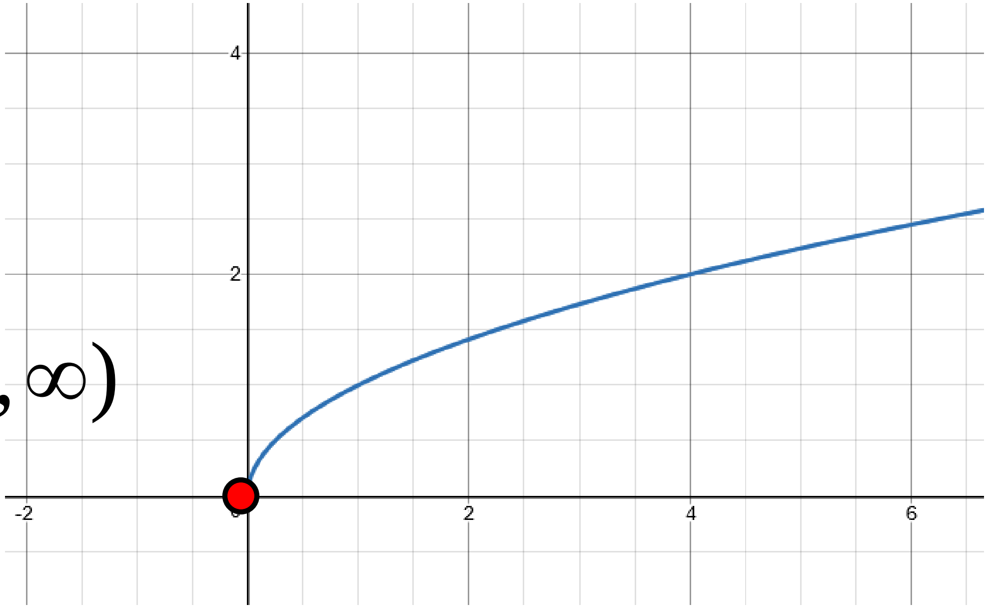
<u>Domain</u> of <u>all square functions</u> are "<u>all real numbers</u>" (redundant to write it in "set-builder" notation).

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

Endpoint of k(x) = ? (0, 0)

Domain of k(x) = ? $x = [0, \infty)$

Graph k(x)



Write k(x) in "set-builder" notation.

$$k(x) = \{\sqrt{x}, \mathrm{x} = [0, \infty)\}$$

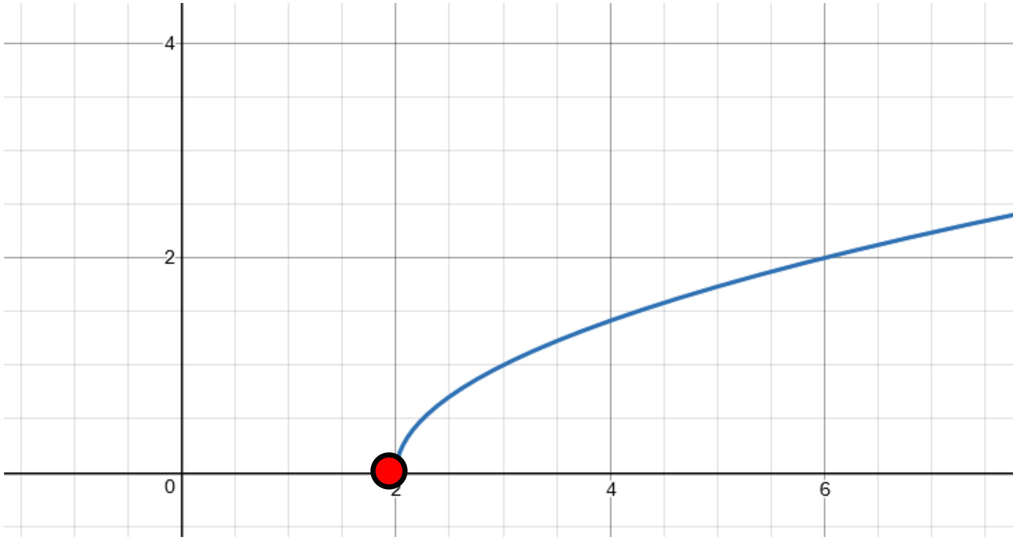
Domain of all square root functions are NOT "all real numbers" (redundant BUT more useful to write it in "set-builder" notation).

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

Endpoint of j(x) = ? (2, 0)

Domain of j(x) = ? $x = [2, \infty)$

Graph j(x)

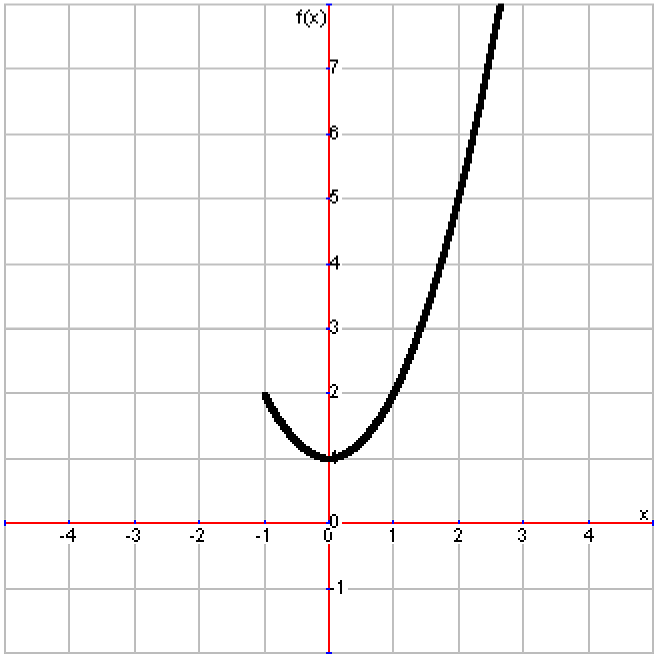


Write j(x) in "set-builder" notation.

$$j(x) = \{\sqrt{x-2}, \mathrm{x} = [2, \infty)\}$$

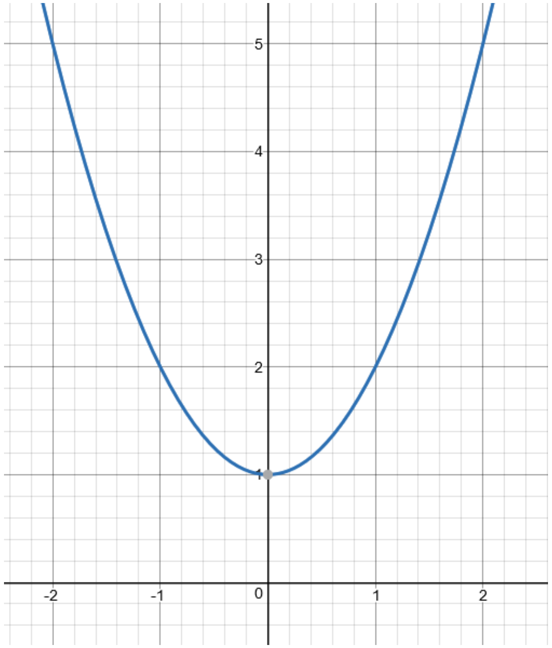
What is the domain of the graph?

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



What is the equation of the graph?

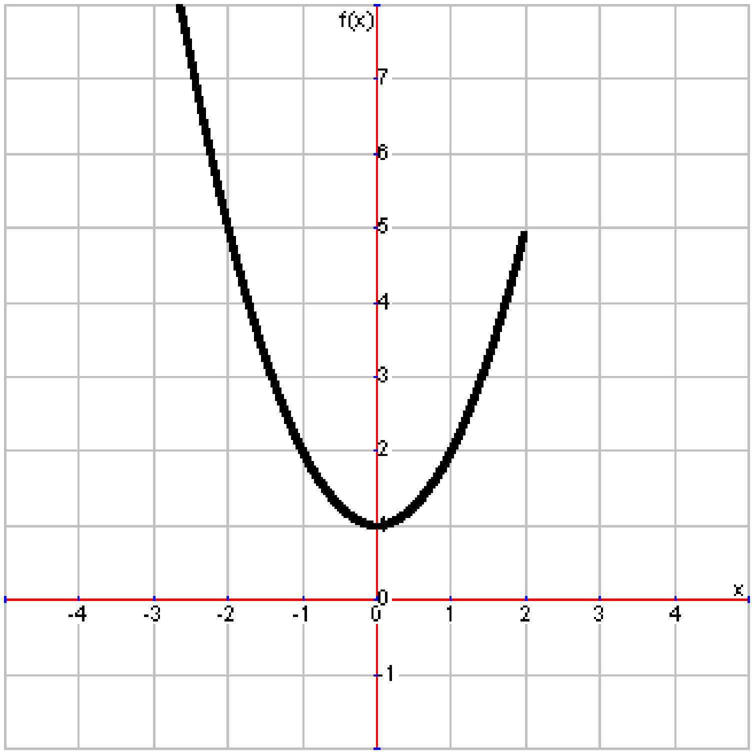
$$k(x) = x^2 + 1$$



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

$$k(x) = \{x^2 + 1, \mathrm{x} = [\text{-}1, \infty)\}$$

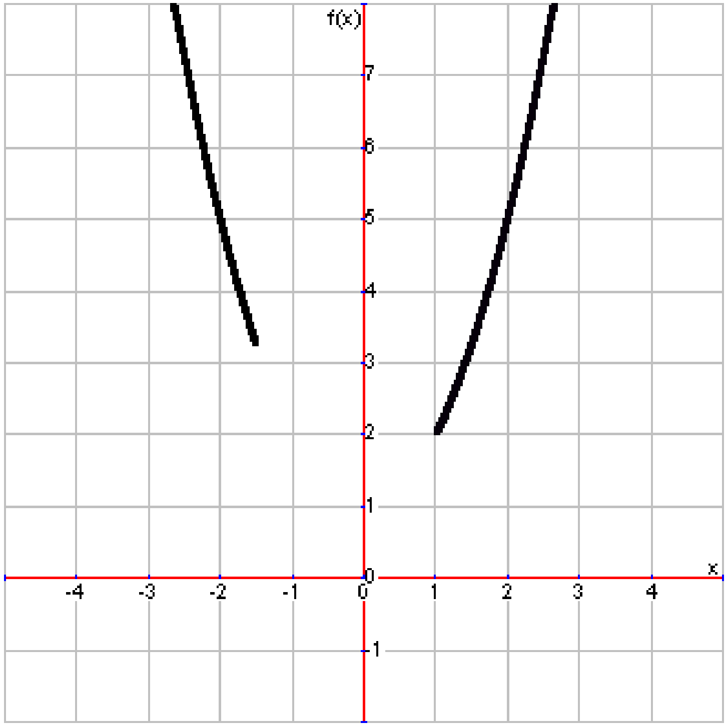
p(x)



Define p(x) using “set-builder” notation.

$$p(x) = \left\{ x^2 + 1, \text{ for x} = (-\infty, 2] \right\}$$

m(x)

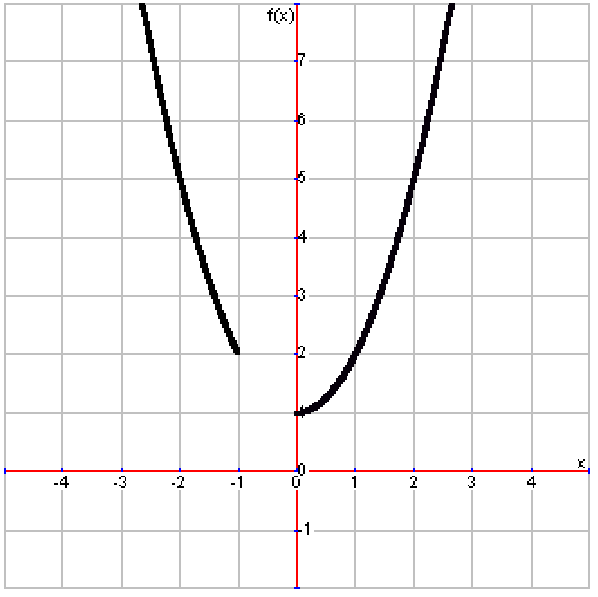


Define m(x) using “set-builder” notation.

$$m(x) = \{x^2 + 1, \text{for x} = (\text{-}\infty, -1.5] \cup [1, \infty)\}$$

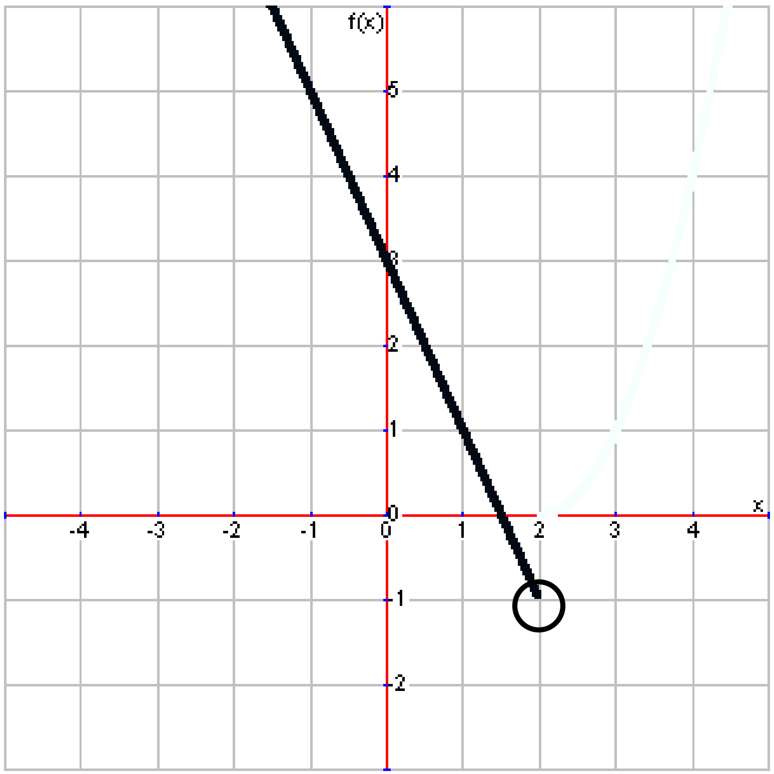
Graph j(x)

$$j(x) = \{x^2 + 1, \text{x} = (-\infty, -1] \cup [0, \infty)\}$$

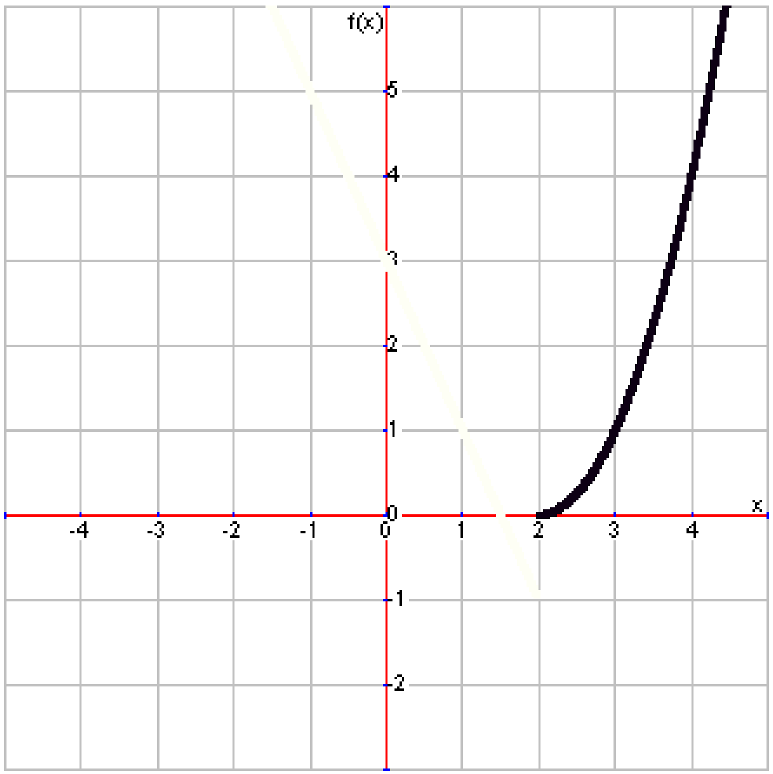


$f(x) = \{-2x+3,\ x = (-\infty, 2)\}$

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

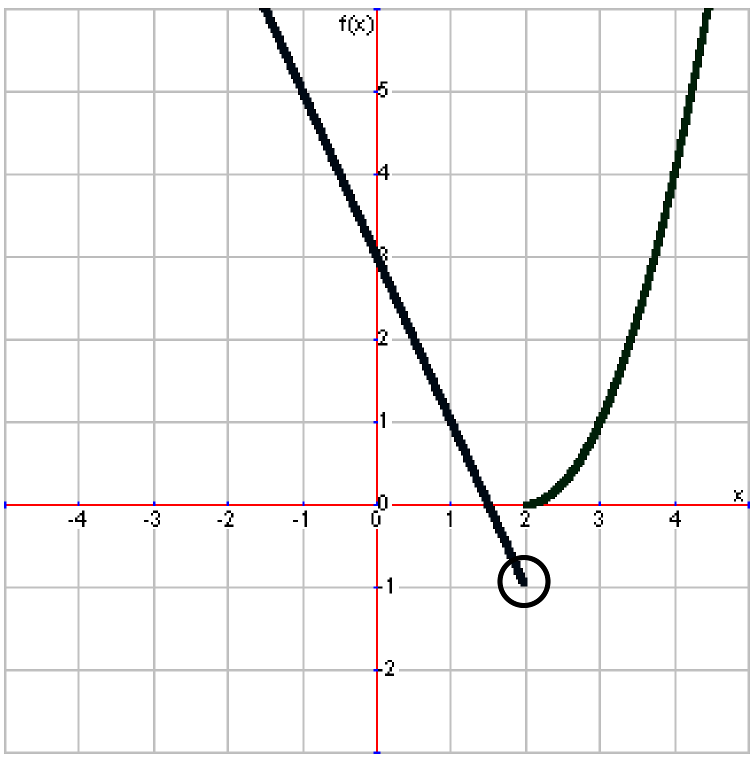


What is the equation of the graph?



What is the equation of the graph?

How would you define the following graph?

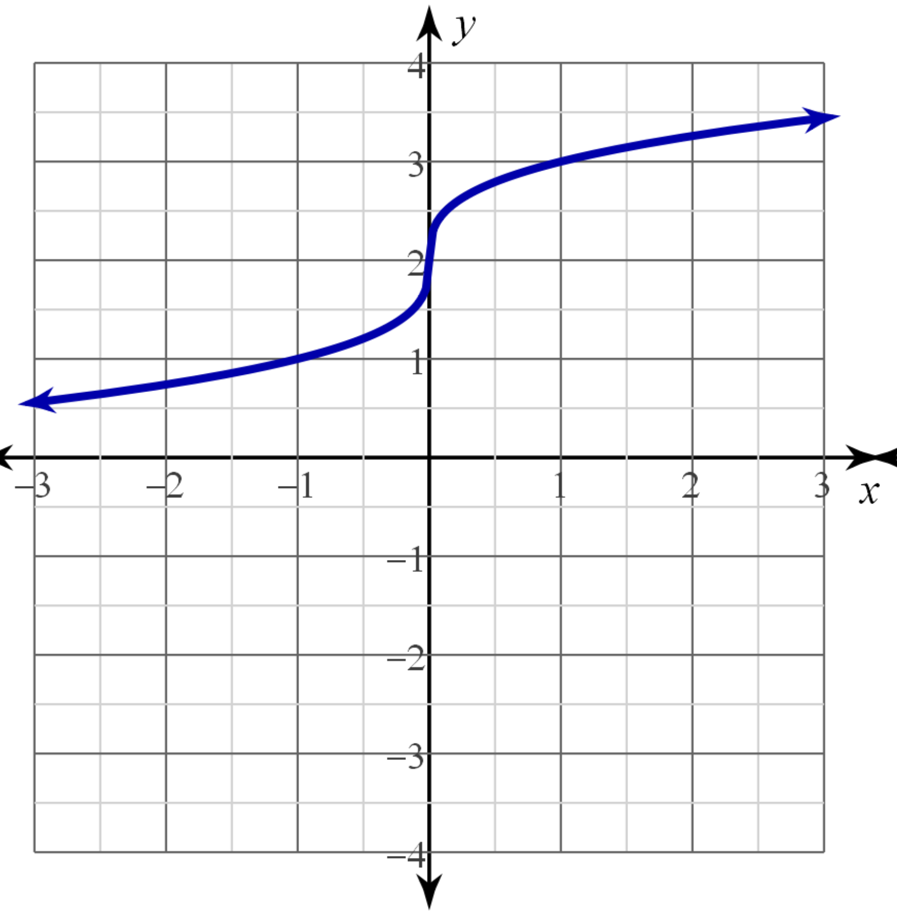


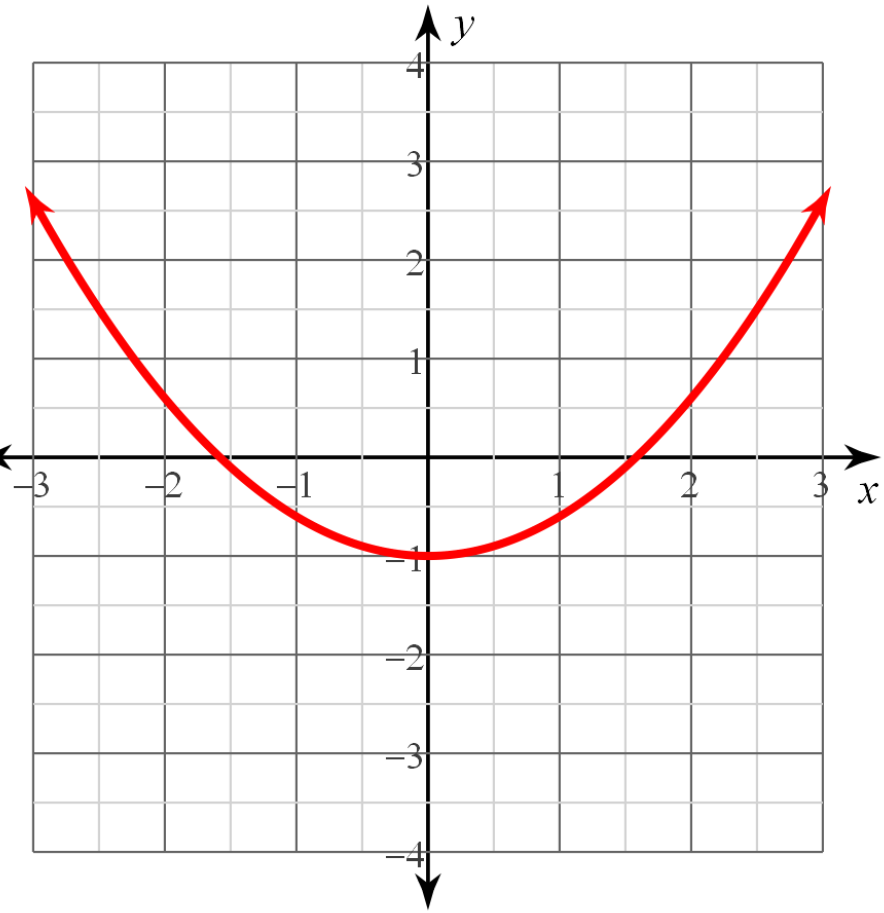
$$h(x) = \begin{Bmatrix} -2x+3, x=(-\infty, 2) \\ (x-2)^2, x=[2,\infty) \end{Bmatrix}$$

<u>We call this a “piece-wise” defined function.</u>

Graph them both:

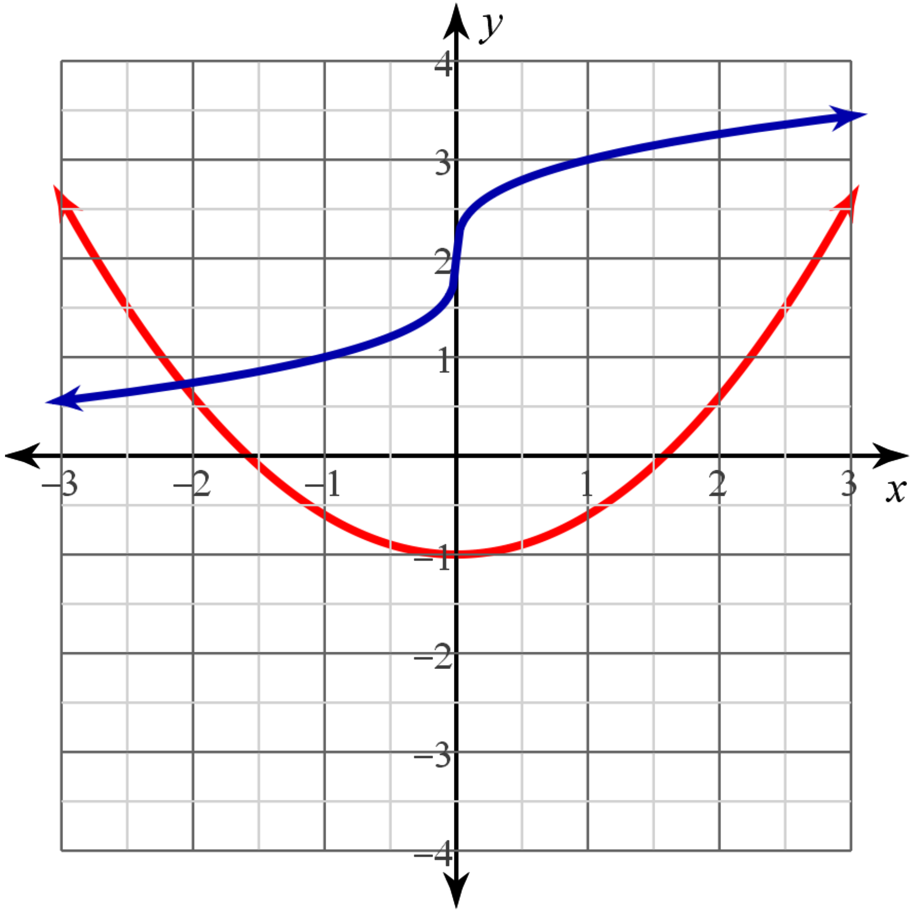
$$h(x) = \begin{cases} 2 + \sqrt[3]{x} \ , \ x = (0, \infty) \\ 0.4x^2 - 1 \ , \ x = (-\infty, 0] \end{cases}$$





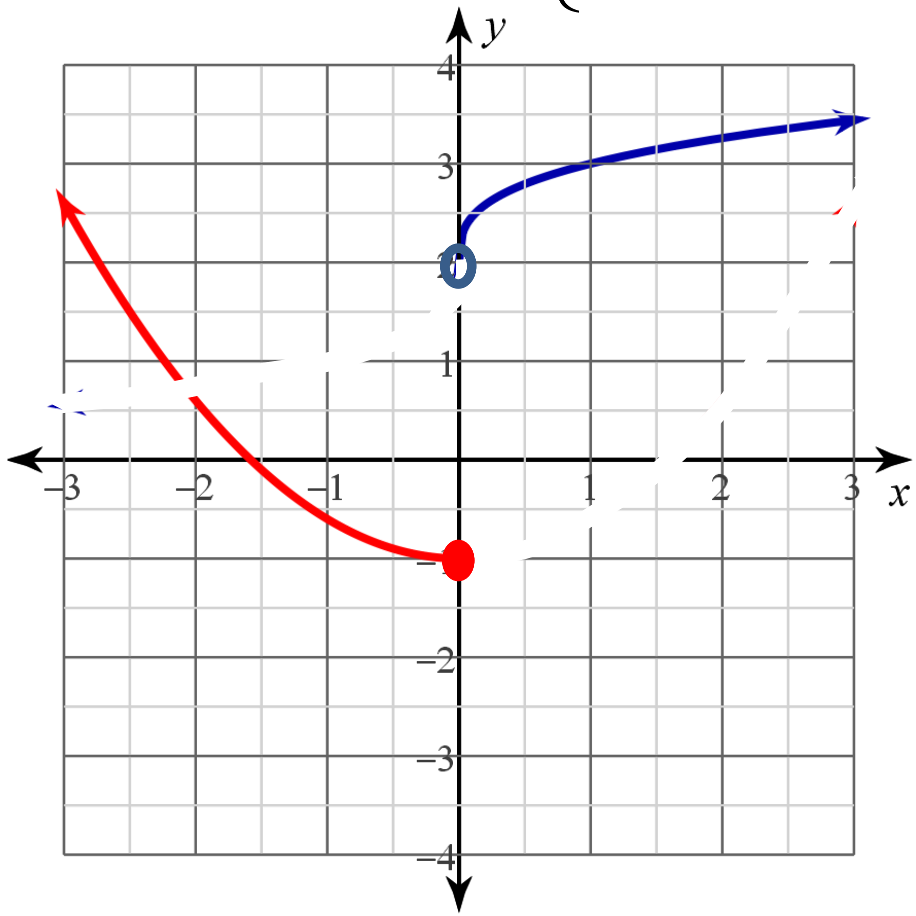
But, put them on the same x-y plot:

$$h(x) = \begin{cases} 2 + \sqrt[3]{x}\ , x = (0, \infty) \\ 0.4x^2 - 1\ , x = (-\infty, 0] \end{cases}$$



Now erase the part of the graph for each that does not apply based upon "restricted domain".

$$h(x) = \begin{cases} 2 + \sqrt[3]{x}, & x = (0, \infty) \\ x^2 - 1, & x = (-\infty, 0] \end{cases}$$



Graph these piecewise-defined functions:

$$h(x) = \left\{ \begin{array}{l} x^2 \ , \ x = (-\infty, 0) \\ |x| \ , \ x = [0, \infty) \end{array} \right\}$$

$$g(x) = \left\{ \begin{array}{l} 1 + \sqrt{x} \ , \ x = (-\infty, -1) \\ 2x - 3 \ , \ x = [0, \infty) \end{array} \right\}$$