

Functions

A function f is a machine which takes an input x and produces an output $f(x)$.

For this course: x and $f(x)$ will be (real) numbers.

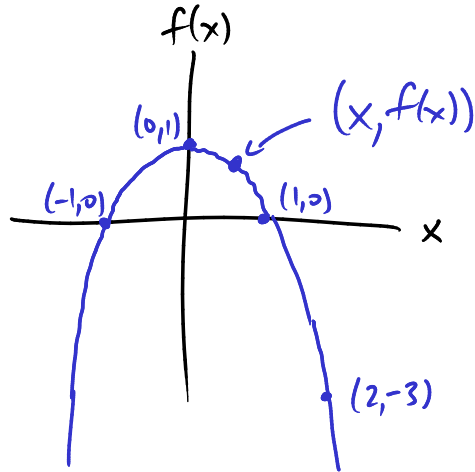
Ex $f(x) = 1 - x^2$

x	$f(x)$
0	1
1	0
2	-3

$$1 - 0^2 = 1$$

$$1 - 1^2 = 0$$

$$1 - 2^2 = -3$$



The domain of f is the set of all allowed x (all x for which $f(x)$ exists.) Ex for $f(x) = 1 - x^2$, domain = all real x

$$= \{x: -\infty < x < \infty\}$$

$$= (-\infty, \infty)$$

The range of f is the set of all y such that $y = f(x)$ for some x .

Ex for $f(x) = 1 - x^2$,

$$\text{range} = -\infty < y \leq 1$$

$$= (-\infty, 1]$$

Ex for $f(x) = -\sqrt{x}$: domain = $[0, \infty)$

$$\text{range} = (-\infty, 0]$$

Why? This means: for any $y \in (-\infty, 0]$ there is some x for which $f(x) = y$. i.e. $-\sqrt{x} = y$

To find that x , square both sides: $(-\sqrt{x})^2 = y^2$
 $\underline{\underline{x = y^2}}$

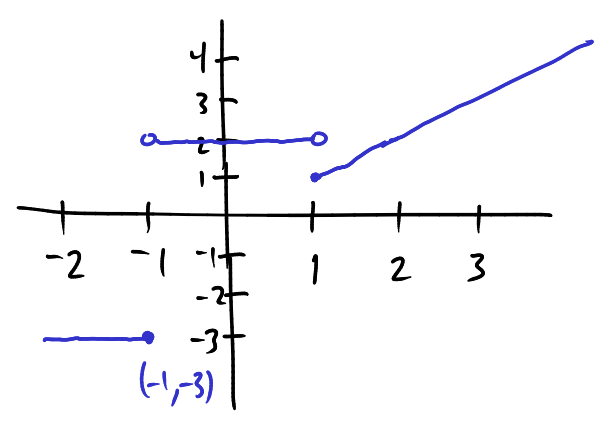
$y = -\sqrt{x}$

$(-\sqrt{x})^2$
 $"$
 $((-1) \cdot \sqrt{x})^2$
 $"$
 $(-1)^2 \cdot (\sqrt{x})^2$
 $"$
 x

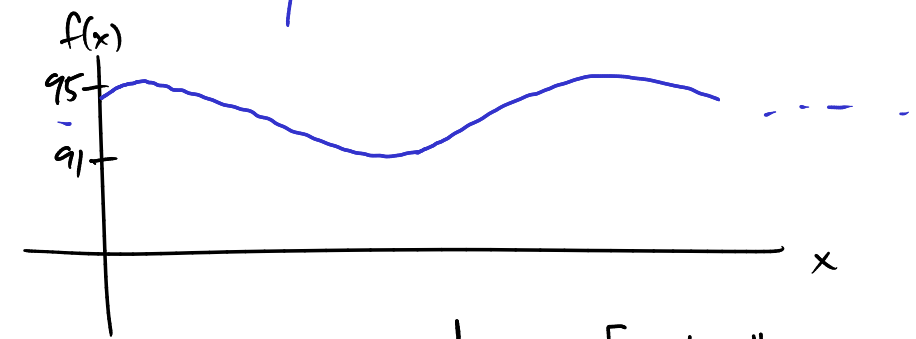
Ex

$$f(x) = \begin{cases} \frac{1}{2}(x+1) & \text{if } x \geq 1 \\ 2 & \text{if } -1 < x < 1 \\ -3 & \text{if } x \leq -1 \end{cases}$$

domain = $(-\infty, \infty)$
 range = $\{-3\} \cup [1, \infty)$



Ex $f(x)$ = the distance in millions of miles from the center of Earth to the center of Sun at x seconds past start of 2018 GMT



domain = $[0, 10 \cdot \# \text{sec. in year})$
 range $\approx (91, 95)$