Wednesday, August 31 – Fall '22
Lecture #2

Announcements / Reminders

* Grade Calc Pretest and turn in in lecture
* Discussion tomorrow (no quiz)
* No class on Monday (Labor Day)
* WP HW 0 due next Wed
* Q1 next Thurs covering 1.1
* WP HW 1 due next Fri
    * Join Wiley Plus ASAP!
      No deadline extensions, even for technical issues.
* If you weren't here Monday, see me after class.

"(Pantone) HW 1"

What is Calculus?

- "the study of how things change"

Two main topics

(1) Derivatives
- most of this course

- "rate of change"

Ex: If you know the position of a car at every point in a race, can you also find its speed at every point? Yes, that's a derivative. What about the acceleration? Also yes.

(2) Integrals
- a little bit at the end
- a lot in Calc 2
- the reverse of derivatives

Ex: If you know the starting place of a car and you know its speed (velocity) at every point in time, can you tell its position at any point in time? Yes.

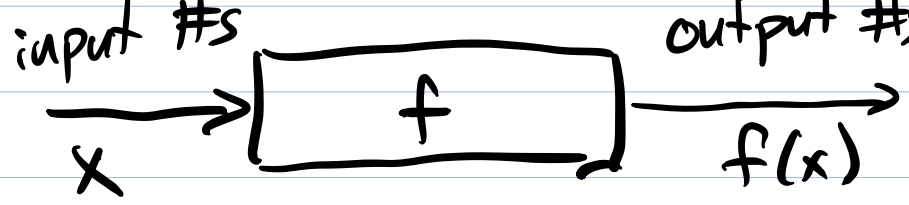
Section 1.1 - Functions and Change

In math before calculus, you learn about all kinds of functions:
- lines

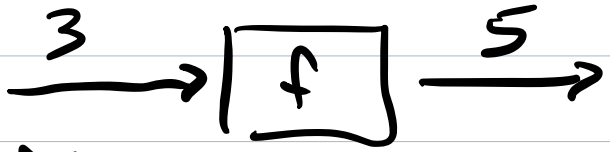
- inverses
- quadratic
- exponentials
- logarithmic
- trig

A <u>function</u> is just a predefined rule that transforms numbers into other numbers.

Think about a function as a <u>black box</u> that you feed input #s to, and it does something and it gives you back output #s.



Ex:



Notation: $f(3) = 5$

<u>Book Definition</u>: A <u>function</u> is a rule that takes certain #s as inputs and assigns

to each a definite output #.

The set of all input #s is the domain of a function.

The set of all resulting output #s is the range.

Domain: set of valid inputs
Range: set of outputs you get

The domain can be explicit (we specify the domain when we define the function) or implicit (all real #s that make sense when you plug them in).

A few notes:

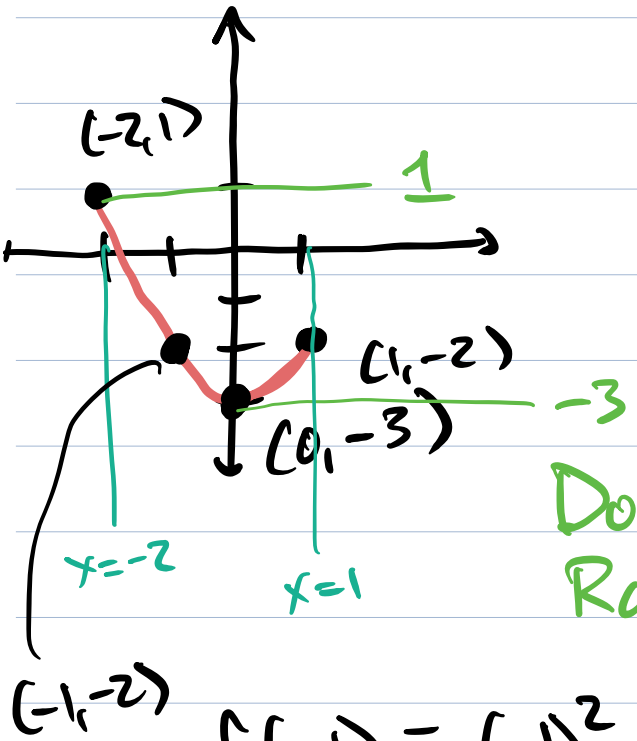
- "f" is just a common name for a function. We could use g(x), B(x), α(x), ...
- It's common to write "y" for the output instead of f(x).

$y = 3x + 5$
$y(x) = 3x + 5$
$f(x) = 3x + 5$
} same thing

Example

explicit

$f(x) = x^2 - 3$ on domain $-2 \le x \le 1$



$f(0) = 0^2 - 3 = -3$

$f(1) = -2$

$f(-2) = (-2)^2 - 3$

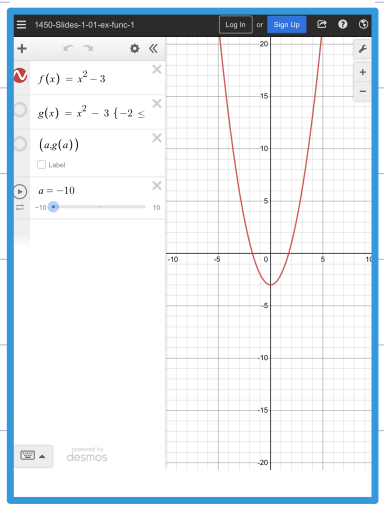
$= 4 - 3 = 1$

Domain: $-2 \le x \le 1$ $[-2, 1]$

Range: $-3 \le y \le 1$ $[-3, 1]$

$f(-1) = (-1)^2 - 3 = -2$

Desmos



Example: $Q(x) = \sqrt{x - 2} + 5$

(implicit domain)

$$Q(11) = \sqrt{11-2} + 5$$

$$= \sqrt{9} + 5$$
$$= 3 + 5 = 8$$

Domain: All x values where $\sqrt{x-2} + 5$ is valid.

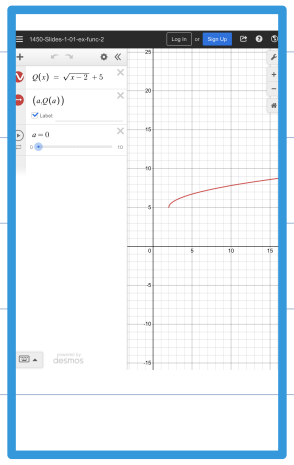
* You can't take the square root of a negative #.

0, 1, −5

$$Q(1) = \sqrt{1-2} + 5$$
$$= \sqrt{-1} + 5$$

We need $x - 2 \geq 0$

$\Rightarrow x \geq 2$



Domain: $x \geq 2$

$2 \leq x \leq \infty$

$[2, \infty)$

Range: $x \geq 5$

$-\infty$ $+\infty$

Side note on interval notation

"[" or "]" = inclusive

"(" or ")" = exclusive

Convention: ∞ always get "(" or ")"

$a \leq x \leq b$ $\quad [a, b]$

$a < x \leq b$ $\quad (a, b]$

$a \leq x < b$ $\quad [a, b)$

$a < x < b$ $\quad (a, b)$

$x \geq a$ $\quad [a, \infty)$

$x < b$ $\quad (-\infty, b)$

Example: $m(x) = -\sqrt[3]{x}$

If $y = x^2$ then $x = \sqrt{y}$

If $y = x^3$ then $x = \sqrt[3]{y}$

$(-2)^3 = (-2)(-2)(-2) = -8$

$\sqrt[3]{-8} = -2$

Domain: $(-\infty, \infty)$

Range: $(-\infty, \infty)$