Physics 421 / PCSE 503
Lecture 1

Python / Jupyter Notebooks

→ anaconda

Data Collection

→ do the experiment

→ internet → public

→ NSF
NIH
DoE

JLab

gov'ts

DATA MINING

Data Format

Data

→ numerical

↳ integer

↳ floating point

int

float

scalar (m, T, ρ)

vector ($\vec{F}, \vec{v}, \vec{a}$)

mixed

→ surveys → yes/no

T/F

categorical "words"

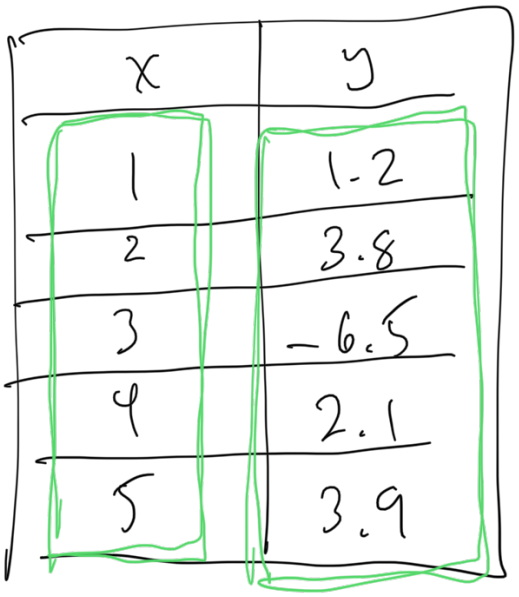
→ boolean

→ String data

Data Structures

→ lots of data

2D array → 3D array



$$\begin{bmatrix} a_1 & a_2 & a_3 \end{bmatrix}$$

$$\begin{bmatrix} b_1 & b_2 & b_3 \end{bmatrix}$$ transpose

$$\begin{bmatrix} a_1 & a_2 & a_3 \end{bmatrix} \begin{bmatrix} b_1 \\ b_2 \\ \end{bmatrix}$$

$= a_1 b_1 + a_2 b_2 + a_3 b_3$

Finding Roots of an Equation

$f(x) =$ ~~~~~

$f(x) = 0$

$\rightarrow F = ma$

$a = F/m$

$F - ma = 0$

$f(a) = 0$

$$f(x) = ax^2 + bx + c$$

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$f(x) = ax^3 + bx^2 + cx + d$$

$x =$ [ ]

cubic formula

(1) $ax + b = 0$

$x = -b/a$

(2) ✓

(3) ✓

(4) ✓

(5) $ax^5 + bx^4 + cx^3 + dx^2 + e = 0$

NO SOLUTION!

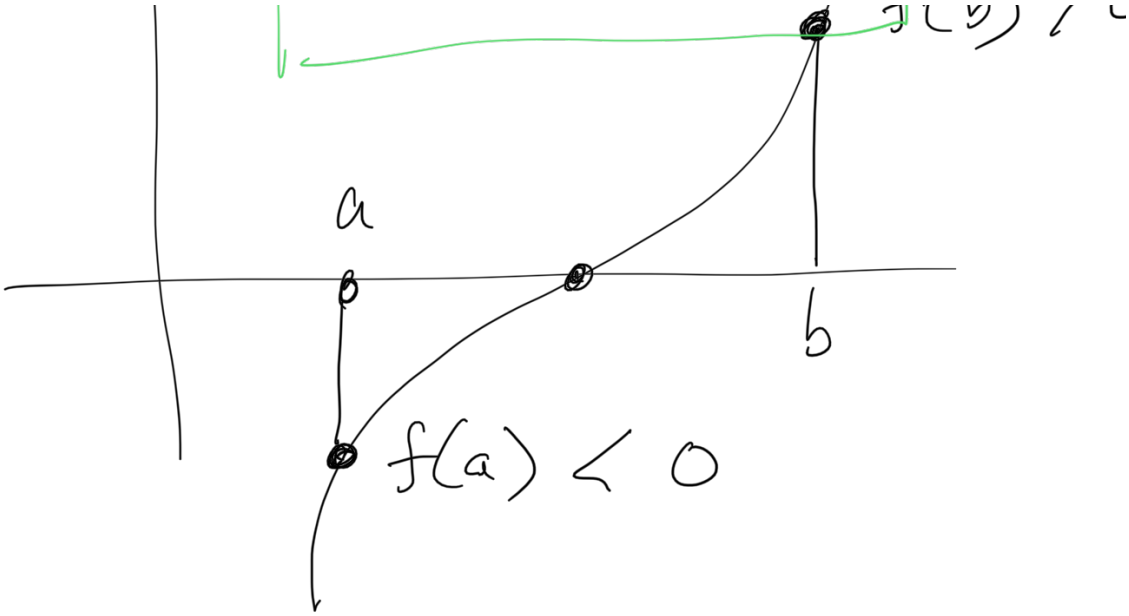
Numerical Solutions

→ Newton's Method

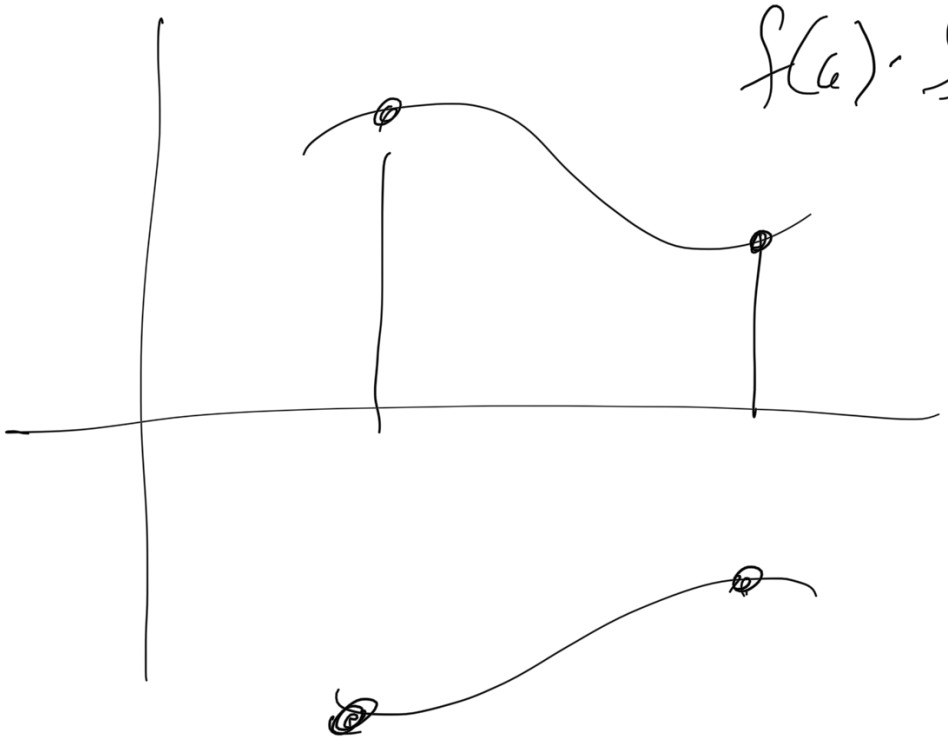
→ Bisection Method ←

→ .

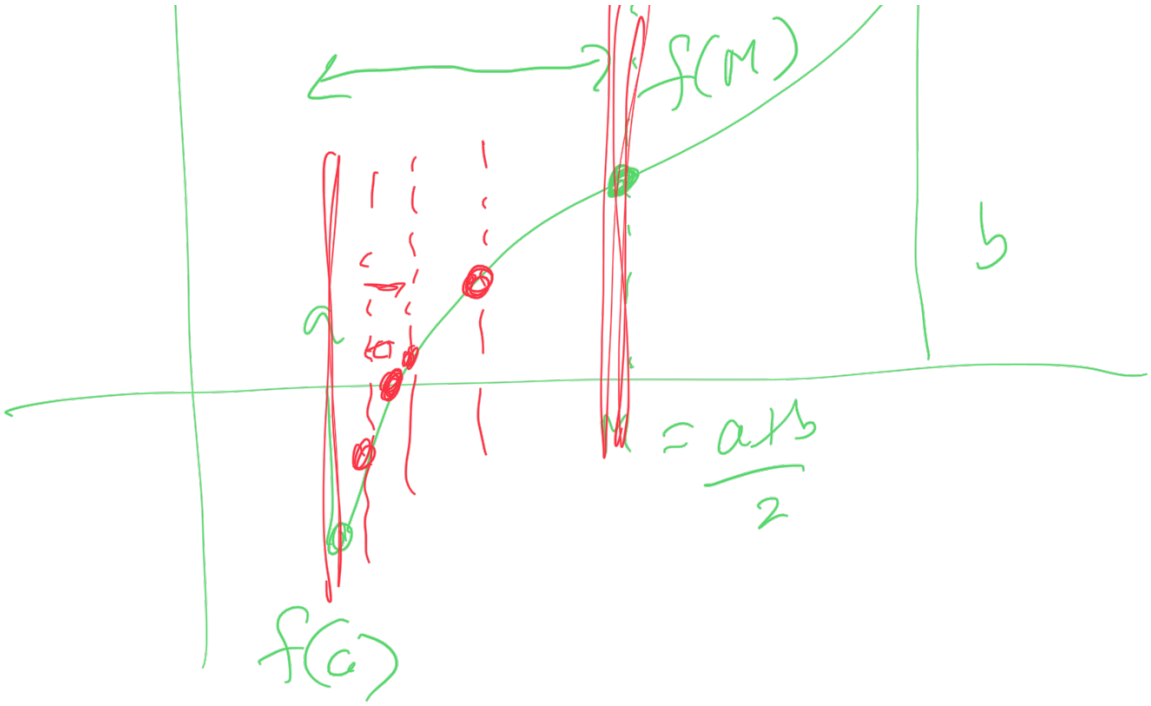
$f(a) \cdot f(b) < 0$ $f(b) > 0$



$f(a) \cdot f(b) ?$



Bzzt



$$\boxed{f(a) \cdot f(M) < 0}$$

$$f(b) \cdot f(M) > 0$$