# Lecture 2

- Intro Survey on Gradescope ⊛ due Sunday ⊛
- Office hours
- Recording of class. ✓

→ please see poll on Ed Discussion

## Questions

- Why is $f(x) = \|Ax-b\|^2$ smooth + convex? ✓
- Why not "non-linear" manipulations in a Matrix? ✓
- Why only 2d for a matrix? ✓
- Julia is not class based OOP. Why not?

## Explain Julia Least Sq Example

- Useful Matrix Decomp Include

$A = PLUQ$ ✓

What is this?? How is it diff. from $A = LU$.?

Why not "non-linear"?

↳ Not Specific Enough

→ could be "quadratic/polynomial/convex/etc."

but the class is

LINEAR ALGEBRA.

My Handwriting is ... not good?

Why only 2d?

A Matrix Represents an Input-Output map.

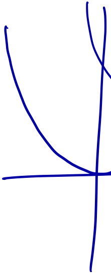
These are your 2 dimensions!

$A = PLUQ$

$A = PLdU$

Why is

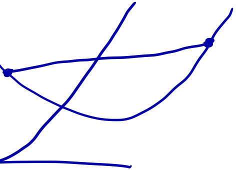
Smooth



$Ax$ :

$f(\underline{x}) = \|A\underline{x} - \underline{b}\|_2^2$

and Convex.



linear map

$y = A\underline{x} \Rightarrow$

$$y_i = \sum_{j=1}^{n} A_{ij} x_j$$

$$f(\underline{x}) = \|x\|_2^2$$

$$= \sum x_i^2 .$$

$f(x)$ is Convex if

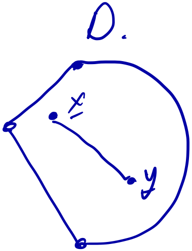
for all $x, y$ in the domain of $f$,

then $0 \le \alpha \le 1$

$f(\alpha \underline{x} + (1-\alpha) \underline{y}) \le \alpha$

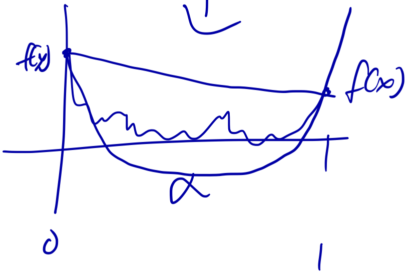
and the domain of $f$ is Convex set, i.e.

any line is inside the



$f(\underline{x}) + (1-\alpha) f(\underline{y})$

a

set.