Welcome to Math 33A!

Discussion 1A: 11-11:50 am
Public Affairs 1234

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Campuswire!

M - Th.

SMC TBD (Open 9am-3pm MS 3974 Starts next week!)

Zoom OH TBD (Fill out survey!)

Plan for Discussions:

- Review at beginning of discussion
- Weekly worksheet (not graded, will have full solutions posted!)

- Main role of discussion: A place to ask questions!

Tips for Math 33A

- Ask questions!!! (Campuswire!)
- Focus your studying on the <u>why</u>, not just the how
- Do lots of problems (but also read your textbook)

What is Linear Algebra?

Motivating Question 1: How do we solve systems of linear equations?

↳ no exponents bigger than 1

ex:

$$3x + y = 2$$
$$+ \quad x - y = 0$$

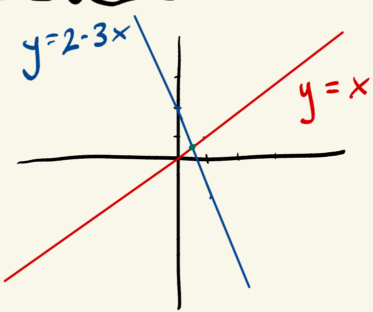
$$\frac{4x}{4} \cancel{+y-y} = \frac{2}{4} \qquad x = \tfrac{1}{2}$$

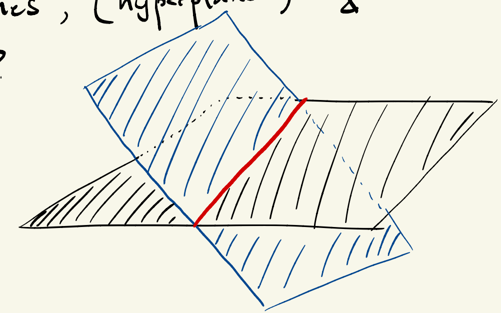
$$\tfrac{1}{2} - y = 0 \Rightarrow y = \tfrac{1}{2}$$

Motivating Question 2: How do we understand lines, planes, (hyperplanes) & how they $\boxed{\text{relate}}$ to each other?

↓

intersections





To study this question, we will focus our attention on matrices (vectors, vector spaces, ..)

Linear systems of equations

Linear subspaces of Euclidean space

$\boxed{\text{Matrices}}$

Linear transformations of Vector spaces

From an application perspective:

Linear algebra is the mathematical foundation of:

- solving diff. eqns. ↳ aka: physics, engineering, etc.
- computer graphics
- AI / data science
- Basically everything:

  Joke: mathematics is the art of turning problems into linear algebra

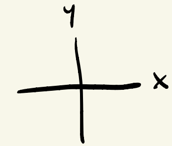
Intro to Vectors

$(\mathbb{R}^1)$

$\mathbb{R}$: set of all real numbers

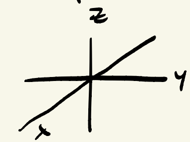
Not^n : $\boxed{\mathbb{R}^n}$

$\mathbb{R}^2$: set of all ordered pairs of real numbers ex: $(0,1)$ $(-1.2, \pi)$ (π, e)



$\vec{v} \in \mathbb{R}^n$

$\mathbb{R}^3$: set of all triples of real numbers ex: $(0,0,0)$ $(-1,0,2)$ $(1,0,0)$ (π, π, π)



$\mathbb{R}^{1,000}$: $(x_1, x_2, \ldots, x_{1000})$

$\mathbb{R}^2$, $\begin{bmatrix} 1 \\ 0 \end{bmatrix} \in \mathbb{R}^2$

↳ "is in"

this is a vector

↳ <u>vector</u> : element of $\mathbb{R}^n$, $\vec{v}$

The numbers that make up a vector are its <u>components</u>

Two most important properties of vectors :

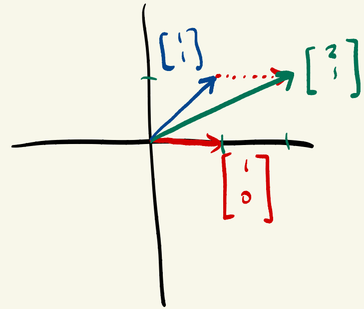
① Add vectors, $\begin{bmatrix} x_1 \\ y_1 \end{bmatrix} + \begin{bmatrix} x_2 \\ y_2 \end{bmatrix} = \begin{bmatrix} x_1 + x_2 \\ y_1 + y_2 \end{bmatrix}$

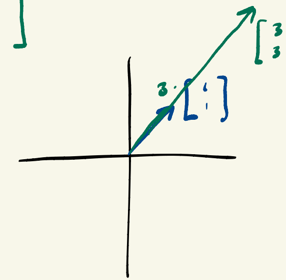
ex : $\begin{bmatrix} 1 \\ 0 \end{bmatrix} + \underset{\vec{v}_1}{\begin{bmatrix} 1 \\ -1 \end{bmatrix}} = \underset{\vec{v}_2}{\begin{bmatrix} 1+1 \\ 0+(-1) \end{bmatrix}} = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$

Vectors as "arrows" :

$$\mathbb{R}^{1,000} \quad \underbrace{\begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix}}_{1,000 \text{ 1's}} + \begin{bmatrix} -1 \\ -1 \\ \vdots \\ -1 \end{bmatrix} = \begin{bmatrix} 0 \\ \vdots \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 1 \\ 1 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$





2 scale vectors:

$$3 \cdot \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 3 \cdot 1 \\ 3 \cdot 0 \end{bmatrix} = \begin{bmatrix} 3 \\ 0 \end{bmatrix}$$

↑ scalar

$$\begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix} \in \mathbb{R}^4$$