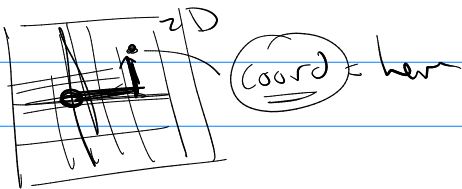
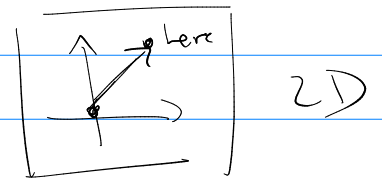
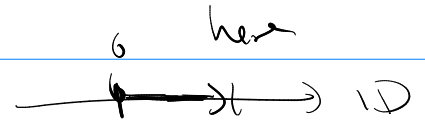
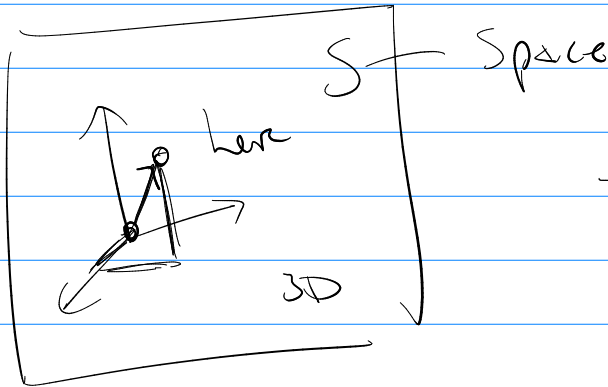


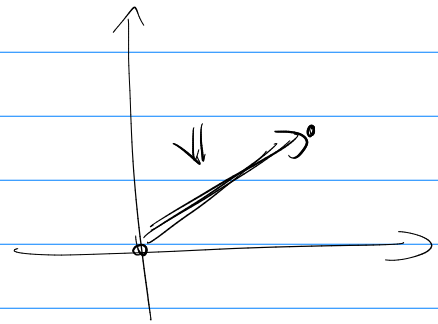
Math 511

Math models things that we experience

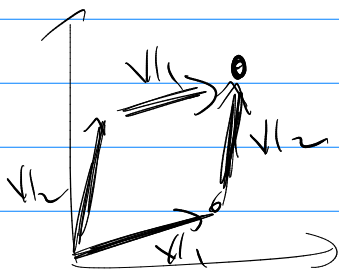
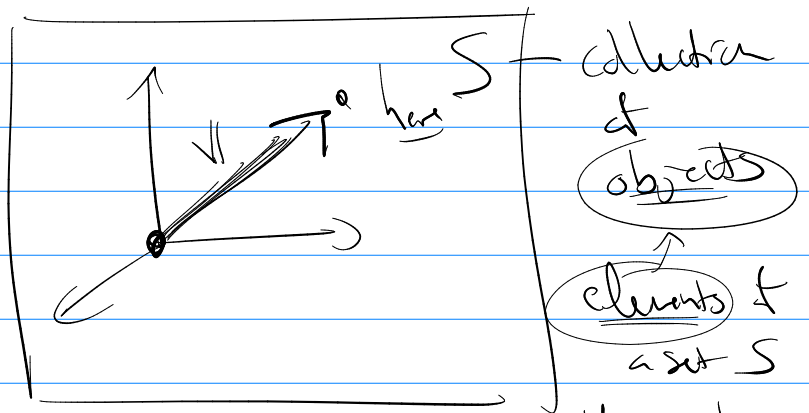
Physical Space



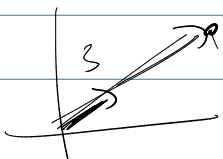
Math & Space: Vectors



3.1 Vector Space



$$v_1 + v_2 = v_2 + v_1$$



- ① S is a set of objects ^{vectors} $v_1, v_2, v_3, \dots, v_i \in S$ element
- ② define two operations - based upon math in space

- closure
- (i) Addition $v_1 + v_2 \in S$
- (ii) Scalar mult $\alpha v \in S$
- textbook
labels

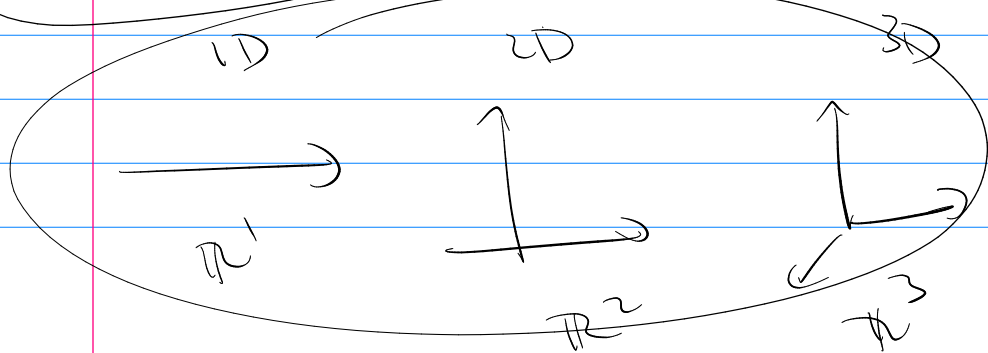
③ 8 more axioms for vector spaces --

- Properties
- (A1) $v_1 + v_2 = v_2 + v_1$
- (A2) $(v_1 + v_2) + v_3 = v_1 + (v_2 + v_3)$
- (A3)
- (A4) See textbook - contact video

- αv
- (A5)
- (A6)
- (A7)
- (A8)

Typical Vector Space

\mathbb{R}^n n -dimensional space



4 or ...
No way to see
these ...

$$v = \begin{bmatrix} 1 \\ 2 \\ 3 \\ \vdots \\ n \end{bmatrix} \in \mathbb{R}^n$$

3.1 (to do)

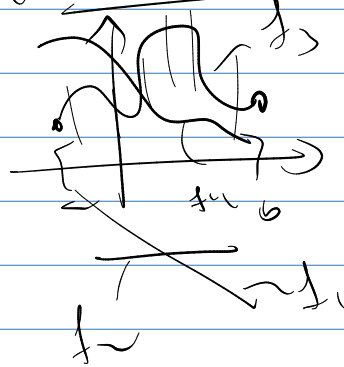
① take

objects

① normal vectors? \mathbb{R}^n

② continuous function

$y = f(x)$ over $[a, b]$



③ polynomial

has only n -terms

ex

④

Matrix: $N \times M$ matrices

\mathbb{R}

⑤

define $\|v\|$, $\|v_1 + v_2\|$

Now

check

that

all 10 axioms are true

axioms are true

2 closure

3 Par ops

3.1 #3

Set is all complex $\{a+bi \mid a, b \in \mathbb{R}\}$

① $z_1 + z_2$

$z_1 = a+bi$ $z_2 = c+di$

$z_1 + z_2 = (a+c) + (b+d)i$

closure?

are these complex?

② $2z_1$

$2z_1 = 2a + 2bi$

Yes

check: A1) $(a+bi) + (c+di) = (a+c) + (b+d)i$

$(c+di) + (a+bi) = (c+a) + (d+b)i$

A2)

etc.

