Vectors represent space in Physics.
In math they are arbitrary.

$$\begin{bmatrix} 10 \\ 4 \\ 3 \end{bmatrix} \begin{matrix} \text{(horses)} \\ \text{(sheep)} \\ \text{(boats)} \end{matrix}$$

Linear Systems must

1. be additive

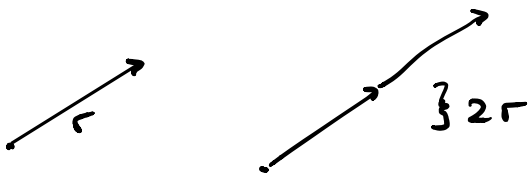
$$L(Y+Z) = L(Y) + L(Z)$$

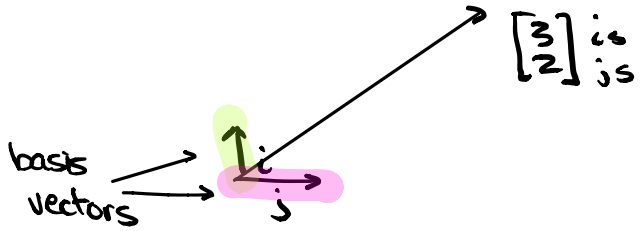
2. be scalar commutative?

$$L(cY) = c \cdot L(Y)$$

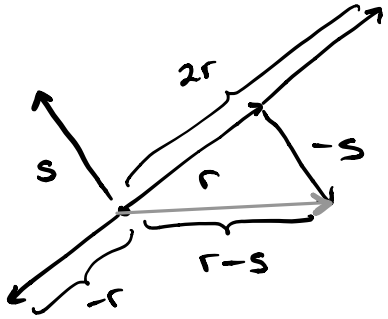
3. Associativity
$(\vec{r} + \vec{s}) + \vec{t}$ and
$\vec{r} + (\vec{s} + \vec{t})$

Drawing Vector Ops.



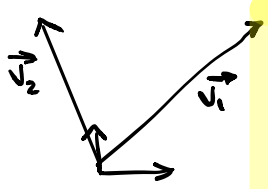


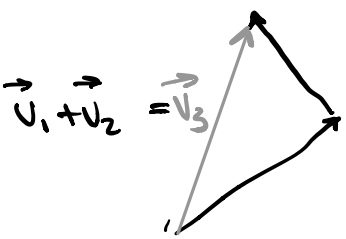
VECTOR SUB.



$$\underbrace{\begin{bmatrix} 3 \\ 2 \end{bmatrix}}_{r} - \underbrace{\begin{bmatrix} -1 \\ 2 \end{bmatrix}}_{-s} = \underbrace{\begin{bmatrix} 4 \\ 0 \end{bmatrix}}_{r-s}$$

VECTOR ADD.





$$\begin{bmatrix} -1 \\ 2 \end{bmatrix} + \begin{bmatrix} 3 \\ 2 \end{bmatrix} = \begin{bmatrix} 2 \\ 4 \end{bmatrix}$$