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
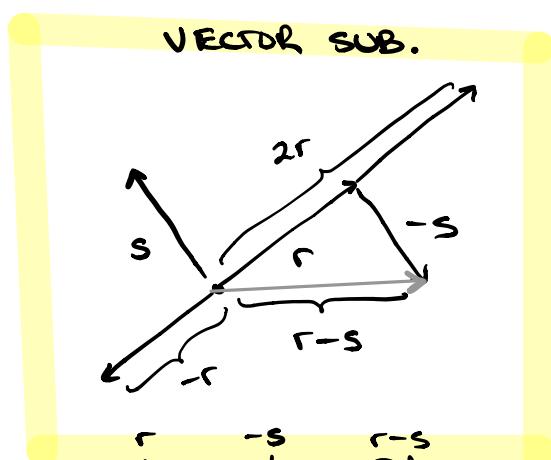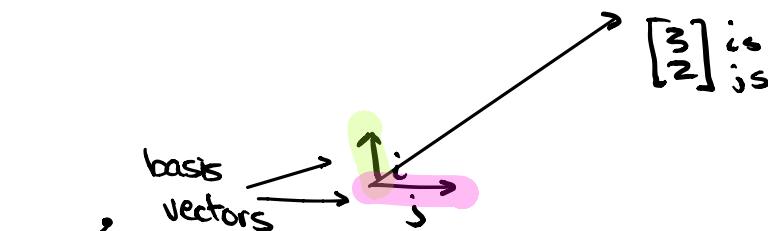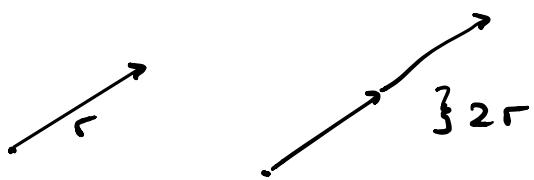
1. be additive

$$L(Y+Z) = L(Y) + L(Z)$$
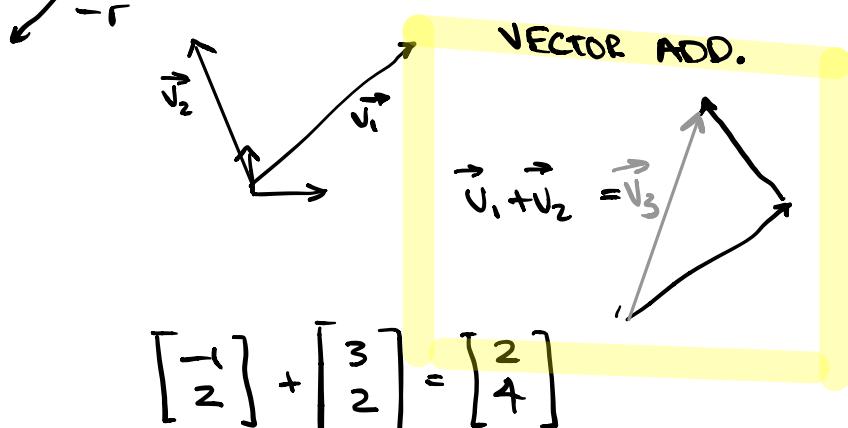
2. be scalar   commutative ?

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

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

Drawing vector Ops.

r

$32r$

$\begin{bmatrix} 3 \\ 2 \end{bmatrix}$ is   is

basis →
vectors → i j

$-r$

VECTOR SUB.

$2r$

s $-s$

r

$r-s$

$-r$

$\overbrace{r}\quad \overbrace{-s}\quad \overbrace{r-s}$

$$\begin{bmatrix} 3 \\ 2 \end{bmatrix} - \begin{bmatrix} -1 \\ 2 \end{bmatrix} = \begin{bmatrix} 4 \\ 0 \end{bmatrix}$$

$\vec{v_2}$ $\vec{v_1}$

VECTOR ADD.

$\vec{v_1} + \vec{v_2} = \vec{v_3}$

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