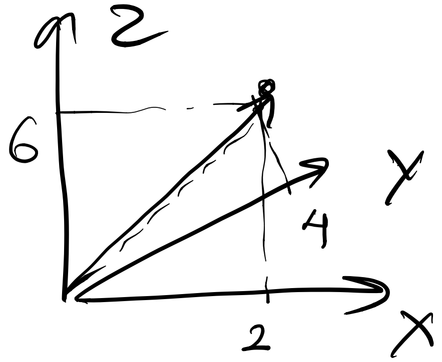
- $\boxed{\text{Vector}}$ intro for linear Algebra



$$\begin{bmatrix}2\\4\\6\end{bmatrix}$$

$\vec{V} = (2,4,6)$

- Real Coordinate space

$\mathbb{R}^2 \Rightarrow$ 2D real Coordinate space.

= all possible real valued 2-tuple

$\mathbb{R}^n$

$x = \begin{bmatrix}x\\y\end{bmatrix}$ Any real number

$x \in \mathbb{R}^2$

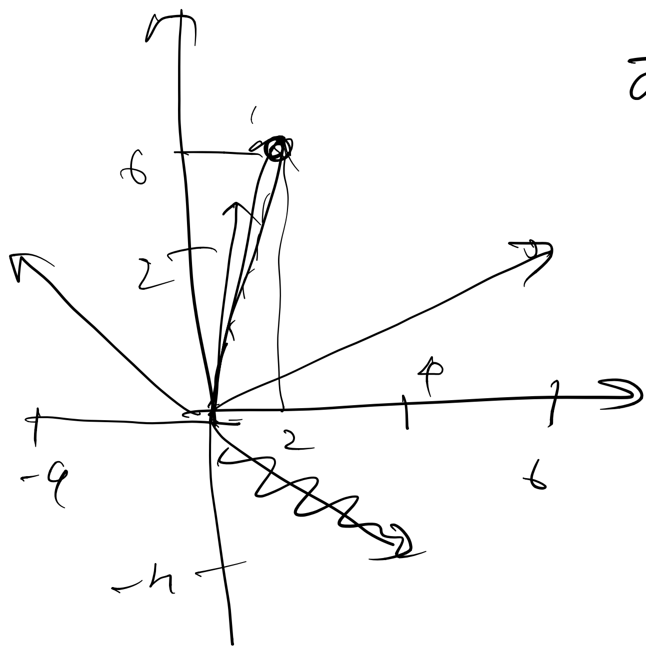
∴ x is a member of $\mathbb{R}^2$.

- Adding vectors algebrically & graphically.

$$\vec{a} = \begin{bmatrix} 6 \\ 2 \end{bmatrix} \quad \vec{b} = \begin{bmatrix} -4 \\ 4 \end{bmatrix}$$

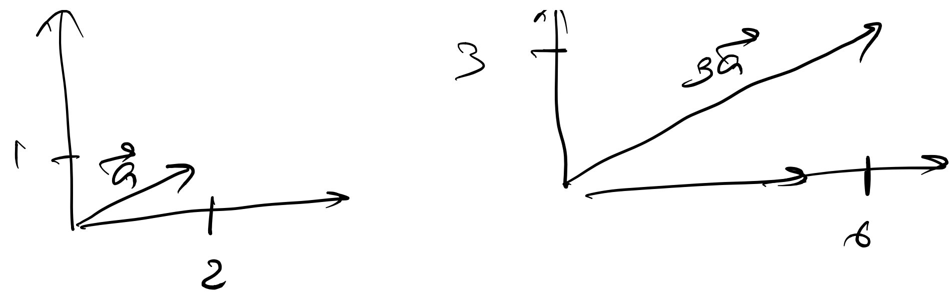
$$\vec{a} + \vec{b} = \begin{bmatrix} 6 \\ 2 \end{bmatrix} + \begin{bmatrix} -4 \\ 4 \end{bmatrix} = \begin{bmatrix} 2 \\ 6 \end{bmatrix}$$

$\vec{a}, \vec{b} \in \mathbb{R}^2$

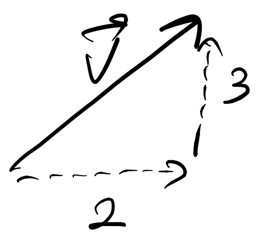


- Multiplying a vector by a scalar

$$\vec{a} = \begin{bmatrix} 2 \\ 1 \end{bmatrix} \qquad 3\vec{a} = \begin{bmatrix} 6 \\ 3 \end{bmatrix}$$



- Unit Vector



$\vec{v} = \begin{bmatrix}2\\3\end{bmatrix}$ $\quad \hat{i} = \begin{bmatrix}1\\0\end{bmatrix}$

$\vec{v} = (2, 3)$ $\quad \hat{j} = \begin{bmatrix}0\\1\end{bmatrix}$

$$\vec{v} = 2\begin{bmatrix}1\\0\end{bmatrix} + 3\begin{bmatrix}0\\1\end{bmatrix}$$

$$\vec{v} = 2\hat{i} + 3\hat{j}$$

Just another notation

$\vec{b} = -1i + 4j$

$\vec{v} + \vec{b} = 2i + 7j$

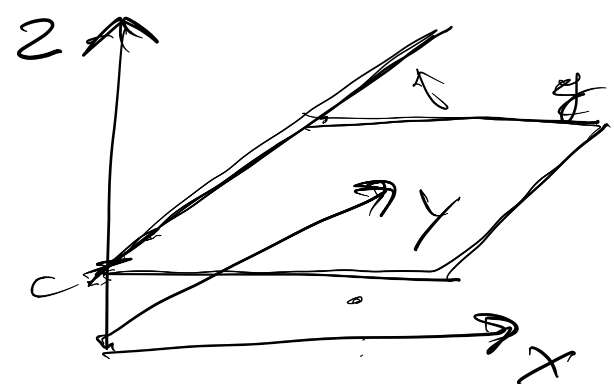
- why this parametric representation of lines is important?

How to reprent a line in 2D?

$y = mx + c$

https://youtu.be/hWhs2cIj7Cw For more details

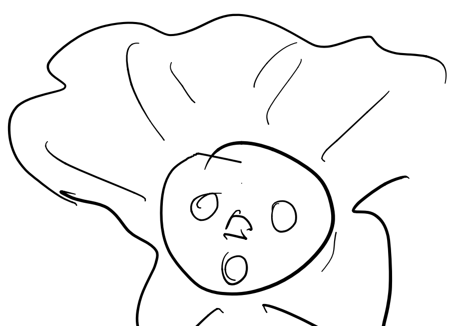
How to reprent a line in 3D?



is it

$z = m_1x + m_2y + C$

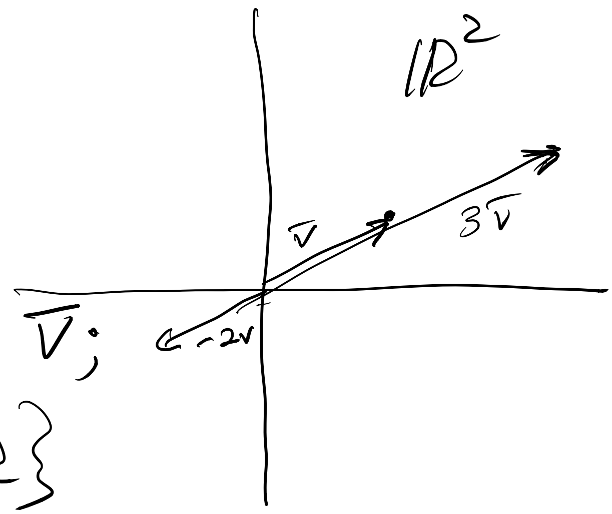
this is not a line it is a plane



- Linear Algebra provide a notation system to reprent a line in any dimension.

- Parametric representation of lines

$\bar{V} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$



- all the vectors I can create with $\bar{V}$;

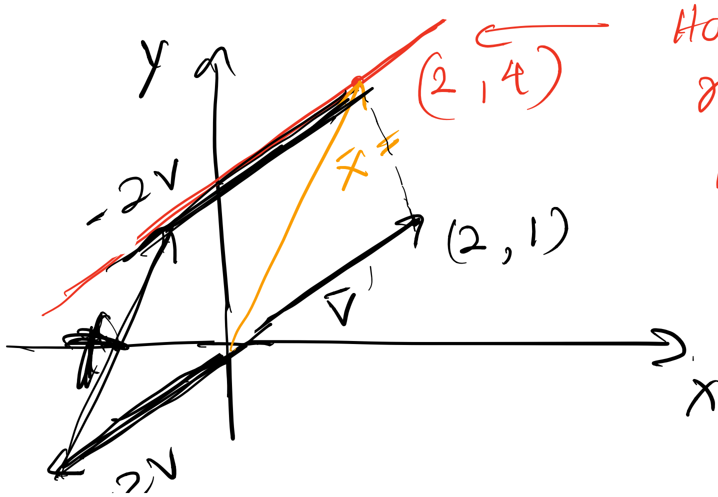
$S = \{ c\bar{V} \mid c \in \mathbb{R} \}$

(A set of co-linear vectors)

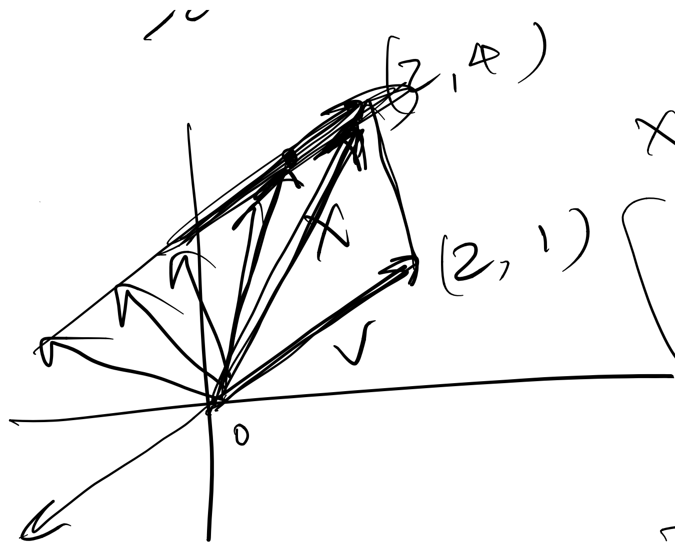
$\overbrace{\begin{bmatrix} 2 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 0.5 \end{bmatrix}, \begin{bmatrix} 6 \\ 3 \end{bmatrix}} \;----$

if $\bar{V} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$ is a position,

S is a line



How to represent this line?



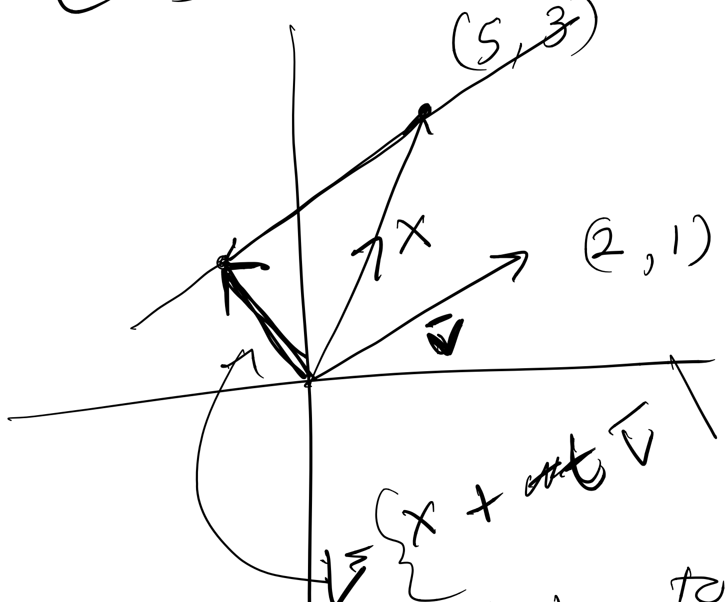
$x + tv$

$\begin{bmatrix}2\\4\end{bmatrix} + t\begin{bmatrix}2\\1\end{bmatrix}$

$\begin{bmatrix}4\\5\end{bmatrix}$

$\hat{x} = \begin{bmatrix}2\\4\end{bmatrix}, \quad \vec{v} = \begin{bmatrix}2\\1\end{bmatrix}$

$\begin{bmatrix}2\\4\end{bmatrix} + 1\begin{bmatrix}2\\1\end{bmatrix} = \begin{bmatrix}4\\5\end{bmatrix}$

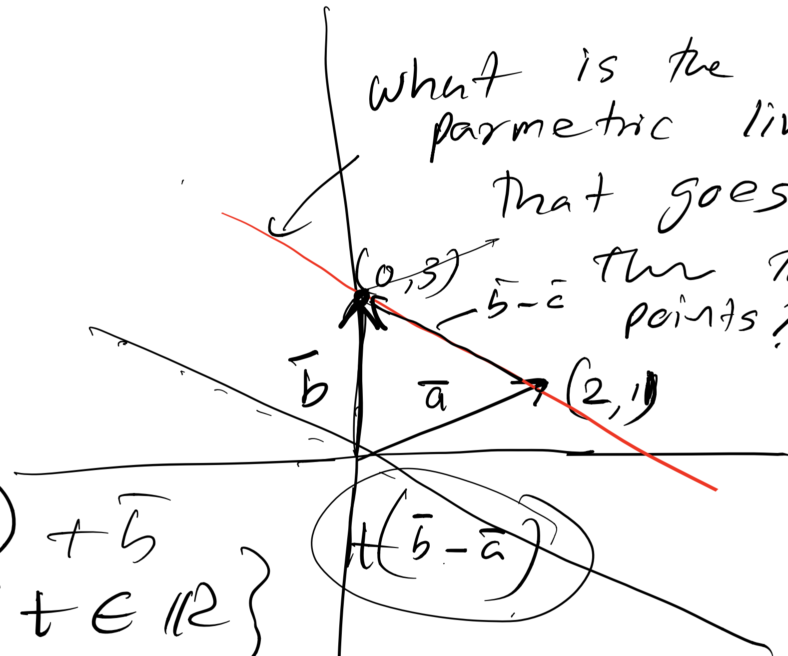


$\vec{v} \in \{x + t\vec{v} \mid t \in \mathbb{R}\}$

This vector points to a location in that line

$\vec{a} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

$\vec{b} = \begin{bmatrix} 0 \\ 3 \end{bmatrix}$



what is the parmetric line that goes thru these points?

$L = \{ t(\bar{b} - \bar{a}) + \bar{b} \mid t \in \mathbb{R} \}$

$P_1 = \begin{bmatrix} -1 \\ 2 \\ 7 \end{bmatrix} \qquad P_2 = \begin{bmatrix} 0 \\ 3 \\ 4 \end{bmatrix}$

what is the line that pass through this 2 points.

$L = \{ \vec{P}_1 + t(\vec{P}_2 - \vec{P}_1) \mid t \in \mathbb{R} \}$

$L = \begin{bmatrix} -1 \\ 2 \\ 7 \end{bmatrix} + t \begin{bmatrix} -1 \\ -1 \\ 3 \end{bmatrix}$

$x = -1 + t$, $y = 2 + -1t$

$z = 7 + 3t$

only way to define a line in 3D.