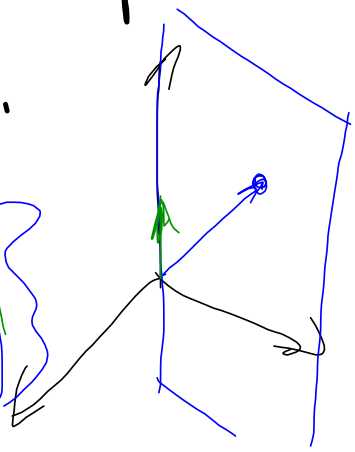
① The line in $\mathbb{R}^3$ through the origin and $(-2,1,5)$ is a subspace of $\mathbb{R}^3$. Give a basis for it.

$$\left\{ t\begin{bmatrix} -2 \\ 1 \\ 5 \end{bmatrix} \mid t \in \mathbb{R} \right\} \qquad \mathcal{B} = \left\{ \begin{bmatrix} -2 \\ 1 \\ 5 \end{bmatrix} \right\}$$

(2) The plane in $\mathbb{R}^3$ containing the z-axis and $(-2,1,5)$ is a s.s. space of $\mathbb{R}^3$. Give a basis for it.

$$\mathcal{B} = \left\{ \begin{bmatrix} -2 \\ 1 \\ 5 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \right\}$$

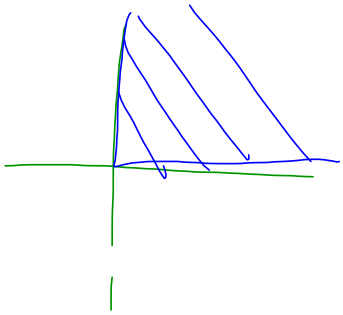


$$s\begin{bmatrix}-2\\1\\5\end{bmatrix}+t\begin{bmatrix}0\\0\\1\end{bmatrix}$$

$A\vec{x}=\vec{0}$ $\vec{x}=\vec{0}$ is always a sol.

If inf many

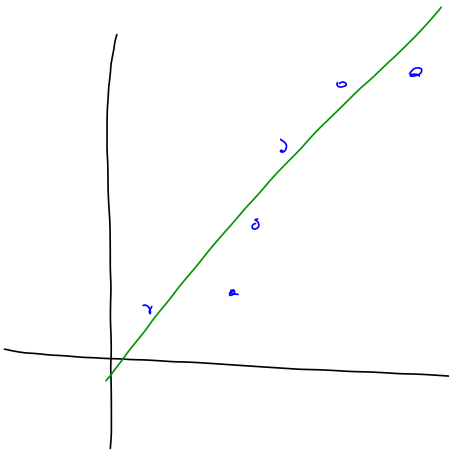
$\vec{x}=s[\ ]+t[\ ]$ $y=\{[\ ]\}$



$$T: \mathbb{R}^2 \to \mathbb{R}^2$$

$$T\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 3x_1 - x_2 \\ x_1 + x_2 \end{bmatrix}, \quad [T] = \begin{bmatrix} 3 & -1 \\ 1 & 1 \end{bmatrix}$$

$$T\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = [T]\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$



$$y = a_1 x + a_0$$

$$y = \beta_1 x + \beta_0$$

$$\vec{x} = (A^T A)^{-1} A^T \vec{b}$$

$$\begin{bmatrix} & A & \end{bmatrix} \begin{pmatrix} a_1 \\ a_0 \end{pmatrix} = \begin{bmatrix} \vec{b} \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 5 \\ 2 & 6 \\ 3 & 7 \\ 4 & 8 \end{bmatrix}$$

$$S\begin{bmatrix}x\\y\end{bmatrix}=\begin{bmatrix}x+y\\2x\\-3y\end{bmatrix} \qquad T\begin{bmatrix}x\\y\end{bmatrix}=\begin{bmatrix}5x-y\\x+4y\end{bmatrix}$$

$S\circ T$ ~~$T\circ S$~~

$$S\circ T\begin{bmatrix}x\\y\end{bmatrix}=S\left(T\begin{bmatrix}x\\y\end{bmatrix}\right)$$

$$=S\left(\begin{bmatrix}5x-y\\x+4y\end{bmatrix}\right)$$

$$=\begin{bmatrix}(5x-y)+(x+4y)\\2(5x-y)\\-3(x+4y)\end{bmatrix}$$

$$=\begin{bmatrix}6x+3y\\10x-2y\\-3x-12y\end{bmatrix}$$

$$[S\circ T]=[S][T]$$