

LINEAR ALGEBRA #6

VECTORS & LINEAR EQUATIONS II: OUTLIERS I

DO NOW: Convert to $Ax=b$ form

$$\begin{aligned} x+3y+5z &= 4 \\ x+2y-3z &= 5 \\ 2x+5y+2z &= 8 \end{aligned} \iff \begin{bmatrix} 1 & 3 & 5 \\ 1 & 2 & -3 \\ 2 & 5 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 5 \\ 8 \end{bmatrix}$$

Q: How to solve?
R₂: Make coefficient matrix
I: And put all #'s in

LESSON: We will investigate this system.

① ROW PICTURE:

$$\begin{aligned} + (1x+3y+5z=4) \\ + (1x+2y-3z=5) \\ - (2x+5y+2z=8) \\ \hline 0x+0y+0z=1 \end{aligned}$$

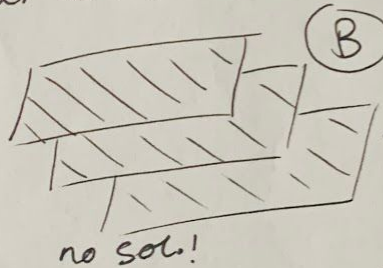
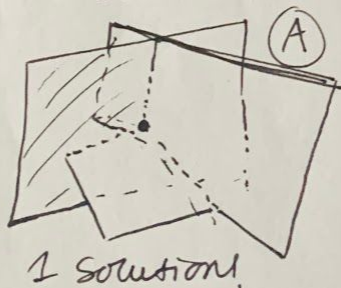
Row picture tells us no solution! Why? Are any two of the planes parallel? No! How do I know?
 $ax+by+cz=d$

I could also multiply $ax+by+cz=d$ by a constant, but that would be the same plane!

changing d moves the plane in a (parallel way)
R: which sol. space is it?
R₂: A!
I: B!
R: Wrong!

... But, now if I change b :

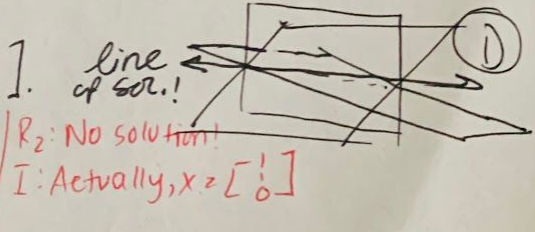
$b = \begin{bmatrix} 4 \\ 5 \\ 8 \end{bmatrix} \rightarrow b = \begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}$, I suddenly have a solution x . What is it?



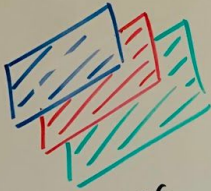
EXIT SLIP: We change b to $\begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}$.

Now what is x ?

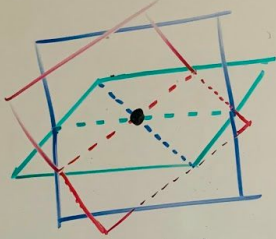
$$x = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$$



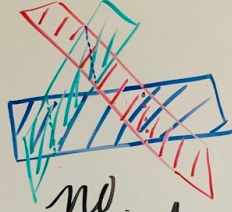
R₂: No solution!
I: Actually, $x = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$



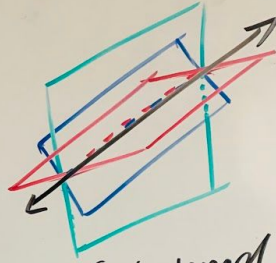
All planes
parallel =
No solution!



1 unique
solution!



No
solution!



∞ Solutions!
lie on a line!