31 August 2020 ROB 101

Review

- $ax^2+bx+c=0$ $a \neq 0$ quadratic equation
- $\Delta = b^2-4ac$ discriminant
- $\Delta > 0 \Leftrightarrow$ 2 distinct real roots (solutions)
- $\Delta = 0 \Leftrightarrow$ repeated root
- $\Delta < 0 \Leftrightarrow$ 2 complex roots

$$x^* = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

Today

- Masks are mandatory
- Course organization
  - Operational agreement
  - Grading
  - Canvas course page
    - Files
    - Piazza
    - Illumidesk
- Why ROB 101?
- Systems of Linear Equations — What can happen?

Can you help me with ....?

Is a sign of respect, NOT WEAKNESS

Operational Agreement

- Strive for intellectual humility.
- Hold your opinions lightly and with humility.
- Let go of personal anecdotal evidence and look at broader group-level patterns.
- Notice your own defensive reactions.
- Recognize how your own social positionality (e.g., race, class, gender, sexuality, ability) informs your perspectives.
- Differentiate between safety and comfort. Accept discomfort as necessary for growth.
- Identify where your learning edge is and push it.

Systems of Linear Equations

Typically means more than one equation.

$$\left.\begin{aligned} x+y+z+w &= 0 \\ x-y+z-w &= 1 \\ x+y-z-w &= 1 \\ x-y-z+w &= 1 \end{aligned}\right\}$$

4 equations in the 4 unknowns x, y, z, w!

A system of linear equations can have:

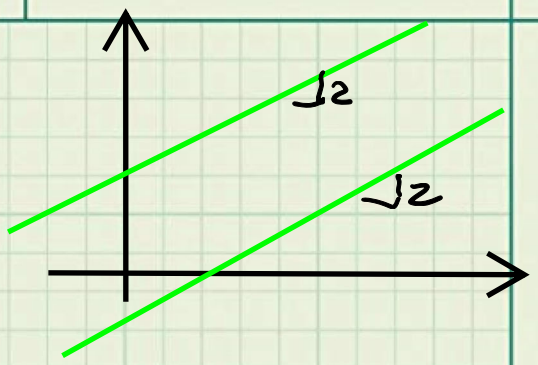
- No solutions
- Unique solution (means one & only one solution)
- Infinite number of solutions

Cannot have 2 and only 2 solutions.

No Solution

$-2x+y=2 \quad (a.1)$

$-4x+2y=-2 \quad (a.2)$



$(a.1) \Rightarrow y = 2x+2$

Substitute $y = 2x+2$ into $(a.2)$

$-4x+2(2x+2) = -2$

$-4x+4x+4 = -2 \Rightarrow \boxed{4=-2}$

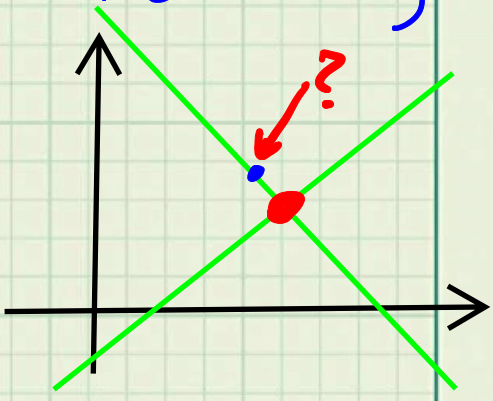
Contradiction

($(a.1)$ & $(a.2)$ have a point in common)

Unique Solution

$3x-3y=3 \quad (b.1)$

$x+y=7 \quad (b.2)$



$(b.1) \Rightarrow 3x = 3y+3$

$x = y+1$

Substitute into $(b.2)$

$(y+1)+y = 7$

$2y = 7-1 = 6 \Rightarrow \boxed{y=3}$

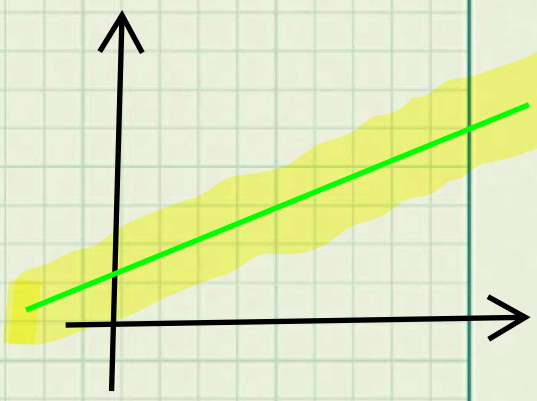
Substitute $y=3$ into (6.2)

$$x+(3)=7 \Rightarrow x=4$$

Answer $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \end{bmatrix}$

Infinity of Solutions

$$x-2y=-2 \quad (C.1)$$
$$3x-6y=-6 \quad (C.2)$$



$$x+2=2y$$

$$\Updownarrow$$

$$\left\{ y=\frac{1}{2}x+1 \;,\; x\in\mathbb{R} \right\}$$ all the solutions