

'19 JANUARY

3.10.20

28

Wk 05 • 028 Day

MONDAY

APPLIED LINEAR ALGEBRA

* System of eqⁿs :

$$\begin{aligned} 3x_1 + 2x_2 &= 5 \\ x_1 + x_2 &= 2 \end{aligned}$$

$$x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}, b = \begin{bmatrix} 5 \\ 2 \end{bmatrix}$$

~~Definition~~

* Linear Eqⁿ : An eqⁿ in which unknown variables are of degree 1.

Hence, x_1, x_2 , are of degree 1.

Here ~~variables~~ x_1, x_2 are

~~eqⁿ.~~ $a_{11}x_1 + a_{12}x_2 = b_1(5)$ or ~~eqⁿ~~
 $a_{21}x_1 + a_{22}x_2 = b_2(2)$. ~~say~~

Or $a_1x_1 + a_2x_2 = b$, $b = 0$ (homogeneous ~~so~~)
 $b \neq 0$ (non homogeneous)

* Coefficient matrix : (A) .

In above example, $A = \begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$

\downarrow $A' = \begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix} \left| \begin{bmatrix} 5 \\ 2 \end{bmatrix} \right.$ = Augmented matrix.

such a A' join b.

System is called augmentation.

* In above example:

$$\begin{aligned} 3x_1 + 2x_2 &= 5 \\ x_1 + x_2 &= 2 \end{aligned} \quad A = \begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix}$$

on solving $x_1, x_2 = (1, 1)$

$$\text{So } x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, b = \begin{bmatrix} 5 \\ 2 \end{bmatrix}$$

January 2019

Wk/M	T	W	T	F
01	1	2	3	4
02	7	8	9	10
03	14	15	16	17
04	21	22	23	24
05	28	29	30	31

	M	T	W	T	F	S	S
05	4	5	6	7	8	9	10
06	11	12	13	14	15	16	17
07	18	19	20	21	22	23	24
08	25	26	27	28			

$$\frac{a_{11}}{a_{21}} = \frac{a_{12}}{a_{22}} \neq \frac{b_1}{b_2} \text{ (No soln)} \quad \text{JANUARY } '19$$

$$= \frac{b_1}{b_2} \text{ (infinitely many soln) } \quad \text{TUESDAY } 29.$$

(a) Unique soln : $\left(\frac{a_{11}}{a_{21}} \neq \frac{a_{12}}{a_{22}} \right)$ intersecting  unique.

$$\frac{3}{1} \neq \frac{2}{1}$$

(b) No soln : $\frac{a_{11}}{a_{21}} = \frac{a_{12}}{a_{22}} \neq \frac{b_1}{b_2}$

Sm slope \neq slope of b.

Ex: $a_1 \neq b_1$ intercept \neq b intercept.

$$3x_1 + 2x_2 = 5 \\ 3x_1 + 2x_2 = 2 \rightarrow \frac{3}{3} = \frac{2}{2} + \frac{5}{2} \text{ (parallel //)}$$

(c) Infinitely many soln : $\left(\frac{a_{11}}{a_{21}} = \frac{a_{12}}{a_{22}} = \frac{b_1}{b_2} \right)$

$$a_1: a_1x + b_1y = c_1 \rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

* For what value, below c_1 is singular $\frac{a_1}{a_2}$ has infinitely many soln.

$$3x + 2y = 10 \rightarrow (0, 5), \left(\frac{3}{2}, \frac{1}{2} \right) \text{ soln.}$$

$$6x + 4y = g \rightarrow \text{putting here } c_1 = 4, g = 20.$$

* Square matrix is singular if & only if its determinant is 0, otherwise not singular.

$$\begin{pmatrix} 0 & 5 \\ 3 & 2 \end{pmatrix} \text{ soln. } 3x + 2y = 10 = 20. \begin{pmatrix} 3 & 2 \\ 6 & 4 \end{pmatrix} \rightarrow \text{Determinant.}$$

$$\begin{aligned} &= 3 \cdot 4 - 12 = 0 \\ &\Rightarrow c = 4, \text{ so given singular.} \end{aligned}$$

$$\frac{1}{2} = \frac{1}{2} = \frac{10}{20} \left(\frac{1}{2} \right)$$

(singular, infinitely many soln.)