Section 1

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Sets of numbers:

- C : $\{1, 2, 3 \ldots\ldots\}$
- N : $\{0, 1, 2, \ldots\ldots\}$
- Z : $\{\ldots -2, -1, 0, 1, 2 \ldots\}$
- Q : Rational numbers
- Q' : Irrational numbers $e, \pi, \sqrt{2}$
- R : $Q \cup Q$

Note: $Q \cap Q' = \{\emptyset\}$

New set of numbers: Complex numbers

$$C = \{x + yi \ , \ x, y \in R\}$$

- Conjugate

Ex. if $a = 2 + 3i$

Then conj of $a = 2 - 3i$

Note

- The sum of a number and it's conjugate is a Real number
- when subtracting the number from it's conj we get pure imaginary number
- when Multiplieng the number and it's Conjugate we get a Real number

Matrix

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1m} \\ a_{21} & a_{22} & \cdots & \\ \cdots & \cdots & \cdots & \cdots \\ a_{n1} & \cdots & \cdots & a_{nm} \end{bmatrix} (n \times m)$$

- size of Matrix $(n \times m) \equiv$ (num of Rows x num of Cols)
  - Matrices are identecal when
    - they are the same size
    - every element in the first equales every element in The 2nd Matrix

Addation and subtraction

Constrains: They Must be the same size

Ex. $A = \begin{bmatrix} 1 & 0 & 1 \\ 2 & -1 & 0 \end{bmatrix}$ $B = \begin{bmatrix} 1 & -1 & 2 \\ -1 & 2 & 1 \end{bmatrix}$

$A+B = \begin{bmatrix} 2 & -1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ $A-B = \begin{bmatrix} 0 & 1 & -1 \\ 3 & -3 & -1 \end{bmatrix}$

* addation properities
  - associative $(A+B)+C = A+(B+C)$
  - Comutitive $A+B = B+A$
  - identity $A+0 = 0+A = A$
  - inverce $A+(-A) = 0$

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Scaler Multiplication

Multiplicating a Constant with a Matrix

Ex. $A = \begin{bmatrix} 1 & 2 & 0 \\ 3 & 2 & 0 \end{bmatrix}$

$K \times A = \begin{bmatrix} 1K & 2K & 0K \\ 3K & 2K & 0K \end{bmatrix}$

$K(A + B) = KA + KB$

$A(K + h) = AK + hA$

Transpose

Making rows columns and Making Columns Rows

Ex. $A^T = \begin{bmatrix} 1 & 3 \\ 2 & 2 \\ 0 & 0 \end{bmatrix}$

> $A^T + B^T = (A + B)^T$

if $A = A^T$
- then A is squared Matrix
- A is symmetric

if $A = -A^T$
- A is squared
- diagonal elements equal to 0
- skew-symmetric

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$A + A^T$

$\because (A + A^T)^T$

$= A^T + A$

$\therefore A + A^T$ is symmetric

$A - A^T$

$\because (A - A^T)^T$

$= A^T - A$

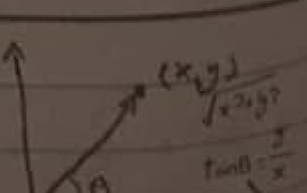
$\therefore A - A^T$ is skew symmetric

$$A = \frac{1}{2}(A + A^T) + \frac{1}{2}(A - A^T)$$

adjoint Matrix C^*

How to Make C adjoint
- First we Transpose C
- Generat the Conjugate of the result

inner product / scaler product



$x \cdot y = [x_1y_1 + x_2y_2 + x_3y_3 \cdots x_ny_n]$

$= x^T y$

$$\underset{n\times 1}{\overset{x}{\begin{bmatrix} \\ \\ \end{bmatrix}}} \underset{n\times 1}{\overset{y}{\begin{bmatrix} \\ \\ \end{bmatrix}}}$$

normes: $\|x\| = \sqrt{p \cdot p} = \sqrt{x \cdot x}$

Trace of Matrix: Sum of Diagonal elements