Matrices # L1.2

- Matrix - a rectangular array of nos, arranged in rows and columns.

$(1,2)^{th}$ entry

ex, $\begin{bmatrix} 1, & 2, & 3 \\ 2, & 3, & 4 \end{bmatrix}_{2\times 3}$ 2×3 matrix (2 rows and 3 columns)

- $(m\times n)$ matrix $\Rightarrow$ m rows and n columns
- $(i,j)^{th}$ entry $\Rightarrow$ i th row and j th column.
- ~~the diagonal of a~~ sq. matrix $\Rightarrow$ no. of rows = no. of column
- The i^{th} diagonal entry of the sq. matrix is the $(i,j)^{th}$ entry.
- The diagonal of a sq. matrix is a set of diagonal entries
- Diagonal matrix - sq. matrix in which all entries except the diagonal are 0.
- Scalar matrix - A diagonal matrix in which all the entries of the diagonal are same.
- Identity matrix (I) - Scalar matrix with all diagonal entries 1.
- A set of linear eq^n can be represented as matrices.

ex, $3x+4y=5$
$4x+6y=10$

$$\left[\begin{array}{cc|c} 3 & 4 & 5 \\ 4 & 6 & 10 \end{array}\right]$$

ex, $$\begin{bmatrix} 1 & 9 \\ 0.6 & 7 \\ 4 & 1.5 \end{bmatrix}_{3\times 2} + \begin{bmatrix} 0 & 7 \\ 0.6 & 7 \\ 2.5 & 0.6 \end{bmatrix}_{3\times 2} = \begin{bmatrix} 1 & 16 \\ 1.2 & 14 \\ 6.5 & 2.1 \end{bmatrix}_{3\times 2}$$

- $(A+B)_{ij} = A_{ij} + B_{ij}$

ex, $$3\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} = \begin{bmatrix} 3 & 6 & 9 \\ 12 & 15 & 18 \end{bmatrix}$$ Scalar Multiplication

- $(cA)_{ij} = c(A_{ij})$

ex, $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}_{2\times2} \begin{bmatrix} 1 & 2 & 3 \\ 3 & 4 & 5 \end{bmatrix}_{2\times3} = \begin{bmatrix} 7 & 10 & 13 \\ 15 & 22 & 29 \end{bmatrix}_{2\times3}$

ex, $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}_{2\times2} \times \begin{bmatrix} 5 \\ 6 \end{bmatrix}_{2\times1} = \begin{bmatrix} 17 \\ 39 \end{bmatrix}_{2\times1}$ Matrix Multiplication

* The no. of columns in first matrix should be same as the no. of rows in second matrix.

$$A_{m\times n} \, B_{n\times p} = (AB)_{m\times p}$$

$$(AB)_{ij} = \sum_{k=1}^{n} A_{ik} B_{kj}$$

Matrix Multiplication

- $\begin{bmatrix} c & 0 & 0 \\ 0 & c & 0 \\ 0 & 0 & c \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix} = \begin{bmatrix} c & 2c \\ 3c & 4c \\ 5c & 6c \end{bmatrix} = c \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}$

↳ multiplication of a spc (scalar/identity) matrix

$$IA_{3\times3} = A_{3\times3} = A_{3\times3} I$$ → Identity matrix acts as 1

- $(A+B)+C = A+(B+C)$ Association of addⁿ
- $(AB)C = A(BC)$ Association of Multiplication
- $A+B = B+A$ Commutavity of addⁿ
- $AB \neq BA$ (both should make sense)
- $\lambda(A+B) = \lambda A + \lambda B$ λ is a scalar
- $\lambda(AB) = \lambda(A)B = \lambda A(B)$
- $A(B+C) = AB + AC$
- $(A+B)C = AC + BC$