DEF : if A =[a_{ij}] is an mXn matrix and r is areal number the rA is the mXn matrix B = [b_{ij}] where $b_{ij} = ra_{ij}$ ($1 \le I \le m$, $1 \le j \le n$)

Ex// if r = -3 and A = $\begin{bmatrix} 4 & -2 & 3 \\ 2 & -5 & 0 \\ 3 & 6 & -2 \end{bmatrix}$

Then rA = -3$\begin{bmatrix} 4 & -2 & 3 \\ 2 & -5 & 0 \\ 3 & 6 & -2 \end{bmatrix}$ $= \begin{bmatrix} -12 & 6 & -9 \\ -6 & 15 & 0 \\ -9 & -18 & 6 \end{bmatrix}$

A = [4 2 3] $B = \begin{bmatrix} \mathbf{1} \\ \mathbf{0} \\ \mathbf{5} \end{bmatrix}$

A B = [(4)(1)+ (2)(0)+ (3)(5)] = [19]

The Transpose

If A =[a_{ij}] is an mXn matrix , the nXm matrix A^T = [$a_{ij}{}^T$] where $a_{ij}{}^T = a_{ji}$ ($1 \le I \le m$, $1 \le j \le n$) is called the Transpose of A .

Ex// A = $\begin{bmatrix} 4 & -2 & 3 \\ 0 & 5 & -2 \end{bmatrix}$ $B = \begin{bmatrix} 6 & 2 & 4 \\ 3 & -1 & 2 \\ 0 & 4 & 3 \end{bmatrix}$ $C = [\mathbf{3} \quad \mathbf{-5} \quad \mathbf{1}]$

Then

$\mathbf{A^T} = \begin{bmatrix} \mathbf{4} & \mathbf{0} \\ \mathbf{-2} & \mathbf{5} \\ \mathbf{3} & \mathbf{-2} \end{bmatrix}$ $B^T = \begin{bmatrix} 6 & 3 & 0 \\ 2 & -1 & 4 \\ 4 & 2 & 3 \end{bmatrix}$ $C^T = \begin{bmatrix} \mathbf{3} \\ \mathbf{-5} \\ \mathbf{1} \end{bmatrix}$

1- $(A)^T = A$
2- $(A+B)^T = A^T + B^T$
3- $(nA)^T = n.A^T$
4- $(A . B)^T = A^T + B^T$
5- $(ABC)^T = C^T . B^T . A^T$