Transpose Matrix

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$$X = \begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1p} \\ x_{21} & x_{22} & & x_{2p} \\ \vdots & & & \\ x_{m1} & & & x_{mp} \end{pmatrix}$$

$m \times p$

$$X^T = \begin{pmatrix} x_{11} & x_{21} & \cdots & x_{m1} \\ x_{12} & x_{22} & & \\ x_{13} & x_{23} & & \\ \vdots & & & \\ x_{1p} & x_{2p} & & x_{mp} \end{pmatrix}$$

$p \times m$

Properties

1) $(A^T)^T = A$ ✓

2) $(A+B)^T = A^T + B^T$ ✓

Imp 3) $(AB)^T = B^T \cdot A^T$ ✓

Order is matter

2×3

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}^T = \begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix}$$ 3×2

$x_{ij}^T = x_{ji}$

Symetric Matrix

$A^T = A$ $\quad A = \begin{pmatrix} a & b & c \\ b & d & e \\ c & e & f \end{pmatrix}$

Skew - symmetric matrix $\quad A^T = -A \quad A = \begin{pmatrix} 0 & b & c \\ -b & 0 & e \\ -c & -e & 0 \end{pmatrix}$