Orthogonal matrix :-

A n-square matrix A is said to be orthogonal if $AA^T = I = A^TA$.

Unitary matrix :-

$AA^* = A^*A = I$

$A^* = \bar{A}^T = \overline{A^T}$

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

$A + A^T = \begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 3 \\ 2 & 1 \end{bmatrix} = \begin{bmatrix} 2 & 5 \\ 5 & 2 \end{bmatrix}$ ← symmetric matrix

$A - A^T = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ ← skew-symmetric matrix.

Similar matrices :-

~~Two square matrices A and B are said to be~~

Let A and B are square matrices. The matrix A is said to be similar to the matrix B if $\cancel{P^{-1}AP = B}$ there exists an invertible matrix P such that $P^{-1}AP = B$.

1 → If two matrices A and B are similar, then

$\det(A) = \det(B)$.

But converse is not true.

2 → Characteristic polynomial will be same, but converse not true.

3 → Minimal polynomial will be same.

Minimal polynomial $m(t)$ is the lowest degree monic polynomial such that $m(A) = 0$.