

① $A^{-1} = A^T$ ✓

Inverse Matrix property

$A A^{-1} = I$ ✓

$A A^T = I$ ✓

$$\begin{aligned} &= (Ax)^T (Ax) \quad A \sim (m \times n) \\ & \quad x \sim (n \times 1) \\ &= \|Ax\|^2 \\ &= x^T \cdot A^T \cdot A \cdot x \\ &= x^T I x \\ &= x^T x = \|x\|^2 \end{aligned}$$

② $A A^T = I$ (provided $A^{-1} = A^T$ // A is Orthogonal Matrix) ✓

③ $A^T A = I$ (if A is orthogonal matrix)

Orthogonal matrix
preserve lengths