Step-1

Complex inner product: $\mathbf{u}^H \mathbf{v} = \bar{u}_1 v_1 + \cdots + \bar{u}_n v_n$.

Step-2

Consider the following orthonormal Eigen vectors form of matrix A.

$$\begin{aligned} A &= U\Lambda U^{-1} \\ &= U\Lambda U^H \end{aligned}$$

Prove the following:

$$AA^H = A^H A$$

Step-3

Calculate the following:

$$\begin{aligned} AA^H &= \left(U\Lambda U^H\right)\left(U\Lambda U^H\right)^H \\ &= \left(U\Lambda U^H\right)\left(\left(U^H\right)^H \Lambda U^H\right) \\ &= U\Lambda U^H U\Lambda U^H \\ &= \left(\left(U^H\right)^H \Lambda U^H\right)\left(U\Lambda U^H\right) \end{aligned}$$

$$AA^H = A^H A$$

Step-4

Therefore, $\boxed{AA^H = A^H A}$. These are exactly the normal matrices