

Step-1

Given that $A = S\Lambda S^{-1}$

$$\begin{aligned} A^3 &= (S\Lambda S^{-1})(S\Lambda S^{-1})(S\Lambda S^{-1}) \\ &= S\Lambda(S^{-1}S)\Lambda(S^{-1}S)\Lambda S^{-1} \\ &= S\Lambda(I)\Lambda(I)\Lambda S^{-1} \\ &= S\Lambda^3 S^{-1} \end{aligned}$$

Observe that Λ^3 is nothing but the diagonal matrix whose diagonal entries are the cubes of the eigen values of A .

Step-2

$$\begin{aligned} A^{-1} &= (S\Lambda S^{-1})^{-1} \\ &= (S^{-1})^{-1} (S\Lambda)^{-1} \\ &= S(\Lambda^{-1} S^{-1}) \quad \text{since } (s^{-1})^{-1} = s \\ &= S\Lambda^{-1} S^{-1} \end{aligned}$$

Observe that the diagonal entries of the diagonal matrix Λ^{-1} are the reciprocals of the eigen values of A .