A symmetric matrix A can be decomposed as

$$A = P\Delta P',$$

where P is orthogonal matrix, i.e., $PP' = P'P = I$, and Δ is a diagonal matric. One of advantage of this decomposition is that, $A^n = P(\Delta)^n P'$. Since Δ is a diagonal matrix, $(\Delta)^n$ is also a diagonal matrix with the diagonal elements being the nth power of the corresponding diagonal elements of Δ. This can greatly simplify the computation of A^n, especially when n is relatively large.

In SAS, *eigval(A)* gives the vector of the diagonal matrix Δ, and *eigvec(A)* gives the orthogonal matric P. In R, *eigen(A)* gives the P and the vector of the diagonal matrix Δ.