Step-1

Consider a matrix A with Eigen values $\lambda = 0$ and $\lambda \neq 0$. Let $N(A)$ be the null space and $C(A)$ be the column space.

(a) Determine when Eigen vectors for $\lambda = 0$ span the subspace $N(A)$.

Eigen vectors for $\lambda = 0$ always span the null space of matrix A.

Step-2

(b) Determine when all the Eigen vectors for $\lambda \neq 0$ span the column space $C(A)$.

Eigen vectors $x_1, x_2, \ldots, x_j$ that correspond to different nonzero Eigen values are linearly independent. Let j be the independent vectors, then Eigen vectors for $\lambda_j \neq 0$ spans the column space of matrix A.