

Tutorial 3 - EE3731C Signal Processing Methods
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1. Find the eigenvalues and eigenvectors for matrix $A = \begin{bmatrix} 1 & 1 \\ -4 & 6 \end{bmatrix}$.

2. For matrix $A = \begin{bmatrix} 1 & a \\ a & 1 \end{bmatrix}$,
 - (a) Calculate the eigenvalues of A.
 - (b) Discuss under what conditions A can be a covariance matrix.

3. Given two sets of data points (i) (1,1), (2,2), (6,6), and (ii) (-1,2), (0,0), (1,1), (2,-1), for each set of data,
 - (a) What is the first principal component?
 - (b) What are the projections from the original 2D space to the 1D space by the principal component from (a)?
 - (c) What is the total reconstruction error if representing the data from (b) in the original 2D space? (The total reconstruction error is denoted as $e = \sum_{i=1}^N ||x_i - (v^T x_i)v||^2$, where x_i is a D-dimensional data point, N is the number of data points, and v is the principal component.)