Lab 10:

Implement Dimensionality reduction using Principal Component Analysis (PCA) method.

Given the data in table, reduce the dimension from 2 using the Principal component Analysis

Feature	Ex. 1	Ex 2	Ex 3	Ex. 4
x_1	4	8	13	7
x_2	11	4	5	14

Eigen value $\lambda_1 = 30.3844$, $\lambda_2 = 6.6151$

Eigen vector $e_1 = \begin{bmatrix} 0.5574 \\ -0.8303 \end{bmatrix}$, $e_2 = \begin{bmatrix} 0.8303 \\ 0.5574 \end{bmatrix}$

Mean of $x_1 = 8$

Mean of $x_2 = 8.5$

$$X_{centered} = \begin{bmatrix} 4-8 & 8-8 & 13-8 & 7-8 \\ 11-8.5 & 4-8.5 & 5-8.5 & 14-8.5 \end{bmatrix} = \begin{bmatrix} -4 & 0 & 5 & -1 \\ 2.5 & -4.5 & -3.5 & 5 \end{bmatrix}$$

Largest E. value $= \lambda_1$

corresponding Eigen vector $e_1 = \begin{bmatrix} -0.5574 \\ -0.8303 \end{bmatrix}$

$$Z = e_1^T \cdot X_{centered}$$

$$Z = \begin{bmatrix} -0.5574 & -0.8303 \end{bmatrix} \begin{bmatrix} -4 & 0 & 5 & -1 \\ 2.5 & -4.5 & -3.5 & 5 \end{bmatrix}$$

$$Z_1 = (-0.5574)(-4) + (-0.8303)(2.5)$$

$$Z_1 = 1.5385$$