Assignment 6

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QUESTION

(Q.No.32, UGC June 2017)
Find the Eigenvalues of the matrix,

$$\mathbf{A} = \begin{pmatrix} 1 & 1 & 2 \\ 1 & -2 & 5 \\ 2 & 5 & -3 \end{pmatrix} \qquad (1)$$

SOLUTION

Using the characteristic equation of the matrix can find the Eigenvalues,

$$\left| \lambda \mathbf{I} - \mathbf{A} \right| = 0 \qquad (2)$$

$$\implies \begin{vmatrix} \lambda - 1 & -1 & -2 \\ -1 & \lambda + 2 & -5 \\ -2 & -5 & \lambda + 3 \end{vmatrix} = 0 \qquad (3)$$

The expression that is obtained after expanding the determinant and simplifying it is,

$$(\lambda - 1)(\lambda^2 + 5\lambda - 19) - (5\lambda + 31) = 0 \qquad (4)$$

Further simplifying this we obtain the cubic equation,

$$\lambda^3 + 4\lambda^2 - 29\lambda - 12 = 0 \qquad (5)$$

Solving this equation, the Eigenvalues obtained are,

$$\lambda_1 = -7.605, \; \lambda_2 = -0.394 \; and \; \lambda_3 = 4 \qquad (6)$$

Therefore, the Eigenvalues of the given matrix are 4, -4 $\pm \sqrt{13}$ (Option 3)