

5.4.37

EE25BTECH11043 - Nishid Khandagre

Question: Using elementary transformations, find the inverse of the following matrix

Solution: Let the given matrix be **A**:

$$A = \begin{pmatrix} 1 & 1 & -2 \\ 2 & 1 & -3 \\ 5 & 4 & -9 \end{pmatrix} \quad (0.1)$$

To find A^{-1} , we augment the matrix **A** with the identity matrix **I**:

$$\left(\begin{array}{ccc|ccc} 1 & 1 & -2 & 1 & 0 & 0 \\ 2 & 1 & -3 & 0 & 1 & 0 \\ 5 & 4 & -9 & 0 & 0 & 1 \end{array} \right) \quad (0.2)$$

Apply elementary row operations:

$$R_2 \rightarrow R_2 - 2R_1$$

$$R_3 \rightarrow R_3 - 5R_1$$

$$\left(\begin{array}{ccc|ccc} 1 & 1 & -2 & 1 & 0 & 0 \\ 0 & -1 & 1 & -2 & 1 & 0 \\ 0 & -1 & 1 & -5 & 0 & 1 \end{array} \right) \quad (0.3)$$

Then

$$R_3 \rightarrow R_3 - R_2$$

$$\left(\begin{array}{ccc|ccc} 1 & 1 & -2 & 1 & 0 & 0 \\ 0 & -1 & 1 & -2 & 1 & 0 \\ 0 & 0 & 0 & -3 & -1 & 1 \end{array} \right) \quad (0.4)$$

Since in the left block the last row is all zeros $\begin{pmatrix} 0 & 0 & 0 \end{pmatrix}$. So the left block cannot be converted into Identity matrix.

Also the left block has $\text{rank} < 3$, So the left block is singular.

Therefore inverse of matrix does not exist.