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Topic: Rank of Matrix
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Q. Find the Rank of Matrix

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \\ 3 & 0 & 5 & -10 \end{bmatrix}_{3 \times 4}$$

Minor of $A = [A_1]_{3 \times 3}$

$$A_1 = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 4 \\ 3 & 0 & 5 \end{bmatrix}_{3 \times 3}$$

$$|A_1| = 1 \begin{vmatrix} 1 & 4 \\ 0 & 5 \end{vmatrix} - 2 \begin{vmatrix} 2 & 4 \\ 3 & 5 \end{vmatrix} + 3 \begin{vmatrix} 2 & 1 \\ 3 & 0 \end{vmatrix}$$

$$|A_1| = 1(1 \times 5 - 0 \times 4) - 2(2 \times 5 - 4 \times 3) + 3(2 \times 0 - 1 \times 3)$$

$$|A_1| = 1(5-0) - 2(10-12) + 3(0-3)$$

$$|A_1| = 1 \times 5 - 2 \times -2 + 3 \times -3$$

$$|A_1| = 5 + 4 - 9$$

$$|A_1| = 0$$

$$A_2 = \begin{bmatrix} 1 & 2 & 4 \\ 2 & 1 & 3 \\ 3 & 0 & -10 \end{bmatrix}_{3 \times 3}$$

$$|A_2| = 1 \begin{vmatrix} 1 & 3 \\ 0 & -10 \end{vmatrix} - 2 \begin{vmatrix} 2 & 3 \\ 3 & -10 \end{vmatrix} + 4 \begin{vmatrix} 2 & 1 \\ 3 & 0 \end{vmatrix}$$

$$|A_2| = 1(-10-0) - 2(-20-9) + 4(0-3)$$

$$|A_2| = 1 \times -10 - 2 \times -29 + 4 \times -3$$

$$|A_2| = -10 + 58 - 12$$

$$|A_2| = -22 + 58 = 36$$

$|A_2| \neq 0$, \therefore Rank of matrix is 3

Q. $\begin{bmatrix} 8 & 1 & 3 & 6 \\ 0 & 3 & 2 & 2 \\ -8 & -1 & -3 & 4 \end{bmatrix}_{3 \times 4}$ find Rank of Matrix
