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Matric Number: 18/SCI01/013

1i). Linear transformation $T: U \longrightarrow V$ is a function that carries element of the vector space U (domain) to vector space V (co-domain) and which has 2 properties:

Additive property: $T(U_1 + U_2) = T(U_1) + T(U_2)$

Multiplicative property: $T(\alpha U) = \alpha T(U)$

ii). Rank of a matrix is the dimension of the vector space generated by its columns. It is also the maximum number of linearly independent column vectors in the matrix.

$$2). X = \begin{pmatrix} 1 & 2 & 8 \\ 4 & 7 & 6 \\ 9 & 5 & 3 \end{pmatrix}$$

$$/X/ = \begin{vmatrix} 1 & 2 & 8 \\ 4 & 7 & 6 \\ 9 & 5 & 3 \end{vmatrix}$$

$$/X/ = 1 \begin{vmatrix} 7 & 6 \\ 5 & 3 \end{vmatrix} - 2 \begin{vmatrix} 4 & 6 \\ 9 & 3 \end{vmatrix} + 8 \begin{vmatrix} 4 & 7 \\ 9 & 5 \end{vmatrix}$$

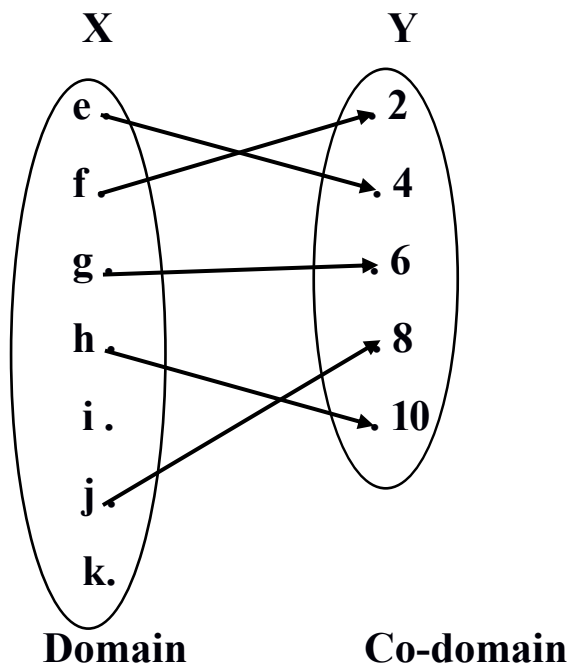
$$/X/ = 1(21 - 30) - 2(12 - 54) + 8(20 - 63)$$

$$/X/ = -9 + 84 - 344$$

$$/X/ = -269$$

$/X/ \neq 0$, therefore, X is a non-singular matrix

3). $T: X \longrightarrow Y$



$$T(e) = 4$$

$$T(f) = 2$$

$$T(g) = 6$$

$$T(h) = 10$$

$$T(j) = 8$$