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QUESTIONS

1). Explain with 2 examples what you understand by linear transformation.

2). Given a linear transformation of a matrix operator A on a vector x, compute T(x) if A=(1,9,3), (-2,6,7), (0, -1,3) and

x= 1

     4

    -8

3). Define completely with mathematical examples what you understand by Rank of a matrix.

**SOLUTION**

1. A linear transformation is a unction from one vector space to another that respects the underlying (linear) structure of each vector pace. It is also known as a linear operator or map.

Examples

(a.) The **expected value**of a random variable( which is in fact a function, and a member of a vector space)

             E(X + Y) = E(x) + E(Y) and E[aX]= aE[X].

(b.) An identity map on any module is a linear transformation.

2. 1      9      3         X=          1

-2      6      7                       4

0       -1     3                      -8

T(x)= A(x)

T(x) = 1      1        +4    9       -8        3

                  -2                6                  7

                   0                -1                 3

                  1         +       36       +     -24

                 -2                  24              -56

                   0                 -4                -24

      =       13                                                                        1

               -34      Hence, the transformation of             4

                       -28                                                                     -8

3. The rank of a matrix is defined as the maximum number of linearly independent column vector in the matrix or maximum number of linearly independent roe vector in the matrix.

**Example**

**A=   1      -3       6**

**4       0        2**

**8        5       1**

(i.)

IMG_256

IMG_257

**RANK OF A**

IMG_258

IMG_259

**A**    =    1     -3      6

           4      0       2

           8      5      1

IMG_260

IMG_261

IMG_262

IMG_263

IMG_264

IMG_265

= **1**  0      2   -(**-3)**  4      2    **+6**4      0N

        5      1             8      1             8       5

= 1(0 - 10)  +3(4-16)  +6(20-0)

=  -10 - 36 +120

= **74**

IMG_266

IMG_267

**Since**A   ≠ 0 , **The Rank of A is 3**

Note: But if the determinant of the matrix is equal to 0 then we delete arrow and column of the 3 x 3 matrix forming a 2 x 2 matrix then we find the determinant of the matrix. If we get an answer not equal to 0 then the matrix of rank 2