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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 function 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

1. 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].

1. 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

1. 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**

1. **RANK OF A**

 **A** = 1 -3 6

 4 0 2

 8 5 1

= **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**

**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