بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

In the Name of Allah,
the Beneficent, the Merciful.

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Q No1: Define Similar matrices. Give Example.

In linear Algebra two n-by-n matrices A and B are called similar if there exists an invertible n-by-n matrix P such that $B = P^{-1}AP$

Similar matrices represent the same linear map under two (possibly) different basis with P being the change of Basis matrix[1][2] A Transformation $A \to P^{-1}AP$ is called a similarity transformation or Conjugation of the matrix A in the general linear group. Similarity is therefore the same Conjugacy and Similar matrices are called Conjugate however in given subgroup H of the general linear group. the notion of the Conjugacy may be more restrictive than Similarity since it require that P be Chosen to lie in H

Example of QNo#1

let $A = \begin{bmatrix} 4 & -2 \\ 3 & 6 \end{bmatrix}$ and $P = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

(a) find $B = P^{-1}AP$ (b) verify $tr(B) = tr(A)$

(c) verify $det(B) = det(A)$

(a) First find P^{-1} using the formula for the inverse of a 2×2 matrix we have.

$$P^{-1} = \begin{bmatrix} -2 & 1 \\ \frac{3}{2} & \frac{-1}{2} \end{bmatrix}$$

Then

$$B = P^{-1}AP = \begin{bmatrix} -2 & 1 \\ \frac{3}{2} & \frac{-1}{2} \end{bmatrix} \begin{bmatrix} 4 & -2 \\ 3 & 6 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 25 & 30 \\ -\frac{27}{2} & -15 \end{bmatrix}$$

(b) $tr(A) = 4+6 = 10$ and $tr(B) = 25-15 = 10$

Hence $tr(B) = tr(A)$

(c) $det(A) = 24+6 = 30$ and $det(B) = -375+405 = 30$

Hence $det(B) = det(A)$

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Q No:2: write definition of dimension of vector space. Find dimension of vector space $\mathbb{R}^2$.

Ans: The number of k vector in finite vector space V is the Dimension of V and is denoted by dim(V). The vector space V={0} is defined to have dimension 0.

- a plane in $\mathbb{R}^3$ is a two dimension subspace.
- a line in $\mathbb{R}^n$ is a one-dimensional.
- a hyperplane in $\mathbb{R}^n$ is an $(n-1)$ dimensional subspace of $\mathbb{R}^n$.
- The vector space F of real function is an infinite dimensional space.
- The vector space or real-valued sequences is an infinite dimensional space.

=> Find dimension of vector space $\mathbb{R}^2$.

Dimension: number of element Basis vector.

Dimension: if the vector space V spanned or generated by finite then V is said to be finite dimension.

if two vector linearly independent Basis vector so the dimension is two.

QNo 2: continue:

$S: v_1 = (1,1)$, v_2 $(1,-1)$ is Basis R^2.

$x = (x_1, x_2)$

$c_1v_1 + c_2v_2 = x$.

$c(1,1) + c_2(1,1) = (x_1, x_2)$

$c_1 + c_2 = x_1$

$c_1 - c_2 = x_2$

$c_1v_1 + c_2v_2 = 0$

$c_1(1,1) + c_2(1,-1) = (0,0)$

$(c_1 + c_2, c_1 - c_2) = (0,0)$

Equation corresponding homogeneous. system.

$c_1 + c_2 = 0$

$c_1 - c_2 = 0$

$c_1 = c_2 = 0$

S is linearly independent.

Dimension. Number of element of Basis vector.

so Basis is 2

linearly independent is 2.

so dimension is 2.

$V = R^2$

$v_1(0,1) + v_2(1,0)$

$a_1v_1 + a_2v_2$

$a_1(0,1) + a_2(1,0)$

QNo 2: Continue.

$a_1 + a_2 = 0$

$\Rightarrow a_1 = 0$

$\Rightarrow a_2 = 0 \Rightarrow$ Basis.

$V = \mathbb{R}^2$

So linearly independent.

So Dimension is 2.

Ques 3: Define nullity of square matrix of order n.

Ans: The nullity of square matrix with linearly independent rows is at least one because if the rows are linearly dependent then the rank is at least 1 less than the number of rows so since the matrix is square its nullity is at least one.

Hence,

Nullity of matrix is defined only for square matrices.

rank (A) + nullity (A) = order of matrix

Since.

nullity (A) = order of matrix - rank (A).

Qns 4:- Show that nullity of two similar (square) matrix is same of order n.

Proof:-

Suppose that matrix A is similar to B $\exists$ a matrix C with

$$B = C^{-1}AC.$$

first we have to show if $x \in \ker(B)$ then $Cx \in \ker(A)$.

Note that $AC = CB$. if $x \in \ker(B)$ then $A(Cx) = CBx = C0 = 0$, so that $Cx \in \ker(A)$ as claimed.

Now we have to show that nullity (A) = nullity (B) ~~then vectors~~.

If $\{v_1, v_2 \ldots\ldots v_p\}$ is a basis for $\ker(B)$ then vectors.

$\{Cv_1, Cv_2 \ldots\ldots Cv_p\} \subset \ker(A)$ are linearly independent. Now reverse the role of A A & B.

we observe that

nullity (B) = $\dim(\ker B)$ = $\leq \dim$.

$\ker(A)$ = nullity (A)

Q No 4 is cont inue:

Since $Cv_i, \ldots, cv_p$ are linearly independent vectors in $Ka(A)$.

Reversing the roles of A & B. show that

Conversely.

nullity (A) ≤ nullity (B), so that the Equal ion.

nullity (A) = nullity (B).

proved.

COMMON INTEGRATION IS ONLY THE MEMORY OF DIFFERENTIATION...

AUGUSTUS DE MORGAN