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Assignment - 03 GE-02

Linear Algebra

Q.1. Suppose $L : \mathbb{R}^3 \to \mathbb{R}^2$ is a linear transformation with $L([1,-1,0]) = [2,1]$, $L([0,1,-1]) = [-1,3]$ and $L([0,1,0]) = [0,1]$. Find $L([-1,1,2])$. Also give a formula for $L([x,y,z])$, for any $[x,y,z] \in \mathbb{R}^3$.

Q.2. Let $L : \mathbb{R}^2 \to \mathbb{R}^2$ be the linear operator that performs a counterclockwise rotation through an angle $\theta = 30°$. Find the matrix A for L with respect to the standard ordered basis for $\mathbb{R}^2$. Hence or otherwise find the matrix for L with respect to the basis $\{[4,-3],[3,-2]\}$ similar to A

Q.3. Let $T : \mathbb{R}^2 \to \mathbb{R}^3$ be the linear transformation given by $T([x,y]) = [13x - 9y, -x - 2y, -11x + 6y]$. Find the matrix for T with respect to the ordered bases $B = \{[2,3],[-3,-4]\}$ for $\mathbb{R}^2$ and $C = \{[-1,2,2],[-4,1,3],[1,-1,-1]\}$ for $\mathbb{R}^3$.

Q.4: Let $T : \mathbb{R}^3 \to \mathbb{R}^3$ be the linear operator given by

$$T\left(\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}\right) = \begin{bmatrix} 5 & 1 & -1 \\ -3 & 0 & 1 \\ 1 & -1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Find a basis for $\ker(T)$ and a basis for Range (T). Also verify dimension Theorem

Q.5: Find a least-squares sol^n to the inconsistent system $Ax = b$, where

$$A = \begin{bmatrix} 5 & 2 \\ 3 & 1 \\ 4 & 3 \end{bmatrix} \text{ and } b = \begin{bmatrix} 12 \\ 15 \\ 4 \end{bmatrix}$$

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