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2110201 Quiz3

Basic Skill

1. (2 points) A non-empty subset of $S \subset \mathbb{R}^n$ is called a subspace if it is

   (a)_____

   (b)_____

2. (4 points) Find the null space of the following matrix

$$\begin{bmatrix} 0 & 1 & 7 & 0 & 8 & 2 & 4 \\ 0 & 0 & 0 & 0 & 5 & 1 & 1 \\ 0 & 0 & 0 & 0 & 3 & 3 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 & 1 \end{bmatrix}$$

3. (2 points) Let $S = \text{span}(\{v_1, v_2\})$ where $v_1 = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$ and $v_2 = \begin{pmatrix} 0 \\ 0 \\ 1 \\ 1 \end{pmatrix}$. Find $S^{\perp}$.

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4. (8 points) Let $A = \begin{bmatrix} 2 & 2 & 3 & 3 \\ -3 & -3 & 2 & 2 \\ 2 & 2 & 1 & 1 \end{bmatrix}$.

   Given that $\text{RRE}(A) = \begin{bmatrix} 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ and $\text{RRE}(A^T) = \begin{bmatrix} 1 & 0 & \frac{7}{13} \\ 0 & 1 & \frac{-4}{13} \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$.

   Find a basis for the null space, column space, row space and left null space of A.
   What is the rank and nullity of A?

5. (4 points) Which of the following sets in $\mathbb{R}^3$ is dependent? Which is independent?

   a. $\left\{\begin{pmatrix}1\\2\\3\end{pmatrix}, \begin{pmatrix}3\\4\\5\end{pmatrix}, \begin{pmatrix}5\\6\\7\end{pmatrix}\right\}$ b. $\left\{\begin{pmatrix}1\\2\\3\end{pmatrix}, \begin{pmatrix}4\\4\\4\end{pmatrix}, \begin{pmatrix}3\\2\\1\end{pmatrix}\right\}$