

MAT 211: Linear Algebra

Homework Problems

4.1. *Subspace or Not?* (5+5 points)

Decide whether the following subsets of \mathbb{R}^3 are linear subspaces.

(a) $V = \{(x, y, z) \in \mathbb{R}^3 : x = 2y + 3z\}$.

(b) $V = \{(x, y, z) \in \mathbb{R}^3 : x \leq y \leq z\}$.

4.2. *Image and Kernel of a Linear Map.* (20 points)

Let $T : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be a linear map such that $T(1, 0, 0) = (1, 2, 4)$, $T(1, 0, 1) = (1, 3, -1)$, $T(1, 1, 1) = (6, 17, -1)$.

(a) Find the matrix of T .

(b) Find a minimal set of generators for the image and kernel of T .

4.3. *Composition of Linear Transformations.* (10 points)

Write the matrix representing a linear transformation that first rotates vectors by 90 degrees counter-clockwise, and then projects them onto the line $y = 2x$.

4.4. *(Bonus Problem) Containment of subspaces.* (10 points)

Let W_1 , W_2 and W_3 be linear subspaces of \mathbb{R}^n such that W_1 is contained in $W_2 \cup W_3$. Show that W_1 is either contained in W_2 , or contained in W_3 .

Due Date: Wednesday, March 7.