Math 6091/3091: Recitation 2

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Do any **all** of the following problems.

(1) **(2 points)** Let $V \subseteq \mathbb{R}^4$ denote the space of solutions of the following homogenous system:

$$2x_1 + x_3 + x_4 = 0,$$
$$x_1 + 2x_2 - x_4 = 0.$$

Find the basis of V.

(2) **(2 points)** Is $W = \{(x_1, x_2, x_3) \in \mathbb{R}^3 \mid x_1^3 + x_2^3 + x_3^3 = 0\}$ a subspace of $\mathbb{R}^3$? Give an element of this subspace.

(3) **(3 points)** Let $T : \mathbb{R}^3 \longrightarrow \mathbb{R}$ be a map defined as

$$T(a_1, a_2, a_3) = 3a_1 + 2a_2 + a_3.$$

(a) (2 points) Show that T is a linear transformation.

(b) (0.5 point) What is the image of the element $(1, 2, -2)$ under this transformation?

(c) (0.5 point) Find $(a, b, c) \in \mathbb{R}^3$ such that $f(a, b, c) = 399$.

(4) **(3 points)** Let $T : \mathbb{R}^3 \longrightarrow \mathbb{R}^2$ be a linear transform such that

$$T(1, 0, 1) = (1, 0),$$
$$T(0, 1, 1) = (0, 1),$$
$$T(1, 1, 0) = (1, 1).$$

(a) (2 points) Find $T(3, 2, 3)$.

(b) (1 point) Find 2 different elements $(a_1, b_1, c_1), (a_2, b_2, c_2) \in \mathbb{R}^3$ such that

$$T(a_1, b_1, c_1) = T(a_2, b_2, c_2) = (1, 1).$$