Math 54: Worksheet #3

Name: ______________________________ Date: September 7, 2021

Fall 2021

Problem 1 (True/False)**.** The map $T : \mathbb{R} \to \mathbb{R}$ given by $T(x) = 2x + 1$ is a linear map.

Problem 2 (True/False)**.** The map $T : \mathbb{R} \to \mathbb{R}$ given by $T(x) = 2x$ is a linear map.

Problem 3 (True/False)**.** A linear map $T : \mathbb{R}^2 \to \mathbb{R}^3$ can be a surjection.

Problem 4 (True/False)**.** Suppose $T : \mathbb{R}^n \to \mathbb{R}^m$ is a linear map. Then,

$$T(c_1\underline{v}_1 + \cdots + c_n\underline{v}_n) = c_1T(\underline{v}_1) + \cdots + c_nT(\underline{v}_n).$$

Problem 5 (True/False)**.** If A is a 4×3 matrix and T is the linear transformation defined by $T(\underline{x}) = A\underline{x}$, then the domain of T is $\mathbb{R}^3$.

Problem 6 (1.8 #10)**.** Find all $\underline{x}$ in $\mathbb{R}^4$ that are mapped to the zero vector by the transformation $\underline{x} \mapsto A\underline{x}$ for the matrix

$$A = \begin{bmatrix} 1 & 3 & 9 & 2 \\ 1 & 0 & 3 & -4 \\ 0 & 1 & 2 & 3 \\ -2 & 3 & 0 & 5 \end{bmatrix}$$

Problem 7 (1.8 #20)**.** Let $\underline{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$, $\underline{v}_1 = \begin{bmatrix} -2 \\ 5 \end{bmatrix}$, and $\underline{v}_2 = \begin{bmatrix} 7 \\ -3 \end{bmatrix}$, and let $T : \mathbb{R}^2 \to \mathbb{R}^2$ be a linear transformation that maps $\underline{x}$ to $x_1\underline{v}_1 + x_2\underline{v}_2$. Find a matrix A such that $T(\underline{x}) = A\underline{x}$ for each $\underline{x}$.