MATH 350: Linear Algebra

Quiz 2

NAME: _____ Date: October 4, 2018

Solve the following problems on this sheet of paper. No calculators or other electronic devices are permitted.

1. (6 points) Let

$$V = M_{2\times 2}(\mathbb{R}),$$
$$W_1 = \left\{ \begin{pmatrix} a & b \\ c & a \end{pmatrix} \mid a, b, c \in \mathbb{R} \right\},$$
$$W_2 = \left\{ \begin{pmatrix} 0 & a \\ -a & b \end{pmatrix} \mid a, b \in \mathbb{R} \right\}.$$

Prove that W_1 is a subspace of V. Find the dimensions of $W_1, W_2, W_1 + W_2$, and $W_1 \cap W_2$. Provide justification (e.g. no points will be given for guessing). Note: you do **not** need to prove that W_2 is a subspace of V(it is).

2. (4 points) Is there a linear transformation $T : \mathbb{R}^3 \to \mathbb{R}^2$ such that

$$T \begin{pmatrix} 1 \\ 0 \\ 3 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix},$$
$$T \begin{pmatrix} -2 \\ 0 \\ -6 \end{pmatrix} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}?$$

If there is, find one such T. If none exist, explain why. *Hint:* Note that

$$\begin{pmatrix} -2 \\ 0 \\ -6 \end{pmatrix} = -2 \begin{pmatrix} 1 \\ 0 \\ 3 \end{pmatrix}.$$