MATH 220
Fall 2017
Quiz 5

Name: SOLUTION

Section Number: _____

Instructions: This is a closed-book quiz. Be sure to show **ALL** your work, as this is a partial credit quiz. Full credit will not be given for answers which are not accompanied by some justification.

1. (6 points) Let $T : \mathbb{R}^3 \to \mathbb{R}^2$ be a linear transformation that maps $\mathbf{u} = \begin{bmatrix} 1 \\ 3 \\ 4 \end{bmatrix}$ into $\begin{bmatrix} 1 \\ 3 \end{bmatrix}$ and $\mathbf{v} = \begin{bmatrix} -5 \\ 3 \\ 1 \end{bmatrix}$ into $\begin{bmatrix} 1 \\ -1 \end{bmatrix}$. Find $T(3\mathbf{u} - \mathbf{v})$.

Because T is linear, we have

$$T(3u - v) = 3T(u) - T(v)$$

$$= 3 \cdot \begin{bmatrix} 1 \\ 3 \end{bmatrix} - \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

$$= \begin{bmatrix} 2 \\ 10 \end{bmatrix}$$

Note that it is irrelevant for this problem which specific vectors u and v are. One only needs to know their images!

2. (4 points) Let T be the linear transformation whose standard matrix is

$$\begin{bmatrix} -1 & -4 & 8 & 1 \\ 0 & 3 & -1 & 2 \\ 0 & 0 & 0 & 13 \end{bmatrix}$$

Mark each statement True or False.

(a) T is a linear transformation from $\mathbb{R}^3$ to $\mathbb{R}^4$.

False

(b) T is a linear transformation from $\mathbb{R}^4$ to $\mathbb{R}^3$.

True

(c) T is one-to-one.

False (not every column has pivot)

(d) T is onto.

True (every row has a pivot)