Math 322 - Matrix Algebra SOLUTIONS
Friday, October 16 $**$ *Quiz 6* Name: ____________________

1. (**4 points**) Use the determinants to find the area of the parallelogram with vertices

$$\begin{pmatrix}4\\1\end{pmatrix}, \quad \begin{pmatrix}1\\2\end{pmatrix}, \quad \begin{pmatrix}3\\7\end{pmatrix}, \quad \text{and} \quad \begin{pmatrix}6\\6\end{pmatrix}.$$

None of the vertices are at the origin, so we first translate the shape by subtracting off $\begin{pmatrix}1\\2\end{pmatrix}$. The new vertices are the origin and $\begin{pmatrix}3\\-1\end{pmatrix}$, $\begin{pmatrix}2\\5\end{pmatrix}$, and $\begin{pmatrix}5\\4\end{pmatrix}$. It follows that the area is

$$\begin{vmatrix}3 & -1\\2 & 5\end{vmatrix} = 15 + 2 = 17.$$

$$\boxed{\text{area} = 17}$$

2. (**6 points**) Determine whether the following sets of vectors are **subspaces** or not. Select either **S** for subspace or **N** for not a subspace.

(a) $\{(x,y,z) \mid x+y+z=0\} \overset{?}{\subseteq} \mathbb{R}^3$

S / N

This is a nullspace.

(b) $\{(x,y,z) \mid x+y+z=2\} \overset{?}{\subseteq} \mathbb{R}^3$

S / N

Does not contain $\mathbf{0}$.

(c) $\{(x,y,z) \mid x+y+z>0\} \overset{?}{\subseteq} \mathbb{R}^3$

S / N

Does not contain $\mathbf{0}$.

(d) $\text{Span}\left\{\begin{pmatrix}2\\1\\1\end{pmatrix}, \begin{pmatrix}1\\3\\5\end{pmatrix}\right\} \overset{?}{\subseteq} \mathbb{R}^3$

S / N

A span is always a subspace.

(e) $\{\text{invertible matrices}\} \overset{?}{\subseteq} M_{3\times 3}$

S / N

Does not contain $\mathbf{0}$.

(f) $\{A \mid a_{1,3}=0\} \overset{?}{\subseteq} M_{3\times 3}$

S / N

This is a nullspace.