MTH 266, Quiz #6, Fall 2018 Name KEY

Instructions: Show all work. Use exact answers unless otherwise asked to round.

1. One corner of a tetrahedron is defined by the vectors $\vec{u}_1 = \begin{bmatrix} -4 \\ 2 \\ -3 \end{bmatrix}, \vec{u}_2 = \begin{bmatrix} 1 \\ -1 \\ 5 \end{bmatrix}, \vec{u}_1 = \begin{bmatrix} 3 \\ 4 \\ 1 \end{bmatrix}$. Find the volume of the tetrahedron.

$$V = \begin{vmatrix} -4 & 1 & 3 \\ 2 & -1 & 4 \\ -3 & 5 & 1 \end{vmatrix} \quad -4\begin{vmatrix} -1 & 4 \\ 5 & 1 \end{vmatrix} - 1\begin{vmatrix} 2 & 4 \\ -3 & 1 \end{vmatrix} + 3\begin{vmatrix} 2 & -1 \\ -3 & 5 \end{vmatrix}$$

$$= -4(-1-20) - 1(2+12) + 3(10-3) =$$

$$-4(-21) - (14) + 3(7) = 84 - 14 + 21 = 70 + 21 = 91$$

2. Determine if the vectors $\vec{u}_1 = \begin{bmatrix} 1 \\ 2 \\ 1 \\ 0 \end{bmatrix}, \vec{u}_1 = \begin{bmatrix} -4 \\ 1 \\ 3 \\ -1 \end{bmatrix}, \vec{u}_1 = \begin{bmatrix} 2 \\ 2 \\ 0 \\ 1 \end{bmatrix}, \vec{u}_1 = \begin{bmatrix} 0 \\ 2 \\ -3 \\ 0 \end{bmatrix}$ form a basis for R^4.

Explain your reasoning. If they do not form a basis for R^4, explain why not.

$$\begin{bmatrix} 1 & -4 & 2 & 0 \\ 2 & 1 & 2 & 2 \\ 1 & 3 & 0 & -3 \\ 0 & -1 & 1 & 0 \end{bmatrix} \Rightarrow \text{rref} \Rightarrow \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

the vectors do form a basis for $\mathbb{R}^4$

since the vectors are independent and

span $\mathbb{R}^4$