MTH 309 QUIZ 2 FEBRUARY 21ST

20/20

Please show **all** your work! Answers without supporting work will not be given credit.

Name: Ivan Wang

1. Given the vectors $\vec{u} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ and $\vec{v} = \begin{bmatrix} 0 \\ 2 \\ -2 \end{bmatrix}$, determine if the following vectors are in $\text{Span}\{\vec{u}, \vec{v}\}$. If the vector is in the span, express it as a linear combination of $\vec{u}$ and $\vec{v}$.

a.) $\begin{bmatrix} 0 \\ 2 \\ -2 \end{bmatrix}$ $0\vec{u} + \vec{v} = \begin{bmatrix} 0 \\ 2 \\ -2 \end{bmatrix}$ In $\text{span}\{\vec{u}, \vec{v}\}$, $\begin{bmatrix} 0 \\ 2 \\ -2 \end{bmatrix} \in \text{span}\{\vec{u}, \vec{v}\}$

b) $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$ $0\vec{u} + 0\vec{v} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$ In $\text{span}\{\vec{u}, \vec{v}\}$, $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \in \text{span}\{\vec{u}, \vec{v}\}$

c) $\begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix}$ $1\vec{u} + 1\vec{v} = \begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix}$ $\begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix} \in \text{span}\{\vec{u}, \vec{v}\}$

d) $\begin{bmatrix} 1 \\ 1 \\ 1 \\ -2 \end{bmatrix}$ $\notin \text{span}\{\vec{u}, \vec{v}\}$ Not in $\text{span}\{\vec{u}, \vec{v}\}$

2. (12 points)Determine if the following vectors are linearly independent. Make sure to **explain** your reasoning.

$\vec{v}_1 = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$, $\vec{v}_2 = \begin{bmatrix} 1 \\ 3 \\ 1 \end{bmatrix}$, $\vec{v}_3 = \begin{bmatrix} 0 \\ 2 \\ 2 \end{bmatrix}$

$\vec{v}_1 - \vec{v}_3 = 0$
$\vec{v}_2 = 0$
$\vec{v}_3 = 0$

Linearly independet b/c there's only one solution (No inf solutions))

$1-1=0$
$3-1=2$
$2-0=2$

$[\vec{v}_1\ \vec{v}_2\ \vec{v}_3 \mid \vec{0}]$

$\left[\begin{array}{ccc|c} 1 & 1 & 0 & 0 \\ 1 & 3 & 2 & 0 \\ 0 & 1 & 2 & 0 \end{array}\right] \xrightarrow{R_2 - R_1} \left[\begin{array}{ccc|c} 1 & 1 & 0 & 0 \\ 0 & 2 & 2 & 0 \\ 0 & 1 & 2 & 0 \end{array}\right]$

$0 - \frac{1}{2}$

$0\vec{v}_1 + 0\vec{v}_2 + 0\vec{v}_3 = \vec{0}$

$\xrightarrow{R_3 - \frac{1}{2}R_2} \left[\begin{array}{ccc|c} 1 & 1 & 0 & 0 \\ 0 & 2 & 2 & 0 \\ 0 & 0 & 1 & 0 \end{array}\right] \xrightarrow{\substack{R_2 - 2R_3 \\ R_1 - \frac{1}{2}R_2}} \left[\begin{array}{ccc|c} 1 & 0 & -1 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{array}\right]$

$2 - \frac{1}{2}(2)$
$2 - 1$

$0 - \frac{1}{2}(0) = 0$
$1 - \frac{1}{2}(2) = 0$

$0 - \frac{1}{2}(2)$
$2 - 2(1)$

$0 - 2(0)$
$2 - 2(0)$