1. (6 pts.) Define each of the following terms.

(a) Span{$\mathbf{v}_1, \ldots, \mathbf{v}_m$}

(b) Linearly independent

(c) Basis

2. (4 pts.) Let V be the first octant in xyz-space; that is, let

$$V = \left\{ \begin{bmatrix} x \\ y \\ z \end{bmatrix} : x \geq 0,\ y \geq 0,\ z \geq 0 \right\}.$$

Let "+" be the usual vector addition in $\mathbb{R}^3$, and let the scalar multiplication be the usual scalar multiplication in $\mathbb{R}^3$.

(a) If **u** and **v** are in V, is **u** + **v** in V? Why??

(b) Find a specific vector **u** in V and a specific scalar c so that c**u** is not in V. What does this imply about V?

3. (10 pts.) Suppose matrices A and B are row equivalent, where

$$A = \begin{bmatrix} -3 & 6 & -1 & 1 & -7 \\ 1 & -2 & 2 & 3 & -1 \\ 2 & -4 & 5 & 8 & -4 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 1 & -2 & 0 & -1 & 3 \\ 0 & 0 & 1 & 2 & -2 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}.$$

Using this information, solve the following problems:

(a) Obtain a basis for Col(A).(2 pts)

(b) Obtain a basis for Nul(A).(3 pts.)

(c) Using your basis for Nul(A), explicitly write each column of A which is not in your basis for Col(A) as a linear combination of the elements of the basis for Col(A).(3 pts.)

(d) Using your basis elements for Col(A), show the first column of B is not in Col(A). (This implies Col(A) $\neq$ Col(B).) (2 pts.)