1. Below are three matrices. Matrix $M$ is a row echelon form of matrix $A$. Matrix $A^{-1}$ is the inverse of matrix $A$.

$$A = \begin{bmatrix} 1 & 3 & 1 \\ 1 & 1 & 2 \\ 2 & 3 & 4 \end{bmatrix} \quad M = \begin{bmatrix} 1 & 3 & 1 \\ 0 & -2 & 1 \\ 0 & 0 & 1 \end{bmatrix} \quad A^{-1} = \begin{bmatrix} 2 & 9 & -5 \\ 0 & -2 & 1 \\ -1 & -3 & 2 \end{bmatrix}$$

Use this information to find the coordinate vector $[\vec{x}]_B$ of $\vec{x}$ relative to basis $B$. $B$ and $\vec{x}$ are defined as follows:

$$B = \left\{ \begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}, \begin{bmatrix} 3 \\ 1 \\ 3 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ 4 \end{bmatrix} \right\} \quad \vec{x} = \begin{bmatrix} 2 \\ -2 \\ -1 \end{bmatrix}$$

(Caution: not all of the information given is relevant to the problem.)

2. Indicate whether the following statements are true or false:

(a) The number of pivot columns of a matrix equals the dimension of its column space.

(b) A plane in $\mathbb{R}^3$ is a two-dimensional subspace of $\mathbb{R}^3$.

(c) The dimension of the vector space $\mathbb{P}_4$ is 4. (Recall that $\mathbb{P}_4$ is the set of all polynomials with degree at most 4).

(d) If the dimension of $V$ is $n$ and $S$ is a linearly independent set in $V$, then $S$ is a basis for $V$.

(e) If a set $\{\vec{v}_1, \vec{v}_2, \ldots, \vec{v}_p\}$ spans a finite-dimensional vector space $V$ and $T$ is a set of more than $p$ vectors, then $T$ is linearly dependent.