1. (4 pts.) (a) Find a parametric equation for the line through

$\mathbf{a} = \begin{bmatrix} -3 \\ 5 \end{bmatrix}$ and parallel to $\mathbf{b} = \begin{bmatrix} 23 \\ -5 \end{bmatrix}$.

(b) Find a parametric equation for the line through **a** and **b**, where

$\mathbf{a} = \begin{bmatrix} -3 \\ 5 \end{bmatrix}$ and $\mathbf{b} = \begin{bmatrix} 23 \\ -5 \end{bmatrix}$.

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2. (6 pts.) Using complete sentences and appropriate notation, define each of the items below.

(a) Linear Combination

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

(c) Linear Independent

3. (2 pts.) Write the general solution of the equation

$$x_1 - 6x_2 + 8x_3 = 25$$

in parametric form.

4. (2 pts.) The general solution of a certain matrix equation A**x** = **b** with **b** ≠ **0** is given in parametric vector form as follows:

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} -3 \\ 12 \\ -5 \end{bmatrix} + x_2\begin{bmatrix} -5 \\ 1 \\ 0 \end{bmatrix} + x_3\begin{bmatrix} 15 \\ 0 \\ 1 \end{bmatrix}$$

,where x_2 and x_3 are arbitrary real numbers. Give the solution to the corresponding homogeneous equation, A**x** = **0**.

5. (4 pts.) Suppose A is a 5 x 3 matrix with 2 pivot elements.
(a) Are the columns of A linearly independent? Explain.

(b) Does the matrix equation A**x** = **b** have a solution for every **b** in $\mathbb{R}^5$?? Explain.

6. (2 pts.) After asserting whether the following proposition is always true or false in at least one case, give a brief justification for or provide a counterexample to it:

If $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3, \mathbf{v}_4\}$ is a linear independent set of vectors in $\mathbb{R}^5$, then $\{\mathbf{v}_2, \mathbf{v}_3\}$ is also linearly independent.