1. Let \( A = \begin{bmatrix} 1 & -3 & -4 \\ -3 & 2 & 6 \\ 5 & -1 & -8 \end{bmatrix} \) and \( b = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix} \).

(a) Show that the matrix equation \( Ax = b \) does not have a solution for all possible \( b \); that is, show that there exists at least one \( b \) for which \( Ax = b \) does not have a solution.

(b) Describe the set of all \( b \) for which \( Ax = b \) does have a solution.

2. Let \( v_1 = \begin{bmatrix} 0 \\ 0 \\ -2 \end{bmatrix} \), \( v_2 = \begin{bmatrix} 0 \\ -3 \\ 8 \end{bmatrix} \), \( v_3 = \begin{bmatrix} 4 \\ -1 \\ -5 \end{bmatrix} \).

Determine whether or not \( \{v_1, v_2, v_3\} \) spans \( \mathbb{R}^3 \). Clearly explain your reasoning.

3. Let \( p = \begin{bmatrix} 2 \\ -5 \\ 3 \end{bmatrix} \) and \( q = \begin{bmatrix} -3 \\ 1 \\ 2 \end{bmatrix} \).

Find a parametric equation for the line \( L \) passing through \( p \) and \( q \).

(\textit{Hint:} \( L \) is parallel to \( q - p \).)

4. Suppose \( Ax = b \) has a solution. Explain why the solution is unique precisely when \( Ax = 0 \) has only the trivial solution.

5. Find the value(s) of \( h \) for which the following set of vectors is linearly dependent, and justify your answer.

\[
\left\{ \begin{bmatrix} 2 \\ -4 \\ 1 \end{bmatrix}, \begin{bmatrix} -6 \\ 7 \\ 3 \end{bmatrix}, \begin{bmatrix} 8 \\ h \end{bmatrix} \right\}
\]

6. Suppose \( A \) is a \( m \times n \) matrix with the property that for all \( b \in \mathbb{R}^m \) the equation \( Ax = b \) has at most one solution. Use the definition of linear independence to explain why the columns of \( A \) must be linearly independent.