1. Let

\[ A = \begin{pmatrix} 1 & -3 & -5 \\ 0 & 1 & 1 \end{pmatrix} \]
\[ b = \begin{pmatrix} 0 \\ 3 \end{pmatrix} \]

Give the solutions to \( Ax = b \) in parametric form.

2. Determine \( h \) and \( k \) such that the solution set of the system (i) is empty, (ii) contains a unique solution, and (iii) contains infinitely many solutions.
   a.
   \[
   \begin{align*}
   x_1 + 3x_2 &= k \\
   4x_1 + hx_2 &= 8 
   \end{align*}
   
   b.
   \[
   \begin{align*}
   -2x_1 + hx_2 &= 1 \\
   6x_1 + kx_2 &= -2 
   \end{align*}
   
3. a. Construct a \( 4 \times 4 \) matrix \( A \) such that every collection of 3 columns is linearly independent, but all 4 vectors are linearly dependent.
   
   b. Show that if \( v_1, \ldots, v_4 \) are linearly independent vectors in \( \mathbb{R}^4 \), then \( \{v_1, v_2, v_3\} \) is also linearly independent.

4. Let \( T : \mathbb{R}^4 \to \mathbb{R}^3 \) be the linear transformation determined by the following rule:

\[
T(1, 0, 0, 0) = (-1, 5, 2) \\
T(0, 1, 0, 0) = (1, 0, 3) \\
T(0, 0, 1, 0) = (1, 1, 4) \\
T(0, 0, 0, 1) = (2, -7, 1)
\]

   a. Is \( T \) 1-1?
   
   b. Is \( T \) onto?