1. Solve the systems of equations:
   (a) \[
   \begin{align*}
   x + y &= 1 \\
   3x + 3y &= 1 
   \end{align*}
   \]
   (b) \[
   \begin{align*}
   3x - 2y - z &= -9 \\
   -x + y + 2z &= 5 \\
   5x - 3y + 4z &= -9 
   \end{align*}
   \]

2. Let \( A = \begin{bmatrix} 2 & 1 \\ 4 & -1 \end{bmatrix} \) and \( B = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \).
   (a) Compute the length of \( B \).
   (b) Write a formula for the angle \( B \) makes with the vector \( \begin{bmatrix} 1 \\ 0 \end{bmatrix} \) (the \( x \)-axis).
   (c) Find the transpose of \( A \).
   (d) Compute the determinant of \( A \).
   (e) Compute the trace of \( A \).
   (f) Compute \( AA + 3A \).
   (g) Find \( A^{-1} \).
   (h) Use \( A^{-1} \) to solve the matrix equation \( AX = B \) for \( X \).
   (i) Find the eigenvalues and eigenvectors of \( A \).

3. Consider (but do not solve) the system of equations
   \[
   \begin{align*}
   x + 2y &= 3 \\
   4x + 5y &= 6 
   \end{align*}
   \]
   Create a word problem that would result in this system of equations. Describe the meaning of \( x \) and \( y \) in your problem, and what each equation represents.