Instructions: Write complete legible solutions to the following problems in the space provided. Be sure to supply all the necessary steps that lead to your answers.

1. Show that the set of all 2x2 Diagonal matrices form an Abelian group under the usual matrix addition.

2. Determine if the set of all ordered pairs of the form $(1, x)$ with the operations
$$(1, y) + (1, z) = (1, y + z), \text{ and } k(1, y) = (1, ky)$$
defines a vector space.

3. Determine which of the following form a subspace of R^3

a. All vectors of the form (a,b,c), where $c = a + b + 1$.

b. All vectors of the form (a,b,c), where $c = a + b$.

4. Prove that the solution space to the equation $\mathbf{Ax} = \mathbf{0}$, where A is an mxn matrix is a vector subspace of $\mathbf{R}^n$