Let $\vec{u_1} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, $\vec{u_2} = \begin{bmatrix} 3 \\ 0 \\ 1 \end{bmatrix}$, **and** $\vec{u_3} = \begin{bmatrix} 1 \\ -1 \\ -1 \end{bmatrix}$

1. Find a vector $\vec{x} \in \mathbb{R}^3$ that is orthogonal to $\vec{u_1}$.

2. Find a vector $\vec{y} \in \mathbb{R}^3$ that is orthogonal to both $\vec{u_1}$ and $\vec{u_2}$.

3. Find all vectors $\vec{z} \in \mathbb{R}^3$ that are orthogonal to $\vec{u_1}$, $\vec{u_2}$, and $\vec{u_3}$.

4. Let A be the matrix formed by putting $\vec{u_1}$, $\vec{u_2}$, $\vec{u_3}$ in the rows of A
   (a) How are the vectors $\vec{z}$ from #3 related to row(A)?
   (b) In which fundamental subspace of A do the vectors $\vec{z}$ from #3 lie?