Let $A = \begin{bmatrix} 1 & 2 \\ -2 & 0 \\ 3 & 1 \end{bmatrix}$ and $\mathbf{b} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$.

1. Show that $A\mathbf{x} = \mathbf{b}$ is inconsistent

2. (a) Use *Mathematica* to find an orthogonal basis for $\text{col}(A)$

   (b) Use the Orthogonal Decomposition Theorem to find $\hat{\mathbf{b}}$, the projection of $\mathbf{b}$ onto $\text{col}(A)$

   (c) Verify that $\mathbf{z} = \mathbf{b} - \hat{\mathbf{b}}$ is orthogonal to both columns of A.

3. Solve $A\mathbf{x} = \hat{\mathbf{b}}$