

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

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  $A\mathbf{x} = \hat{\mathbf{b}}$