Let $A=\left[\begin{array}{rr}-1 & 2 \\ 2 & -3 \\ -1 & 3\end{array}\right]$ and let $\mathbf{b}=\left[\begin{array}{l}4 \\ 1 \\ 2\end{array}\right]$.
a. Show that the equation $A \mathbf{x}=\mathbf{b}$ has no solutions.
b. Find a basis for $\operatorname{Col} A$.
c. Find an orthogonal basis for $\operatorname{Col} A$. (Hint: Use Gram-Schmidt.)
d. Compute $\operatorname{proj}_{\operatorname{Col} A} \mathbf{b}$. Recall that this vector, $\hat{\mathbf{b}}$, is the closest vector in $\operatorname{Col} A$ to $\mathbf{b}$.
e. Compute the matrix $A^{T} A$ and the vector $A^{T} \mathbf{b}$.

