Name: _____

Directions: Show all work. No credit for answers without work.

1. **[2 parts, 2 points each]** Let $A = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ and let $\mathbf{x}_0 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$.

   (a) Apply the power method to compute $\mathbf{x}_k$ and μ_k for $0 \leq k \leq 3$.

   (b) Note that $\mathbf{x}_k$ is not approaching the direction of an eigenvector of A. Why does this not contradict the power method?

2. **[4 points]** Given $\mathbf{y}$ and $\mathbf{v}$ below, decompose $\mathbf{y}$ as $\mathbf{y} = c\mathbf{v} + \mathbf{z}$ where c is a scalar and $\mathbf{z} \cdot \mathbf{v} = 0$.

$$\mathbf{y} = \begin{bmatrix} 2 \\ 2 \\ 1 \end{bmatrix} \qquad \mathbf{v} = \begin{bmatrix} -3 \\ 1 \\ -2 \end{bmatrix}$$

3. **[2 points]** Let $W = \text{Span}\{\mathbf{v}_1, \ldots, \mathbf{v}_p\}$. Prove that if $\mathbf{z} \cdot \mathbf{v}_i = 0$ for $1 \leq i \leq p$, then $z \in W^{\perp}$.