Math 314: Linear Algebra Spring 2006 Name _____

Basic rules:

1. (*10 points*) Consider the vectors $\mathbf{a} = [1, 2, 5, 0, 9]$ and $\mathbf{b} = [0, 1, -1, 0, 0]$.
   (a) Compute the length of $\mathbf{a}$.

   (b) Compute the dot product between $\mathbf{a}$ and $\mathbf{b}$.

   (c) Compute the $\text{proj}_{\mathbf{b}}(\mathbf{a})$.

   (d) Compute $\cos\theta$ where θ is the angle between $\mathbf{a}$ and $\mathbf{b}$.

   (e) Find a vector $\mathbf{c}$ orthogonal to $\mathbf{a}$.

2. (*10 points*) Let $\mathbf{u}$, $\mathbf{w}$ and $\mathbf{v}$ three vectors. Assume that $\mathbf{u} \cdot \mathbf{v} = \mathbf{u} \cdot \mathbf{w}$ can we conclude that $\mathbf{v} = \mathbf{w}$? (If yes, give a proof; if no give a counterexample).

3. (*10 points*) Assume that $\mathbf{u}$ is orthogonal to $\mathbf{v}$ and $\mathbf{w}$
   (a) prove that $\mathbf{u}$ is orthogonal to $\mathbf{v} + \mathbf{w}$,

   (b) prove that $\mathbf{u}$ is orthogonal to $s\mathbf{v} + t\mathbf{w}$, where s and t are two scalars.