Math 211 Cross Product Practice

1. You are looking at a map. A vector $\mathbf{u}$ with $||\mathbf{u}|| = 8$ is pointing north on the map, and a vector $\mathbf{v}$ with $||\mathbf{v}|| = 2$ is pointing northeast.
   a. The crossproduct $\mathbf{u} \times \mathbf{v}$ points in which direction?
   b. What is the magnitude $||\mathbf{u} \times \mathbf{v}||$ ?

2. If $\mathbf{a} = \mathbf{i} + 9\mathbf{j} + \mathbf{k}$ and $\mathbf{b} = \mathbf{i} + 18\mathbf{j} + \mathbf{k}$, find a unit vector that is orthogonal to both $\mathbf{a}$ and $\mathbf{b}$ and that has a positive first coordinate.

3. Are the following statements true or false? Explain.
   a. If $\mathbf{v}$ and $\mathbf{w}$ are any two vectors, then $||\mathbf{v} + \mathbf{w}|| = ||\mathbf{v}|| + ||\mathbf{w}||$.
   b. The value of $\mathbf{v} \cdot (\mathbf{v} \times \mathbf{w})$ is always zero.
   c. For any scalar $c$ and any vector $\mathbf{v}$, we have $||c\mathbf{v}|| = c||\mathbf{v}||$.
   d. $(\mathbf{i} \times \mathbf{j}) \cdot \mathbf{k} = \mathbf{i} \cdot (\mathbf{j} \times \mathbf{k})$. 

Adapted from Active Calculus by S. Schlicker, D. Austin, and M. Boelkins