Last name: *First name:*

Recommended problems - *Please do NOT turn these in*:

- §3.3: 3c, 5c, 13, 19, 27, 29.
- §3.4: 1b, 3a, 15, 21a, 37

Submitted problems: *Please turn these problems in*:

(1) Let $\mathbf{u} = (3, -2, 0)$, $\mathbf{v} = (1, -1, -2)$ and $\mathbf{w} = (0, 1, 1)$ be vectors in 3-space.
   (a) Evaluate the expressions if possible. If not, explain why the expression cannot be evaluated.
      - $\|\mathbf{w}\| + \mathbf{u} \cdot \mathbf{v}$.
      - $\mathbf{u} \cdot (\mathbf{v} \times \mathbf{w})$.
      - $\mathbf{u} \cdot (\mathbf{v} \cdot \mathbf{w})$.
      - $\mathbf{u} \times (\mathbf{v} \times \mathbf{w})$.
   (b) Find the angle between $\mathbf{u}$ and $\mathbf{v}$.
   (c) Give an example of two vectors that are both orthogonal to $\mathbf{u}$ – answers may vary.
   (d) Find $proj_{\mathbf{v}}\mathbf{w}$ and the vector component of $\mathbf{w}$ orthogonal to $\mathbf{v}$.

(2) Let $\mathbf{u} = (1, -3, 0, k)$ and $\mathbf{v} = (k, 1, -3, 2)$
   (a) For which value of k are $\mathbf{u}$ and $\mathbf{v}$ orthogonal?
   (b) Assuming that $k = 2$, find $proj_{\mathbf{v}}\mathbf{u}$ and the vector component of $\mathbf{u}$ orthogonal to $\mathbf{v}$.

(3) Indicate whether the statement is always true or sometimes false. Justtify your answer with a logical argument or a counter-example.

   Let $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w}$ be vectors in $\mathbb{R}^3$ and assuming that $\mathbf{w} \neq \mathbf{0}$.

   (a) If $\mathbf{u} \cdot \mathbf{w} = \mathbf{v} \cdot \mathbf{w}$, then $\mathbf{u} = \mathbf{v}$.

   (b) If $\mathbf{u} \times \mathbf{w} = \mathbf{v} \times \mathbf{w}$, then $\mathbf{u} = \mathbf{v}$.

(4) Prove the identity $(\mathbf{u} + k\mathbf{v}) \times \mathbf{v} = \mathbf{u} \times \mathbf{v}$.