COMPONENTS AND PROJECTIONS

(1-5) In each of the problems below, you are given a force vector $\vec{F}$ and a distance vector $\vec{d}$. Suppose the magnitude of $\vec{F}$ corresponds to the number of pounds of force and the magnitude of $\vec{d}$ corresponds to a distance in feet that an object is moved by the force. For each of the problems below find $comp_{\vec{d}}\vec{F}$, $proj_{\vec{d}}\vec{F}$, and the work done by $\vec{F}$ in moving the object the length of $\vec{d}$. Give exact answers, and on the latter, use units of *foot-pounds*.

1. $\vec{F} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{d} = 2\hat{i} + 2\hat{j} + 5\hat{k}$

2. $\vec{F} = 3\hat{i} + \hat{j} + 4\hat{k}$, $\vec{d} = 8\hat{i} + 2\hat{j} + 6\hat{k}$

3. $\vec{F} = 3\hat{i} + 2\hat{j}$, $\vec{d} = 10\hat{i}$

4. $\vec{F} = \hat{i} + \hat{j}$, $\vec{d} = 5\hat{i} + \hat{j}$

5. $\vec{F} = 2\hat{i} + 2\hat{j} + 2\hat{k}$, $\vec{d} = 2\hat{i} + 2\hat{j} + 2\hat{k}$

6. Find the component of $\vec{v} = 4\hat{i} + 5\hat{j} + 6\hat{k}$ in the direction of the unit vector (a) $\hat{i}$, (b) $\hat{j}$, (c) $\hat{k}$, and (d) $\vec{u} = \frac{\sqrt{3}}{2}\hat{i} + \frac{1}{2}\hat{j}$.

7. Explain why the triangle inequality, $\|\vec{u} + \vec{v}\| \le \|\vec{u}\| + \|\vec{v}\|$, is true for the diagram below. (NOTE: The triangle inequality is also true for all real numbers *a* and *b*.)