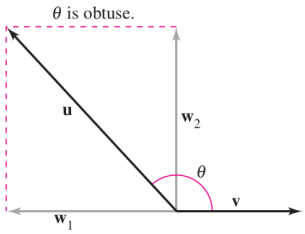
Problems.

1. Suppose $\mathbf{u}$ and $\mathbf{v}$ are two nonzero vectors configured as in the following figure:



Prove that

$$\text{proj}_{\mathbf{v}}\,\mathbf{u} = \left(\frac{\mathbf{v}\cdot\mathbf{u}}{\|\mathbf{v}\|^2}\right)\mathbf{v}$$

2. Use the dot product to verify that $\mathbf{u} - \text{proj}_{\mathbf{v}}\,\mathbf{u}$ is orthogonal to $\mathbf{v}$. (Recall that two non-zero vectors are orthogonal if and only their dot product equals zero.)