6.1.9 Find the unit vector in the direction of the vector $\mathbf{u} = \begin{bmatrix} -30 \\ 40 \end{bmatrix}$. Also find a basis for the set of vectors $\mathbf{v}$ orthogonal to $\mathbf{u}$.

6.1.19c True or false: If the distance from $\mathbf{u}$ to $\mathbf{v}$ equals the distance from $\mathbf{u}$ to $-\mathbf{v}$, then $\mathbf{u}$ and $\mathbf{v}$ are orthogonal. Justify.

Consider
$$\mathbf{v} = \begin{bmatrix} 7 \\ 2 \end{bmatrix}, \qquad \mathbf{u}_1 = \begin{bmatrix} 1 \\ -1 \end{bmatrix}, \qquad \mathbf{u}_2 = \begin{bmatrix} 2 \\ 2 \end{bmatrix}.$$

Note that $\mathbf{u}_1$ and $\mathbf{u}_2$ are orthogonal. For each $\mathbf{u}_i$, compute $\frac{\mathbf{u}_i \cdot \mathbf{v}}{\mathbf{u}_i \cdot \mathbf{u}_i}$ Also find v as a linear combination of $\mathbf{u}_1, \mathbf{u}_2$.