(1) Let $\vec{u}$ and $\vec{v}$ be any two vectors with $\vec{u} \neq \vec{0}$. We want to show that we can write

$$\vec{v} = \vec{v}_{\|} + \vec{v}_{\perp},$$

where $\vec{v}_{\|}$ is parallel to $\vec{u}$, and $\vec{v}_{\perp}$ is orthogonal to $\vec{u}$.

(a) How can you express algebraically (*i.e.*, in terms of vector operations) that $\vec{v}_{\|}$ is parallel to $\vec{u}$?

(b) How can you express algebraically that $\vec{v}_{\perp}$ is orthogonal to $\vec{u}$?

(c) Use your answers to (a) and (b) to find a formula for $\vec{u} \cdot \vec{v}$.

(d) Use your answers to (a) and (c) to find a formula for $\vec{v}_{\|}$.

(e) Use your answer to (d) to show that $\vec{u}$ is orthogonal to $\vec{v} - \vec{v}_{\|}$.

• **Eleven** book problems: #11.3.15, 22, 24, 29, 30, 42, 44, 47, 56, 71, 73. For #11.3.42, you know $\text{proj}_{\overrightarrow{OA}}\, \vec{w}$, where $\vec{w}$ is the weight of the load. How can you use it to find $\|\vec{w}\|$? For #11.3.73, you will need the formula for work on p. 789.