Problem: Write $\vec{a}$ as a sum of two vectors. One which is parallel to $\vec{b}$ or the other which is perpendicular to $\vec{b}$.

Say $\vec{b} = \hat{i}$ and $\vec{a} = (a_1, a_2)$

$$\vec{a} = a_1 \hat{i} + a_2 \hat{j}$$

parallel to $\hat{i}$ \hspace{2cm} \text{perpendicular to} \hat{j}$

In general

$$\vec{a} = \vec{u} + \vec{v}$$

parallel to $\vec{b}$ \hspace{2cm} \text{perpendicular to} \vec{b}$

Note: $\vec{u}$ is the projection of $\vec{a}$ onto $\vec{b}$. 