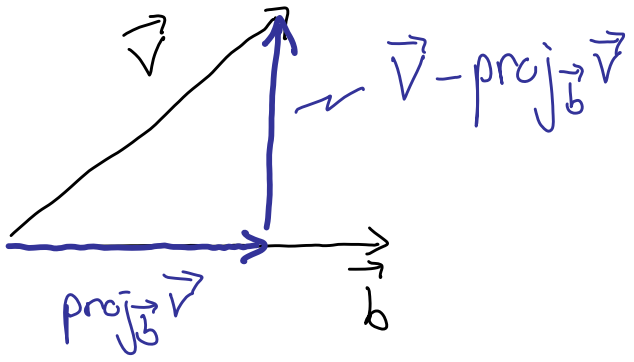
11.3 #8



$\vec{v} = \langle 1, 2, 3 \rangle$

$\vec{b} = \langle -2, 4, -1 \rangle$

$$\text{proj}_{\vec{b}}\vec{v} = \frac{\vec{v}\cdot\vec{b}}{\|\vec{b}\|^2}\vec{b} = \frac{-2+8-3}{4+16+1}\langle -2, 4, -1 \rangle = \left\langle \frac{-2}{7}, \frac{4}{7}, \frac{-1}{7} \right\rangle$$

$$\vec{v} - \text{proj}_{\vec{b}}\vec{v} = \langle 1, 2, 3 \rangle - \left\langle \frac{-2}{7}, \frac{4}{7}, \frac{-1}{7} \right\rangle = \left\langle \frac{9}{7}, \frac{10}{7}, \frac{22}{7} \right\rangle$$

So $\vec{v} = \underbrace{\left\langle \frac{-2}{7}, \frac{4}{7}, \frac{-1}{7} \right\rangle}_{\text{parallel to } \vec{b}} + \underbrace{\left\langle \frac{9}{7}, \frac{10}{7}, \frac{22}{7} \right\rangle}_{\text{perpendicular to } \vec{b}}$