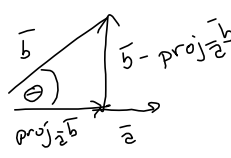


35-40 Find the scalar and vector projections of **b** onto **a**.

36. $\mathbf{a} = \langle 1, 2 \rangle$, $\mathbf{b} = \langle -4, 1 \rangle$

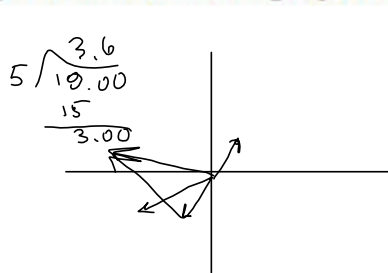


$$\text{comp}_{\vec{a}} \vec{b} = \|\vec{b}\| \cos \theta = \|\vec{b}\| \frac{\vec{a} \cdot \vec{b}}{\|\vec{a}\| \|\vec{b}\|} = \frac{\vec{a} \cdot \vec{b}}{\|\vec{a}\|}$$

$$= \frac{\langle 1, 2 \rangle \cdot \langle -4, 1 \rangle}{\sqrt{1^2 + 2^2}} = \frac{-4 + 2}{\sqrt{5}} = \frac{-2}{\sqrt{5}} = \text{comp}_{\vec{a}} \vec{b}$$

$$\text{proj}_{\vec{a}} \vec{b} = \frac{\vec{a} \cdot \vec{b}}{\|\vec{a}\|^2} \vec{a} = \frac{-2}{(\sqrt{5})^2} \langle 1, 2 \rangle = \left\langle -\frac{2}{5}, -\frac{4}{5} \right\rangle = \text{proj}_{\vec{a}} \vec{b}$$

42. For the vectors in Exercise 36, find $\text{orth}_{\vec{a}} \vec{b}$ and illustrate by drawing the vectors **a**, **b**, $\text{proj}_{\vec{a}} \vec{b}$, and $\text{orth}_{\vec{a}} \vec{b}$.



$$\vec{b} - \text{proj}_{\vec{a}} \vec{b} = \langle -4, 1 \rangle - \left\langle -\frac{2}{5}, -\frac{4}{5} \right\rangle$$

$$= \left\langle \frac{-20+2}{5}, \frac{5+4}{5} \right\rangle = \left\langle -\frac{18}{5}, \frac{9}{5} \right\rangle$$

$$= \left\langle -3.6, 1.8 \right\rangle = \text{orth}_{\vec{a}} \vec{b}$$

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

