

Instructions: Show all work. Use exact answers unless otherwise asked to round.

1. Given the vectors $\vec{u} = \begin{bmatrix} 1 \\ 3 \\ -4 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} 2 \\ -5 \\ 1 \end{bmatrix}$ find the following.

a. $\mathbf{u} \cdot \mathbf{v}$

$$1(2) + 3(-5) - 4(1) = 2 - 15 - 4 = -17$$

b. The distance between \mathbf{u} and \mathbf{v} .

$$\vec{u} - \vec{v} = \begin{bmatrix} -1 \\ 8 \\ -5 \end{bmatrix} \quad \|\vec{u} - \vec{v}\| = \sqrt{1 + 64 + 25} = \sqrt{90} = 3\sqrt{10}$$

c. A unit vector in the direction of \mathbf{v} .

$$\|\vec{v}\| = \sqrt{4 + 25 + 1} = \sqrt{30}$$

$$\hat{\mathbf{v}} = \begin{bmatrix} 2/\sqrt{30} \\ -5/\sqrt{30} \\ 1/\sqrt{30} \end{bmatrix}$$

d. Are \mathbf{u} and \mathbf{v} orthogonal? Why or why not?

no, they are not orthogonal

$$\text{Since } \vec{u} \cdot \vec{v} \neq 0$$