

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

1. Use $\vec{u} = \langle 2, -1, 3 \rangle$, $\vec{v} = \langle -1, 4, 0 \rangle$ to find the following:

a. Find $\vec{u} \cdot \vec{v}$

$$2(-1) + (-1)4 + 3(0) = -2 - 4 = -6$$

b. The angle between $\vec{u}$ and $\vec{v}$.

$$\cos \theta = \frac{-6}{\sqrt{14}\sqrt{17}}$$

$$\|\vec{u}\| = \sqrt{4+1+9} = \sqrt{14}$$

$$\|\vec{v}\| = \sqrt{1+16+0} = \sqrt{17}$$

$$\theta = 112.9^\circ \text{ or } 1.97... \text{ radians}$$

c. Are the two vectors orthogonal? Why or why not?

They are not. the dot product is not 0.

2. Given the vectors $\vec{u} = \langle -1, 2, 3 \rangle$, $\vec{v} = \langle 3, 0, 1 \rangle$, find the following:

a. $\vec{u} \times \vec{v}$

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -1 & 2 & 3 \\ 3 & 0 & 1 \end{vmatrix} = (2-0)\hat{i} - (-1-9)\hat{j} + (0-6)\hat{k} \\ = \langle 2, 10, -6 \rangle$$

b. $\|\vec{u} \times \vec{v}\|$

$$= \sqrt{4 + 100 + 36} = \sqrt{140}$$