

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

1. Use $\vec{u} = \langle 2, -3, 1 \rangle$, $\vec{v} = \langle 1, 4, -5 \rangle$ to find the following.

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

$$2 - 12 - 5 = -10 - 5 = -15$$

- b. Find the angle between \vec{u} and \vec{v}

$$\cos \theta = \frac{-15}{\sqrt{14} \sqrt{42}}$$

$$\theta = 2.2377... \text{ radians} \\ \approx 128.2^\circ$$

$$\|\vec{v}\| = \sqrt{1+16+25} = \sqrt{42}$$

- c. Find $\vec{u} \times \vec{v}$

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -3 & 1 \\ 1 & 4 & -5 \end{vmatrix} = (15-4)\hat{i} - (-10-1)\hat{j} + (8+3)\hat{k} \\ \langle 11, -11, 11 \rangle$$

2. Use $\vec{u} = \langle 5, 1 \rangle$, $\vec{v} = \langle 1, -3 \rangle$ to find the following.

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

$$5 - 3 = 2$$

- b. Find the angle between \vec{u} and \vec{v}

$$\cos \theta = \frac{2}{\sqrt{26} \sqrt{10}}$$

$$\theta = 1.446... \text{ radians} \\ \approx 82.9^\circ$$