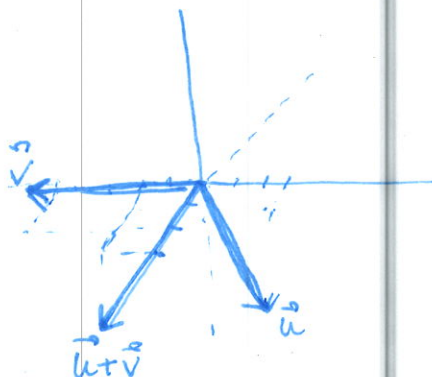


**Instructions:** Show all work. Use exact answers unless otherwise asked to round.

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

- a. Find  $\vec{u} + \vec{v}$ , then graph  $\vec{u}$ ,  $\vec{v}$  and  $\vec{u} + \vec{v}$  on the same graph.

$$\vec{u} + \vec{v} = \langle 1, 3, -4 \rangle + \langle 2, -5, 1 \rangle = \langle 3, -2, -3 \rangle$$



- b.  $\|\vec{u}\|$

$$= \sqrt{1 + 9 + 16} = \sqrt{26}$$

- c. Write a unit vector in the direction of  $\vec{u}$

$$\left\langle \frac{1}{\sqrt{26}}, \frac{3}{\sqrt{26}}, \frac{-4}{\sqrt{26}} \right\rangle$$

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

$$2 - 15 - 4 = -17$$

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

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

$$\cos^{-1} \left( \frac{-17}{\sqrt{26} \sqrt{30}} \right) = 2.225 \text{ radians} \\ = 127.5^\circ$$

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

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 3 & -4 \\ 2 & -5 & 1 \end{vmatrix} = (3 - 20)\hat{i} - (1 + 8)\hat{j} + (-5 - 6)\hat{k} \\ = -17\hat{i} - 9\hat{j} - 11\hat{k}$$

