

Vector Applications

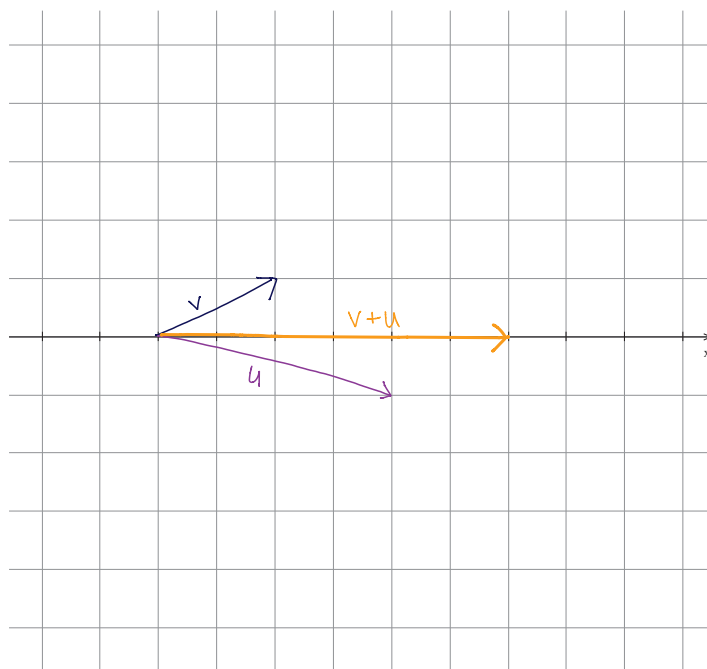
Name Solutions

- 1) Find the length and direction of $\mathbf{u} + \mathbf{v}$ given the vectors $\mathbf{v} = \langle 2, 1 \rangle$ and $\mathbf{u} = \langle 4, -1 \rangle$. Sketch all three vectors on the grid below.

$$\mathbf{v} + \mathbf{u} = \langle 2+4, 1-1 \rangle$$

$$= \langle 6, 0 \rangle$$

notice
no vertical
change so
this vector
will have
a horizontal
direction



- 2) Zack and Brian are paddling a boat across Lake Merced on a windy day that has created an east bound current of 6 mph. They are rowing the boat due north at 10 mph but the current is pushing their boat off course. How fast and in what direction are they actually traveling?

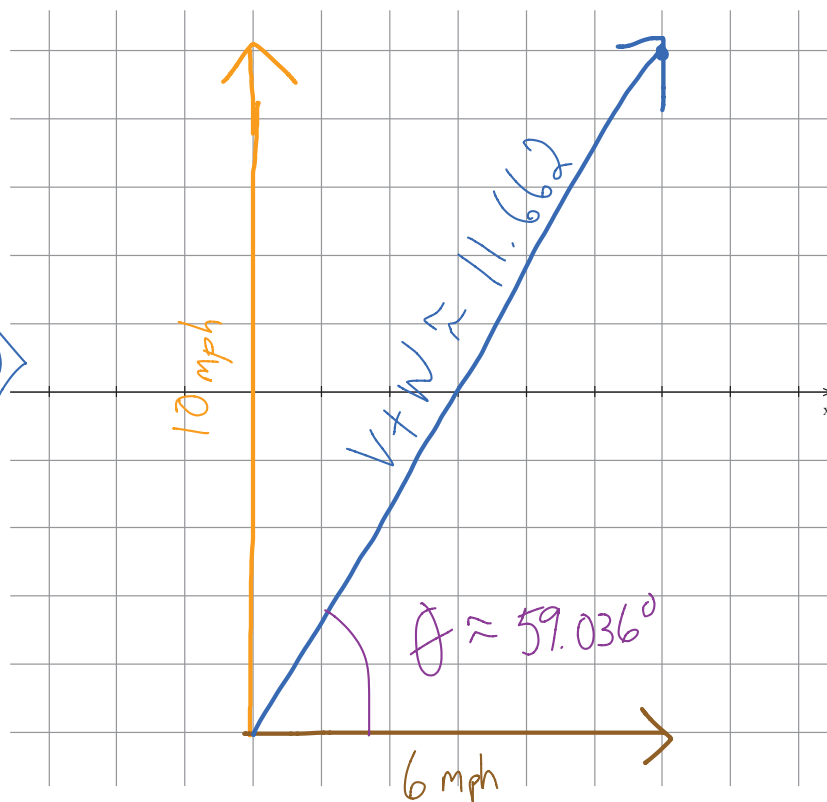
$$\vec{V} = \langle 10 \cos 90, 10 \sin 90 \rangle$$

$$\vec{W} = \langle 6 \cos 0, 6 \sin 0 \rangle$$

$$\vec{V} + \vec{W} = \langle 10 \cos 90 + 6 \cos 0, 10 \sin 90 + 6 \sin 0 \rangle$$

$$\vec{V} + \vec{W} = \langle 6, 10 \rangle$$

$$|\vec{V} + \vec{W}| = \text{speed} = \sqrt{6^2 + 10^2} = \sqrt{136} \approx$$



$$\theta = \cos^{-1} \left(\frac{x_{V+W}}{|V+W|} \right) = \cos^{-1} \left(\frac{6}{11.662} \right) \approx 59.036^\circ$$

- 3) Cian and Ana are taking flying lessons. They are flying 70° north of east at a speed of 400 mph when they get into an argument over who should be pilot and who should be co-pilot. As they argue, they fail to notice that a wind blowing 65 mph in a direction of 123° is affecting their speed and direction. In what direction and at what speed is the plane actually travelling?

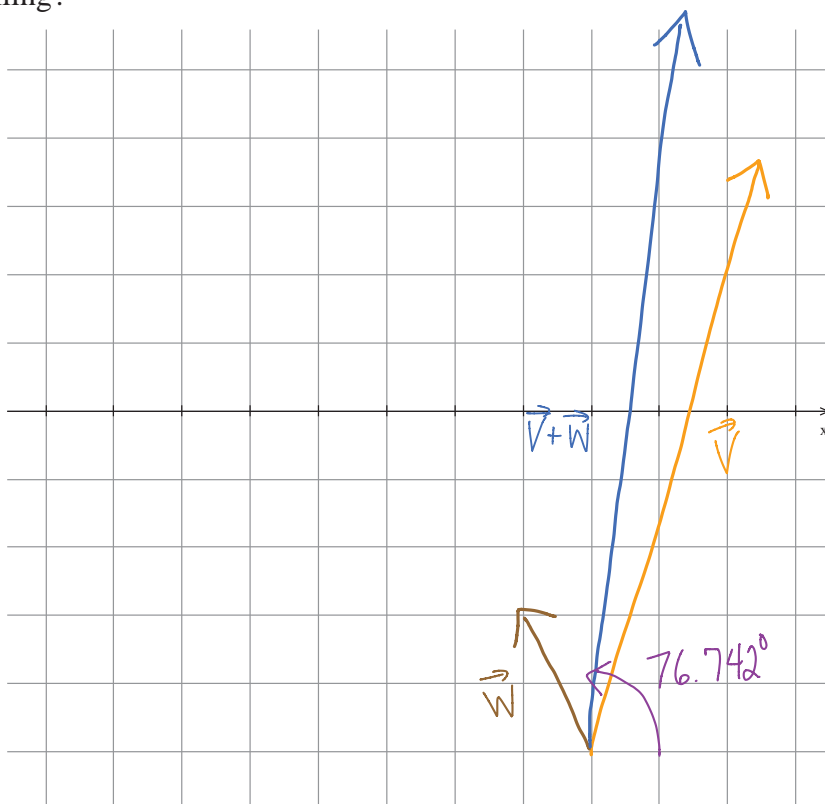
$$\vec{V} = \langle 400 \cos 70, 400 \sin 70 \rangle$$

$$\vec{W} = \langle 65 \cos 123, 65 \sin 123 \rangle$$

$$\vec{V} + \vec{W} = \langle 101.407, 430.391 \rangle$$

$$|\vec{V} + \vec{W}| \approx 442.176$$

$$\theta = \cos^{-1} \left(\frac{x_{V+W}}{|V+W|} \right) = \cos^{-1} \left(\frac{101.407}{442.176} \right) \approx 76.742^\circ$$



- 4) After Cian and Ana get lost, Maria and Claudia have to go find them and escort them back to the airport. Because they had already travelled 75 miles south west in a direction of 223° from the airport when they get the distress call, they had to turn and head due north for 90 miles to catch up to Cian and Ana. How far from the airport and in what direction are they when they finally catch up to Cian and Ana?

$$V = \langle 75 \cos 223, 75 \sin 223 \rangle$$

$$u = \langle 90 \cos 90, 90 \sin 90 \rangle$$

$$V + u = \langle -54.852, 38.850 \rangle$$

$$|V + u| = 67.216$$

$$\theta = \cos^{-1} \left(\frac{x_{V+u}}{|V+u|} \right) = \cos^{-1} \left(\frac{-54.852}{67.216} \right)$$

$$\theta = 144.691^\circ$$

