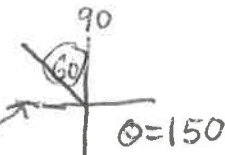


6.12 Apps of Vectors Day 2: Notes

Date: _____



Ex 1: To reach a destination, a pilot is plotting a course that will result in a velocity of 450 miles per hour at an angle of N60°W. The wind is blowing 50 miles per hour to the north. Find the direction and speed the pilot should set to achieve the desired resultant.

$$\vec{p} + \vec{w} = \vec{r}$$

$$\vec{p} = \vec{r} - \vec{w}$$

$$\vec{r} = \langle 450 \cos 150, 450 \sin 150 \rangle$$

$$-\vec{w} = \langle 0, 50 \rangle$$

$$\vec{p} = \langle -389.711, 175 \rangle$$

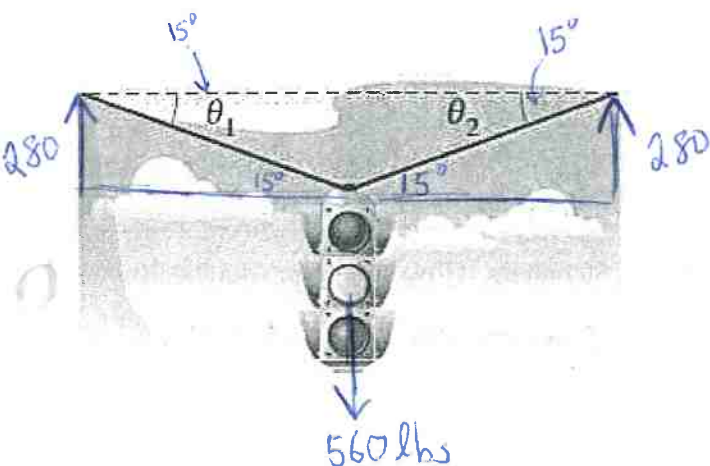
speed $|\vec{p}| = \sqrt{389.711^2 + 175^2}$

$\approx 427.200 \text{ mph}$

$\theta = \tan^{-1}\left(\frac{175}{-389.711}\right)$

Q2 $-24.182 + 180 =$

Ex 2: A traffic light at an intersection is hanging from two wires of equal length at 15° below the horizontal as shown. If the traffic light weighs 560 pounds, what is the tension in each wire keeping the light at equilibrium?



* use $\sin \theta = \frac{\text{opp}}{\text{hyp}}$

$$\sin 15 = \frac{280}{|\vec{T}|}$$

$$\frac{\sin 15}{1} = \frac{280}{|\vec{T}|}$$

$$|\vec{T}| \sin 15 = 280$$

$$|\vec{T}| = \frac{280}{\sin 15}$$

$|\vec{T}| = 1081.837 \text{ lbs}$

6.12 Applications of Vectors Practice Day 2

1. Anne and Mike are lifting a stone statue and moving it to a new location in their garden. Anne is pushing the statue with a force of 120 newtons at a 60° angle while Mike is pulling the statue with a force of 180 newtons at a 40° angle. What is the magnitude of the combined force they exert on the statue?

$$\vec{A} + \vec{M} = \vec{r}$$

$$\vec{A} = \langle 120 \cos 60, 120 \sin 60 \rangle$$

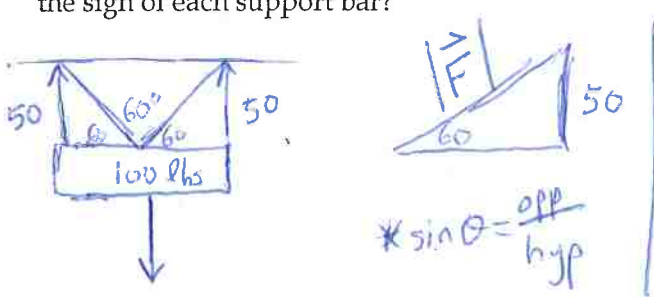
$$+ \vec{M} = \langle 180 \cos 40, 180 \sin 40 \rangle$$

$$\vec{r} = \langle 197.888, 219.625 \rangle$$

$|\vec{r}| = \sqrt{197.888^2 + 219.625^2}$

$= 295.626 \text{ N}$

2. Dr. Smith is hanging a sign for her medical practice that will be held by two support bars. If the bars make a 60° angle with each other and the sign weighs 100 pounds, what are the magnitudes of the forces exerted by the sign of each support bar?



* $\sin \theta = \frac{\text{opp}}{\text{hyp}}$

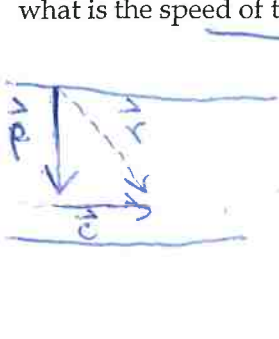
$$\frac{\sin 60}{1} = \frac{50}{|F|}$$

$$|F| \sin 60 = 50$$

$$|F| = \frac{50}{\sin 60}$$

$|F| = 57.735 \text{ lbs}$

3. A person in a canoe wants to cross a 65-foot-wide river. He begins to paddle straight across the river at 1.2 m/s while a current is flowing perpendicular to the canoe. If the resulting velocity of the canoe is 3.2 m/s, what is the speed of the current to the nearest tenth?



$$\vec{p} + \vec{c} = \vec{r}$$

$$\vec{p} = \langle 0, 1.2 \rangle$$

$$\vec{c} = \langle c, 0 \rangle$$

$$\vec{r} = \langle c, 1.2 \rangle$$

$$p^2 + c^2 = r^2$$

$$c^2 = r^2 - p^2$$

$$c^2 = 3.2^2 - 1.2^2$$

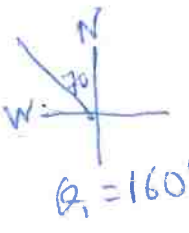
$$c^2 = 8.8$$

$c = 2.966 \text{ m/s}$

4. Kristin walks N70°W for 200 meters. She then walks due east for 90 meters. How far and at what bearing is Kristin from her starting point?

$$\vec{p}_1 = \langle 200 \cos 160, 200 \sin 160 \rangle$$

$$\vec{p}_2 = \langle 90, 0 \rangle$$

$$* \vec{p}_1 + \vec{p}_2 = \vec{r}$$


$$\theta = 160^\circ$$

$$\vec{r} = \langle -97.939, 68.404 \rangle$$

$$|\vec{r}| = \sqrt{97.939^2 + 68.404^2} = 119.462 \text{ m}$$

$$\theta = \tan^{-1} \left(\frac{68.404}{-97.939} \right) = -34.932^\circ$$

+180

$$\theta = 145.068^\circ$$

bearing is 304.932°

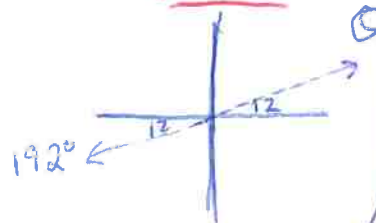
5. A pilot needs to plot a course that will result in a velocity of 500 miles per hour in a direction of due west. If the wind is blowing 100 miles per hour from 192°, find the direction and the speed the pilot should set to achieve this resultant.

$$\vec{p} + \vec{w} = \vec{r}$$

$$\vec{p} = \vec{r} - \vec{w}$$

$$\vec{r} = \langle -500, 0 \rangle$$

$$\vec{w} = \langle 100 \cos 12, 100 \sin 12 \rangle$$

$$\vec{p} = \langle -597.815, -20.791 \rangle$$


$$\theta = 12^\circ$$

$$|\vec{p}| = \sqrt{597.815^2 + 20.791^2} = 598.176 \text{ mph}$$

$$\theta = \tan^{-1} \left(\frac{-20.791}{-597.815} \right) = 1.992^\circ$$

+180

$\theta = 181.992^\circ$