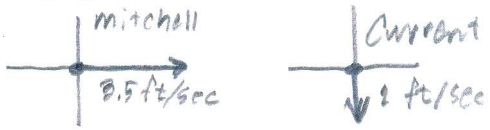
Vector Applications I

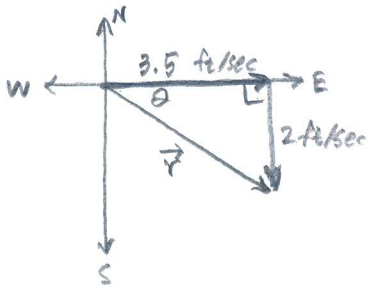
Name Fulton

1. Mitchell swims due east at a speed of 3.5 feet per second across a river directly toward the opposite bank. At the same time, the current of the river is carrying him due south at a rate of 2 feet per second.

(a) Find Mitchell's resultant speed.

(b) Find Mitchell's bearing relative to the shore.





$\vec{r} = 3.5\langle \cos 0°, \sin 0° \rangle + 2\langle \cos 270°, \sin 270° \rangle$

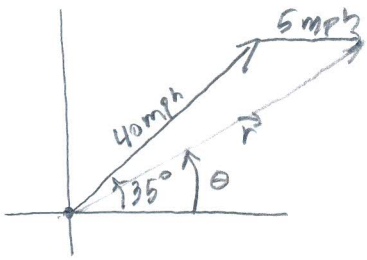
$\vec{r} = \langle 3.5, -2 \rangle$

$\|\vec{r}\| = \sqrt{3.5^2 + 2^2} = \boxed{4.03 \text{ ft/sec}}$ (a)

$\theta' = \tan^{-1}\left(\frac{-2}{3.5}\right) = 29.74°$

$\boxed{E\ 29.74°\ S}$

2. While playing golf, Anna hits a ball at a speed of 40 mph. The bearing of the ball's path is $E35^0N$. At the time, a 5 mph wind is blowing due east. Find the resulting speed and direction of Anna's ball.



$\vec{r} = 40\langle \cos 35°, \sin 35° \rangle + 5\langle \cos 0°, \sin 0° \rangle$

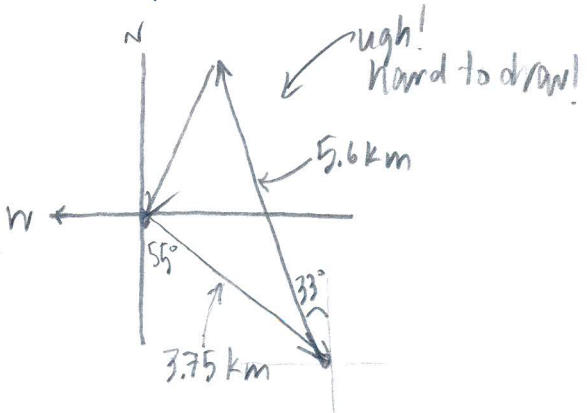
$\vec{r} = \langle 37.77, 22.94 \rangle$

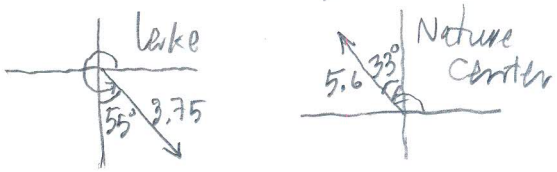
$\|\vec{r}\| = \sqrt{37.77^2 + 22.94^2} = \boxed{44.19 \text{ mph}}$

$\theta' = \tan^{-1}\left(\frac{22.94}{37.77}\right) = 31.27°$

$\boxed{E\ 31.27°\ N}$

3. Joe and Sally hiked 3.75 kilometers to a lake located $S55^0E$ of their campsite. Then they hiked $N33^0W$ to the nature center which was 5.6 kilometers from the lake. Where is the nature center in relation to their campsite? That is, what is the distance and direction ~~from~~ to the nature center ~~to~~ from their campsite?





$\vec{r} = 3.75\langle \cos 325°, \sin 325° \rangle + 5.6\langle \cos 123°, \sin 123° \rangle$

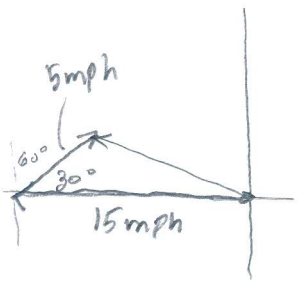
$\vec{r} = \langle 0.02, 2.55 \rangle$

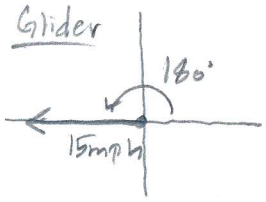
$\|\vec{r}\| = \sqrt{0.02^2 + 2.55^2} = \boxed{2.55 \text{ km}}$

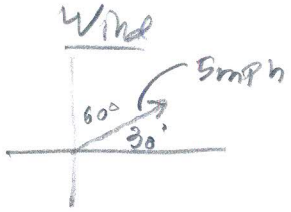
$\theta' = \tan^{-1}\left(\frac{2.55}{0.02}\right) = 89.55°$

$\boxed{E\ 89.55°\ N}$

4. A glider is traveling at an air speed of 15 mph due west. If the wind is blowing at 5 mph with a bearing of $N60^0E$, what is the resulting speed of the glider?





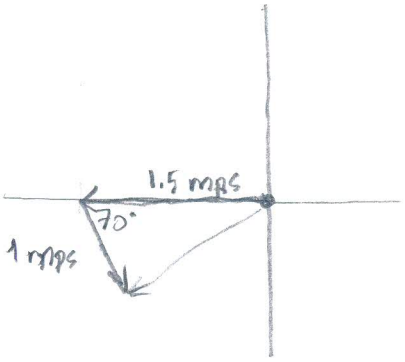


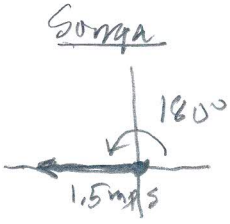
$\vec{r} = 15\langle \cos 180^\circ, \sin 180^\circ \rangle + 5\langle \cos 30^\circ, \sin 30^\circ \rangle$

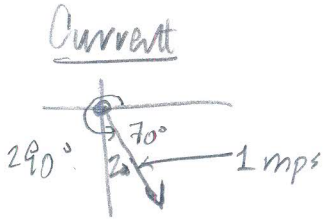
$\vec{r} = \langle -10.67, 2.5 \rangle$

$\|\vec{r}\| = 10.96$ mph

5. Sonya is swimming due west at a rate of 1.5 meters per second. A strong current is flowing $S20^0E$ at a rate of 1 meter per second. Find Sonya's resulting speed and bearing.







$\vec{r} = 1.5\langle \cos 180^\circ, \sin 180^\circ \rangle + 1\langle \cos 290^\circ, \sin 290^\circ \rangle$

$\vec{r} = \langle -1.16, -0.94 \rangle$

$\|\vec{r}\| = 1.49$ mps

$\theta' = \tan^{-1}\left(\frac{-0.94}{-1.16}\right) = 39.02^\circ$

W 39.02° S