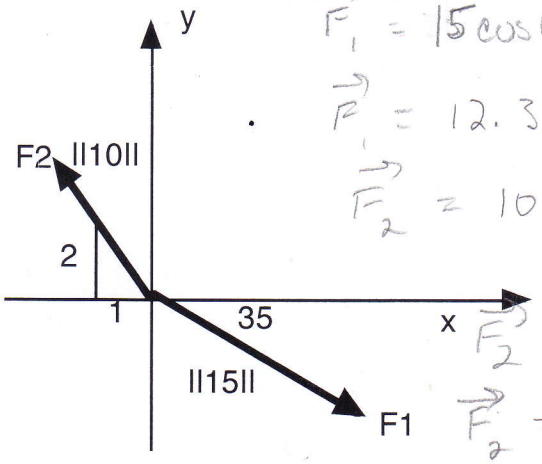
Mac 2313 Quiz 3 Name DeVore
Calculus III

1. The diagram below shows to force vectors, **F1** and **F2**. **F1** has a magnitude of 15 and makes an angle of 35° with the x-axis. **F2** has a magnitude of 10 and points in the direction of the vector $-\hat{i}+2\hat{j}$. Find the sum of the two vectors, **F1** and **F2**. Give your answer as a vector in component form.



$\vec{F_1} = 15\cos(35^\circ)\hat{i} - 15\sin(35^\circ)\hat{j}$

$\vec{F_1} = 12.3\hat{i} - 8.6\hat{j}$

$\vec{F_2} = 10\left(-\frac{1}{\sqrt{5}}\hat{i} + \frac{2}{\sqrt{5}}\hat{j}\right)$

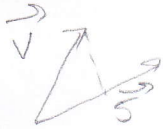
$\vec{F_2} = -\frac{10}{\sqrt{5}}\hat{i} + \frac{20}{\sqrt{5}}\hat{j}$

$\vec{F_2} = -4.5\hat{i} + 8.9\hat{j}$

$\vec{F_1} + \vec{F_2} =$

$7.8\hat{i} + .3\hat{j}$

2. A sail boat is traveling in the direction $\vec{S} = 2\hat{i} - 3\hat{j}$. The wind has a velocity of $\vec{v} = 3\hat{i} + 4\hat{j}$ miles per hour. What is the component of the wind velocity in the direction the sail boat is moving? Give your answer as a vector in component form.



$\vec{u} = \frac{2}{\sqrt{13}}\hat{i} - \frac{3}{\sqrt{13}}\hat{j}$

$\vec{v}\cdot\vec{u} = \frac{6}{\sqrt{13}} - \frac{12}{\sqrt{13}} = -\frac{6}{\sqrt{13}}$

$(\vec{v}\cdot\vec{u})\vec{u} = -\frac{6}{\sqrt{13}}\left(\frac{2}{\sqrt{13}}\hat{i} - \frac{3}{\sqrt{13}}\hat{j}\right)$

$= -\frac{12}{13}\hat{i} + \frac{18}{13}\hat{j}$

3. Find the area of the triangle that is formed by the points A(-1,2,4), B(2,-5,0) and C(3,2,1).

$\vec{AB} = (2-(-1))\hat{i} + (-5-2)\hat{j} + (0-4)\hat{k} = 3\hat{i} - 7\hat{j} - 4\hat{k}$

$\vec{AC} = 4\hat{i} - 3\hat{k}$

$$\vec{AB}\times\vec{AC} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & -7 & -4 \\ 4 & 0 & -3 \end{vmatrix} = \begin{vmatrix} -7 & -4 \\ 0 & -3 \end{vmatrix}\hat{i} - \begin{vmatrix} 3 & -4 \\ 4 & -3 \end{vmatrix}\hat{j} + \begin{vmatrix} 3 & -7 \\ 4 & 0 \end{vmatrix}\hat{k} = 21\hat{i} - 7\hat{j} + 28\hat{k}$$

$-9+16$

$\text{Area} = \frac{1}{2}\|\vec{AB}\times\vec{AC}\| = \frac{1}{2}\sqrt{21^2+7^2+28^2} = \frac{1}{2}\sqrt{1274} \approx \frac{1}{2}(35.7)$

$= 17.85$