NAME: (print!) Fady Besada   **Section:** 22

1. Determine whether the two vectors are orthogonal and if not, whether the angle between them is acute or obtuse. **a.** $\langle 1, 1, 1 \rangle$, $\langle 3, -2, -1 \rangle$.

b. $\langle 4, 3 \rangle$, $\langle 2, -4 \rangle$.

a. $\langle 1,1,1 \rangle \cdot \langle 3,-2,-1 \rangle = 1 \cdot 3 + 1 \cdot (-2) + 1 \cdot (-1) = 3-2-1 = \underline{0}$

The two vectors $\langle 1,1,1 \rangle$ and $\langle 3,-2,-1 \rangle$ are orthogonal.

b. $\langle 4,3 \rangle \cdot \langle 2,-4 \rangle = 4 \cdot 2 + 3 \cdot (-4) = 8-12 = \underline{-4}$

$\cos\theta = A \cdot B / (|A||B|) \Rightarrow \cos\theta = -4 / (\sqrt{25} \cdot \sqrt{20}) \Rightarrow \cos\theta = -4/\sqrt{500}$

$\theta = \cos^{-1}\left(\frac{-4}{\sqrt{500}}\right) \Rightarrow \underline{\theta = 100.3°}$

The two vectors $\langle 4,3 \rangle$ and $\langle 2,-4 \rangle$ are obtuse.

2. Calculate $\mathbf{v} \times \mathbf{w}$, if

$$\mathbf{v} = \langle 0, 1, -1 \rangle , \quad \mathbf{w} = \langle 1, -1, 0 \rangle .$$

$$\begin{bmatrix} i & j & k \\ 0 & 1 & -1 \\ 1 & -1 & 0 \end{bmatrix} \rightarrow [(1 \cdot 0) - (-1 \cdot -1)]i - [(0 \cdot 0) - (1 \cdot -1)]j + [(0 \cdot -1) - (1 \cdot 1)] = \underline{-i - j - k}$$

The cross product of v and w is $\langle -1, -1, -1 \rangle$.