Solutions to the "QUIZ" for Sept. 8, 2009

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

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

Solution: **a.**

$$\langle 1,1,1\rangle \cdot \langle 3,-2,-1\rangle = 1\cdot 3 + 1\cdot(-2) + 1\cdot(-1) = 3-2-1 = 0 \quad .$$

Ans.: Since the dot-product is 0, the vectors are perpendicular.

b.

$$\langle 4,3\rangle \cdot \langle 2,-4\rangle = 4\cdot 2 + 3\cdot(-4) = 8-12 = -4 \quad .$$

Ans.: Since the dot-product is **not** 0, the vectors are **not** perpendicular. Since the dot-product is **negative**, the angle is **obtuse**.

Comments: Most people got it right. Quite a few people, for **b**, volunteered more information, actually finding the angle. This is nice, but not necessary! Answer what you have been asked, not less, but also not more!

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

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

$$v \times w =$$

$$\begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 0 & 1 & -1 \\ 1 & -1 & 0 \end{vmatrix} =$$

$$\mathbf{i}\begin{vmatrix} 1 & -1 \\ -1 & 0 \end{vmatrix} - \mathbf{j}\begin{vmatrix} 0 & -1 \\ 1 & 0 \end{vmatrix} + \mathbf{k}\begin{vmatrix} 0 & 1 \\ 1 & -1 \end{vmatrix}$$

$$= \mathbf{i}(1\cdot(0) - (-1)\cdot(-1)) - \mathbf{j}(0\cdot(0) - (-1)\cdot(1)) + \mathbf{k}(0\cdot(-1) - (1)\cdot(1)) =$$

$$-\mathbf{i} - \mathbf{j} - \mathbf{k} \quad .$$

Finally converting to the **usual** notation, we get $\langle -1,-1,-1\rangle$.

Ans.: $\langle -1,-1,-1\rangle$.

Comments: About %80 of the people got it perfectly. Another %10 set-it up correctly, but messed up the arithmetic (be careful with the minus signs!: minus times ninus is plus, minus times minus times minus is minus, etc.