1. **(5 points)** Find a value of $y$ such that the vectors $\mathbf{u} = \langle 3, 2, 4\rangle$ and $\mathbf{v} = \langle -2, y, 3\rangle$ are perpendicular.

2. **(5 points)** If $\mathbf{a} = \langle 4, -1, -6\rangle$ and $\mathbf{b} = \langle 6, 1, 2\rangle$, calculate $\mathbf{a} \cdot \mathbf{b}$ and $\mathbf{a} \times \mathbf{b}$. Label which is which.

3. **(5 points)** Find the distance between the plane $3x - 2y + 6z = 6$ and the point $(-1, -1, -1)$.

4. **(5 points)** Calculate the angle between the vectors $\mathbf{u} = \langle 2, -2, 1\rangle$ and $\mathbf{v} = \langle -3, 4, 12\rangle$. Trigonometric and inverse trigonometric functions may be left unreduced.

5. **(2 point bonus)** Let $A$ be a point not on a line $\ell$, and let $\mathbf{u}$ be a vector which is not perpendicular to $\ell$. Prove on the back of this page that for any real number $k$, there is a point $B$ on $\ell$ such that $\vec{AB} \cdot \mathbf{u} = k$.

Friday, September 3, 2010