Attempt all questions and show all your work. Due November 3, 2010.

1. Let $\mathbf{u} = [1, 1, 1]$, $\mathbf{v} = [-1, 2, 5]$, $\mathbf{w} = [0, 1, 1]$. Calculate each of the following:
   (a) $(2\mathbf{u} + \mathbf{v}) \cdot (\mathbf{v} - 3\mathbf{w})$
   (b) $||\mathbf{u}|| - 2||\mathbf{v}|| + ||(-3)\mathbf{w}||$
2. Prove the associative rule for addition of vectors in E^3
   $$(\mathbf{u} + \mathbf{v}) + \mathbf{w} = \mathbf{u} + (\mathbf{v} + \mathbf{w})$$
   in the following two different ways:
   (a) by writing each of $\mathbf{u}$, $\mathbf{v}$, $\mathbf{w}$ in terms of their coordinates and simplifying both sides algebraically in coordinate form
   (b) by a geometric argument using arrow representations for $\mathbf{u}$, $\mathbf{v}$, $\mathbf{w}$
3. Find the points where the plane $3x - 2y + 5z = 30$ meets each of the x, y and z axes in E^3. Use these "intercepts" to provide a neat sketch of the plane.
4. (a) Find an equation for the line through points $(1, 3)$ and $(5, 4)$ in parametric form.
   (b) Find an equation for the line through points $(1, 2, 3)$ and $(5, 5, 0)$ in parametric form.
5. Consider the triangle $A(5, 4, 1)$, $B(1, 1, 0)$, and $C(0, 1, 1)$. Determine (with justification) whether this triangle:
   (a) is a right angle triangle
   (b) is an isosceles triangle
   (c) is an equilateral triangle
   (d) has an obtuse angle
6. Let Q be the plane through points $(0, 0, 0)$, $(1, 3, -1)$ and $(1, 1, 1)$, and let R be the plane through point $(2, 2, 1)$ with normal vector $[5, 0, 2]$. To find the line of intersection of these two planes in parametric form, one can proceed as follows:
   (a) Find an equation for R in point-normal form and then in standard form
   (b) Find parametric equations for Q
   (c) Find an equation for Q in standard form using the parametric form you found above (HINT: Eliminate parameters s and t).
   (d) Give a system of linear equations whose solution is the line of intersection of Q and R.
   (e) Find a parametric form for the line of intersection of Q and R by solving the above system, using z as the parameter.