Math 2153 – Recitation 2 September 3, 2015

1. Let $\mathbf{u} = \langle 3, -4, 2 \rangle$
   (a) Compute $\text{proj}_{\mathbf{i}}\, \mathbf{u}$.
   (b) If $\mathbf{v} = \langle v_1, v_2, v_3 \rangle$ what is $\text{proj}_{\mathbf{k}}\, \mathbf{u}$? Prove your answer is correct.
2. An inclined plane forms an angle of 30 degrees with the horizontal. (See figure 12.53 on page 819 of the text)
   (a) If the force of gravity exerts a downward force $\mathbf{F}$ of 10 lbs. what is the magnitude of the component of the force of gravity in the direction parallel to the plane.
   (b) What is the magnitude of the component of the force of gravity in the direction normal to the plane.
3. (a) Compute the angle between the vector $\mathbf{u} = \langle 1, 1 \rangle$ and the vector $\mathbf{i} = \langle 1, 0 \rangle$.
   (b) Compute the angle between the vector $\mathbf{v} = \langle 1, 1, 1 \rangle$ and the vector $\mathbf{i} = \langle 1, 0, 0 \rangle$.
   (c) In an n-dimensional vector space let $\mathbf{w} = \langle 1, 1, \cdots, 1 \rangle$ and $\mathbf{e_1} = \langle 1, 0, \cdots, 0 \rangle$. What is the angle between $\mathbf{w}$ and $\mathbf{e_1}$?
   (d) What is the limit of the angle from part (c) as n goes to infinity?
4. (a) Find a nonzero vector orthogonal to the vector $\mathbf{u} = \langle 3, -4, -1 \rangle$.
   (b) Choose a so that the vector $\langle 3, a, 2a \rangle$ is orthogonal to the vector $\langle 2, 3, -1 \rangle$.
   (c) Can a be chosen so that $\langle 1, a \rangle$ is orthogonal to the vector $\langle 1, 0 \rangle$?
5. Show that the distributive rule
$$\mathbf{u} \cdot (\mathbf{v} + \mathbf{w}) = \mathbf{u} \cdot \mathbf{v} + \mathbf{u} \cdot \mathbf{w}$$
holds for any vectors $\mathbf{u} = \langle u_1, u_2, u_3 \rangle$, $\mathbf{v} = \langle v_1, v_2, v_3 \rangle$ and $\mathbf{w} = \langle w_1, w_2, w_3 \rangle$.