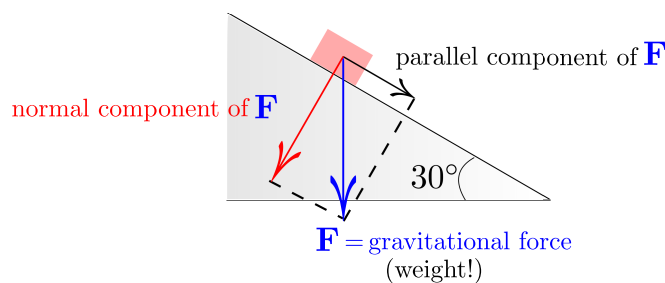# MATH 2153 - Calculus III – Recitation 2

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1. Compute the angle between the vector $\mathbf{u} = \langle 1, 1 \rangle$ and the vector $\mathbf{i} = \langle 1, 0 \rangle$.

2. Let $\mathbf{u} = \langle 3, -4, 2 \rangle$.

   (a) Compute $\operatorname{proj}_{\mathbf{i}} \mathbf{u}$ and $\operatorname{comp}_{\mathbf{i}} \mathbf{u}$.

   (b) If $\mathbf{u} = \langle u_1, u_2, u_3 \rangle$ what are $\operatorname{proj}_{\mathbf{k}} \mathbf{u}$ and $\operatorname{comp}_{\mathbf{k}} \mathbf{u}$? Prove your answers are correct.

3. An inclined plane forms an angle of 30 degrees with the horizontal plane, as in the following figure:

   (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.

4. (a) Choose b so that the vector $\langle 3, b, 2b \rangle$ is orthogonal to the vector $\langle 2, 3, -1 \rangle$.

   (b) Can q be chosen so that $\langle 1, q \rangle$ is orthogonal to the vector $\langle 1, 0 \rangle$?

5. **Tightening a bolt.** A force of 40N is applied to a wrench attached to a bolt in a direction perpendicular to the bolt. Which produces more torque: applying the force counterclockwise at an angle of $60°$ on a wrench that is 0.1 m long or applying the force counterclockwise at an angle of $135°$ on a wrench that is 0.25 m long? In each case, what is the directions of the torque?

6. Show that the four points $(1, 0, 0)$, $(0, 1, 1)$, $(1, 0, 2)$ and $(5, -4, -2)$ are coplanar.