4.3/4.4: Applications of vectors

1. Find the angle between the two vectors $\vec{u} = 7\vec{i} + 2\vec{j} - 3\vec{k}$ and $\vec{w} = \vec{i} + \vec{j} + \vec{k}$.

2. Consider the vector $\vec{u} = (8, -15)$.

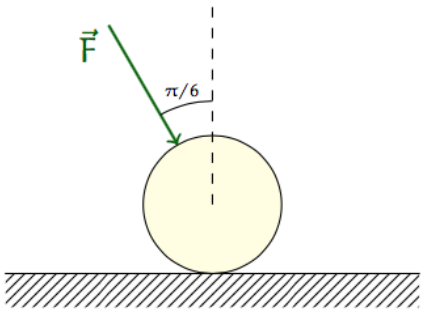
   (a) Find a unit vector in the direction of $\vec{u}$.

   (b) Find a vector $\vec{x}$ which results from rotating the vector $\vec{u}$ counterclockwise by $\pi/3$.

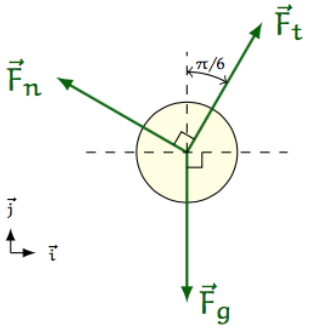
3. Two boats leave the port at the same time. The first boat travels along the vector $\vec{v} = (3, 1)$ and the second boat travles along the vector $\vec{u} = (-1, 5)$. Find the angle between their paths.

4. A small box is sitting on a hill at an incline of60°. The force of gravity on the box is 150 N. This force slides the box down the hill 20 m before the box comes to a rest. Calculate the work imparted by the force of gravity on the box.

5. A force $\vec{F}$ with magnitude 1000 N acts on an object as shown below. The object subsequently moves 200m to the right. Find the work done by $\vec{F}$ in moving the object.



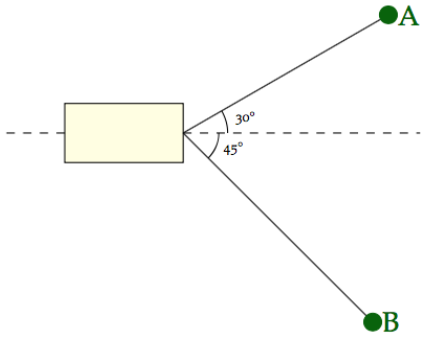
6. Consider the three forces below acting on the circular object. You know that $||\vec{F}_t|| = 750$ N, $||\vec{F}_n|| = 500$ N, and $||\vec{F}_g|| = 200$ N.



(a) Find the resultant force, $\vec{F}$, that acts on the above object. (Hint: Find the components of each force and add them.)

(b) Suppose the object is moved a distance of 30 meters straight up in the air. What is the work done by the resultant force from part (a)?

7. Two tugboats are pulling a larger boat according to the diagram below where the filled in circles are the tugboats and the rectangle is the larger boat.



The force with which tugboat A is pulling has a magnitude of 1.2 million N. What force must tugboat B pull with to keep the larger boat moving along the dashed line?