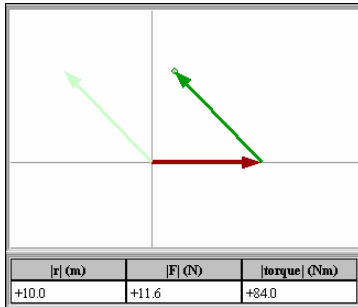# Worksheet for Exploration 11.1: Torque

Drag the tip of the force arrow **(position is given in meters and force is given in newtons)**. The **red arrow is the radius** on which the force acts and the **dark green arrow is the force**. The light green arrow also represents the force and is there to help illustrate the angle between **r** and **F**.

|r| (m)	|F| (N)	|torque| (Nm)
+10.0	+11.6	+84.0

a. When is the cross product zero?
   i. Give two causes for yielding a result of zero here (consider what you are able to change to make the cross product zero).

b. What is the angle between **r** and **F** that goes in r F sin(θ)?
   i. Consider drawing a line through each vector (line of force and line of "r"). Show the angle on the picture above.

c. Is there anything missing in this representation of the torque?
   i. Consider what kind of quantity torque is.

d. Does the assignment of **r** and **F** matter? In other words, if **r** was **F** and **F** was **r**, would the torque be the same?

i. For what conditions of the force vector is the torque positive (not shown in the simulation) or negative?

ii. Select some conditions for the force, and angle. Sketch cases for the torque being positive, and then negative.