Physics 820 homework X, due Mon Nov 3

Reading: Chapter 5

Problems:

1. Goldstein, Problem 5-3.
2. Goldstein, Problem 5-17.

4. A spool rests on a rough table as shown. A thread wound on the spool is pulled with force $T$ at angle $\theta$. (a) If $\theta = 0$, will the spool move to the left or right? (b) Show that there is an angle $\theta$ for which the spool remains at rest. (c) At this critical angle find the maximum $T$ for equilibrium to be maintained. Assume a coefficient of friction $\mu$.

5. A heavy axially symmetric gyroscope is supported at a pivot, as shown. The mass of the gyroscope is $M$, and the moment of inertia about its symmetry axis is $I$. The initial angular velocity about its symmetry axis is $\omega$. Give a suitable approximate equation of motion for the system, assuming that $\omega$ is very large. Find the angular frequency of the gyroscopic precession. Show that the above approximation is justified for $\omega \gg \sqrt{g/\ell}$, where all moments of inertia are taken to be roughly $M\ell^2$. 