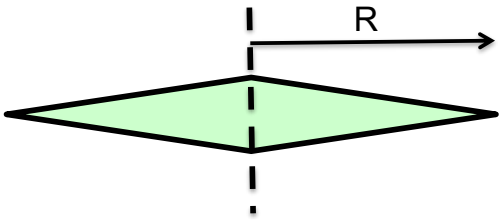
Problem Set #5 due beginning of class, Monday, Oct. 9.

1) Please redo your midterm showing work, but not providing way too much information.
2) Section 4.0 Exercise 1, collision of rotating bodies
3) Section 4.1 Example 1,
4) Section 4.2 Exercise 1,
5) Section 4.2 Exercise 2
6) Section 4.3 Exercise 2,
7) Section 4.3 Exercise 4
8) Section 4.4 Exercise 2
9) Section 4.5 Exercise 1
10) Section 4.5 Exercise 2
11) Read Section 4.5, exercise 3 and do the following:



You invent a new kind of round discus that spins about a vertical axis (dotted line) as shown at right. The object has a thickness of t_o at the axis (at $r=0$) that tapers evenly to a sharp edge at $r=R$, or $t = t_o(1-r/R)$. The mass of the discus is M,

a) Judging from moments of inertia of other objects (above question), please guess as best you can what should be the moment of inertia about the axis in terms of the variables given, and support your estimate with reasons. For starters, you might consider if this moment of inertia is greater or less than a rim of mass M, a disk of mass M, a hollow or solid sphere of mass M.
b) Calculate exactly what the moment of inertia is by integrating over the mass. *Hint: You'll have to do two integrations for this: one to find the volume, and the next to find the moment of inertia. A similar problem was done in the moment of inertia video, and is found as exercise 3 in section 4.5.*

12) Section 4.6 Exercise 2
13) Section 4.7 Exercise 1
14) Section 4.7 Exercise 2
15) You have an ax to grind, and you decide to grind it on the outer rim of a round 5 kg stone grinding wheel of uniform thickness and radius 30 cm. The coefficient of friction between steel and stone is 0.3. You spin the wheel up to 1000 rpm with a 100 W motor.

a) How long does it take to spin the wheel up to 1000 rpm? What lens do you use?
b) Then I push the ax against the wheel with a force of 100 N and the sparks fly! But as soon as you start, the electricity goes out and the wheel is spinning freely without power. What is the angular acceleration of the wheel as you push against it with the ax?