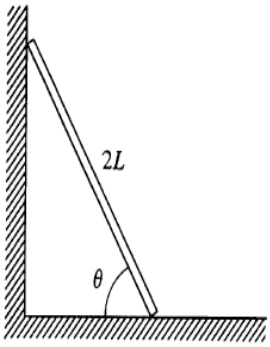
Tutorial 09 Due: Oct 9, 2012

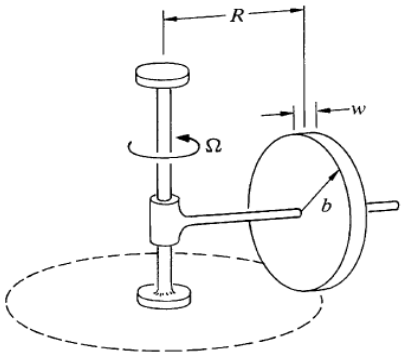
Note Title 05-Oct-12



6.41 This problem utilizes most of the important laws introduced so far and it is worth a substantial effort. However, the problem is tricky (although not really complicated), so don't be alarmed if the solution eludes you.

A plank of length $2L$ leans against a wall. It starts to slip downward without friction. Show that the top of the plank loses contact with the wall when it is at two-thirds of its initial height.

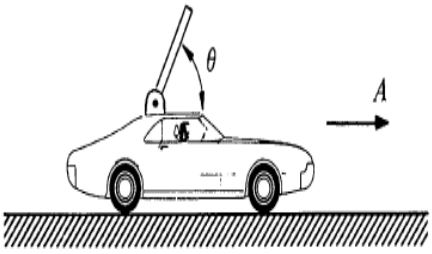
Hint: Only a single variable is needed to describe the system. Note the motion of the center of mass.



7.4 In an old-fashioned rolling mill, grain is ground by a disk-shaped millstone which rolls in a circle on a flat surface driven by a vertical shaft. Because of the stone's angular momentum, the contact force with the surface can be considerably greater than the weight of the wheel.

Assume that the millstone is a uniform disk of mass M, radius b, and width w, and that it rolls without slipping in a circle of radius R with angular velocity Ω. Find the contact force. Assume that the millstone is closely fitted to the axle so that it cannot tip, and that $w \ll R$. Neglect friction.

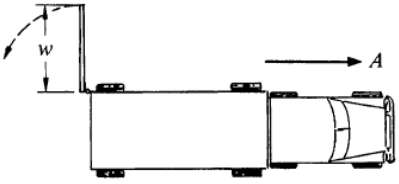
Ans. clue. If $\Omega^2 b = 2\,g$, the force is twice the weight



8.1 A uniform thin rod of length L and mass M is pivoted at one end. The pivot is attached to the top of a car accelerating at rate A, as shown.

a. What is the equilibrium value of the angle θ between the rod and the top of the car?

b. Suppose that the rod is displaced a small angle ϕ from equilibrium. What is its motion for small ϕ?



8.2 A truck at rest has one door fully open, as shown. The truck accelerates forward at constant rate A, and the door begins to swing shut. The door is uniform and solid, has total mass M, height h, and width w. Neglect air resistance.

a. Find the instantaneous angular velocity of the door about its hinges when it has swung through 90°.

b. Find the horizontal force on the door when it has swung through 90°.