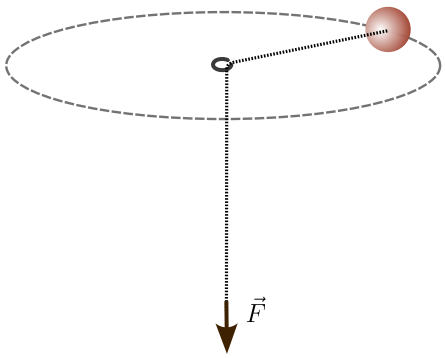
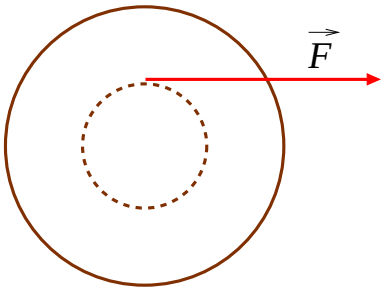
Tutorial 7 **Rotation** 29 August 2024

P1.



Consider the mass whirled around by a string passing through a small hoop, of Tutorial 3. Suppose the string is slowly pulled by a force $\vec{F}$ so that the radius of the circle decreases from l_1 to l_2. Show that the work done by the force equals the change in kinetic energy.

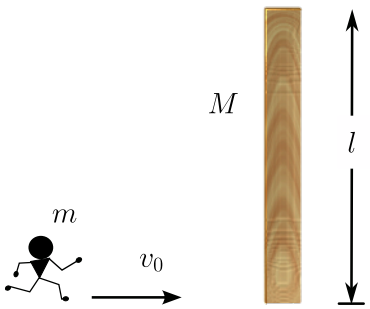
P2.



A wheel attached to a fixed shaft through its center is free to rotate without friction. To measure the MI of the wheel-shaft system, a massless tape is wrapped around the shaft and pulled with a constant, known force F. The system is found to rotate with angular speed ω when a length L of the tape has unwound. Find the MI.

P3. Consider the bead of mass m sliding frictionlessly on a massless rod that is made to rotate about one end with constant angular frequency ω considered in an earlier tutorial. You showed earlier that one possible motion of the bead is given by $r(t) = r(0)e^{\omega t}$. Find the power exerted by agency rotating the rod, and show that it is equal to the rate of change of kinetic energy of the bead.

P4.



A plank of length l and mass M is resting on ice when a boy of mass m running perpendicular to it with speed v_0 steps on one end.

(a) Describe the subsequent motion of the boy-plank system. (neglect friction with ice).

(b) Immediately after the collision one point on the plank is instantaneously at rest. Where is this oint with respect to the boy's end?