Physics 1A: Physics for Scientists and Engineers: Mechanics **Winter 2015**

Discussion 7: Week 9

Table 7.1: Comparison of Angular Kinetics and Linear Kinetics

Linear Kinetics	Angular Kinetics
$x = x_0 + v_0 t + at^2/2$	$\theta = \theta_0 + \omega_0 t + \alpha t^2/2$
$v = \mathrm{d}x/\mathrm{dt} = v_0 + at$	$\omega = \mathrm{d}\theta/\mathrm{dt} = \omega_0 + \alpha t$
$a = \mathrm{d}v/\mathrm{dt} = \mathrm{d}^2 x/\mathrm{d}t^2$	$\alpha = \mathrm{d}\omega/\mathrm{dt} = \mathrm{d}^2\theta/\mathrm{d}t^2$
$v_f^2 - v_i^2 = 2a(x_f - x_i)$	$\omega_f^2 - \omega_i^2 = 2\alpha(\theta_f - \theta_i)$
m	$I = \sum_i m_i r_i^2$
K.E.$= \frac{1}{2} m v^2$	K.E.$= \frac{1}{2} I \omega^2$

Exercise 1 A computer disk drive is turned on starting from rest and has constant angular acceleration. If it took time t_2 for the driver to make its first two complete revolutions, (a) how long did it take to make the first complete revolution, and (b) what is its angular acceleration?

Exercise 2 A thin, uniform rod is bent into a square of side length a. If the total mass is M, find the moment of inertia about an axis through the center and perpendicular to the plane of the square. (Moment of inertia of a slender rod with axis through center is $I = \frac{1}{12}ML^2$)

Exercise 3 In the system shown in the figure on the right, a mass mm is released from rest and falls, causing the uniform cylinder of mass M, diameter R to turn about a frictionless axle through its center. How far will the mass have to descend to give the cylinder a kinetic energy of E? (moment of inertia for a cylinder rotating about its center axis is given by $I = \frac{1}{2}MR^2$)