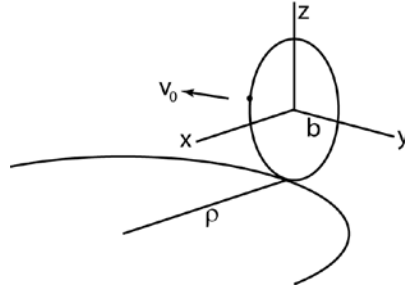


## Classical Dynamics – Physics 312 – Homework 12

1. A small bug crawls with constant speed in a circular path of radius  $b$  on a phonograph turntable rotating with constant angular speed  $\omega$ . The circular path is concentric with the center of the turntable. If the mass of the insect is  $m$  and the coefficient of static friction with the surface of the turntable is  $\mu_s$ , how fast, relative to the turntable, can the cockroach crawl before it starts to slip if it goes (a) in the direction of rotation, and (b) opposite to the direction of rotation?



2. A bicycle travels with constant speed around a track of radius  $\rho$ . What is the acceleration relative to ground of the point at the very front of one of the wheels? Let  $v_0$  denote the speed of the bicycle and  $b$  the radius of the wheel. Use the coordinate system shown in the figure above, whose origin moves with the wheel but does not rotate with the wheel.

3. Taylor 9.11.

For part (b), you can check just one of the Lagrange equations (say, for the  $x$ -coordinate)—the other coordinates work similarly.