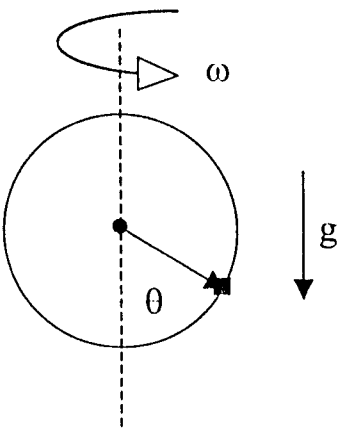
CM Spring01A

A bead of mass m slides without friction on a circular hoop of radius R. The hoop lies in a vertical plane and rotates about a vertical diameter with constant angular velocity ω. Gravity points vertically downward, as shown in the figure.



(a) For ω greater than some critical angular velocity ω_c, the bead can undergo small oscillations about a stable equilibrium point $\theta_0 \neq 0$. Find ω_c and $\theta_0(\omega)$.

(b) Write down the exact equation of motion for arbitrary $\omega > 0$. For $\omega > \omega_c$, find the frequency, $\Omega(\omega)$, for small oscillations about the equilibrium point.

(c) Consider now the case $\omega = \omega_c$. The bead is placed at $\theta = \pi/2$ and then released. What is the speed of the bead at the bottom of the hoop?