Phys 366 Mathematical Methods of Physics

Fall 2016

Homework Assignment #3 (50 points) Due Thursday, September 15 (at lecture)

 $3.5~(10~{\rm points})$ Challenge problem. A particle moves along a circular path given in spherical coördinates by

r(t) = R and $\theta(t) = \theta_0$ and $\phi(t) = 2\pi(1 - e^{-\gamma t})$,

where R > 0, θ_0 , and $\gamma > 0$ are constants.

- (a) Give the particle's path in cylindrical coördinates.
- (b) Give the particle's position vector $\mathbf{r}(t)$ in cylindrical coördinates.
- (c) Give the velocity $\mathbf{v}(t)$ and the speed $v(t) = |\mathbf{v}(t)|$ in cylindrical coördinates.
- (d) Give the acceleration $\mathbf{a}(t)$ in cylindrical coördinates.

(e) Draw the entire trajectory for $t \ge 0$. On your drawing, draw and label at the right place on the trajectory the velocity and acceleration at time t = 0 and at time $t = \gamma^{-1} \ln 2$.