# Part of Hints for to Hw 5 

Math 321

## Exercises in 1.10

1. $\vec{v}=\left(e^{\tan t}-1, \frac{1}{2} t \sqrt{t^{2}+1}+\frac{1}{2} \ln \left(t+\sqrt{t^{2}+1}\right), \frac{t}{2\left(t^{2}+1\right)}+\frac{1}{2} \arctan t\right)$.
2. This problem is harder than I thought. First of all show that $\vec{v}_{\|}($parallel to $\vec{B})$ is always zero and thus the particle is moving in the plane. Then, show that $|\vec{v}|$ is constant. Then, $|\vec{a}|$ won't change. Then the particle must do uniform rotation. It's hard to prove this just using vectors.(actually we can, but we must find the center first, which would be quite complicated...) One optional way is to introduce the Cartesian coordinate... I won't do here.
3. The force is $-m \omega^{2}\left(\vec{r}-\vec{r}_{a}\right)$
4. The force is $m \frac{d \vec{\omega}}{d t} \times\left(\vec{r}-\vec{r}_{a}\right)-m \omega^{2}\left(\vec{r}-\vec{r}_{a}\right)$
5. a). $F(r)=\frac{G M m}{r^{2}}$ and $V(r)=-\frac{G M m}{r}$.
b). Use the conservation law of angular momentum and energy. we have $r_{1}=\frac{v_{0}^{2} r_{0}^{2}}{2 G M-v_{0}^{2} r_{0}}$ and $v_{1}=\frac{v_{0} r_{0}}{r_{1}}$
c). Use the fact that $r_{1}>r_{0}$ and $r_{1}$ is positive.

## Exercises in 1.11

1. Omitted.
2. $\vec{F}_{c}=M \ddot{\vec{r}_{c}}$. We have $m * 2 \hat{y}+(M-m) \vec{r}=\frac{1}{2} t_{2}^{2} q E \hat{x}$
