1. a) A cord moving at low speed $v$ rubs against a round post and deviates from a straight line by a small angle $\Delta \theta$. If the tension on one side of the post is $T + \Delta T$ and on the other side is $T$, what is the difference $\Delta T$ introduced by friction? 
b) Find the ratio of tensions at the two ends of a cord wrapped around a circular post a finite angle $\alpha$ and pulled so as to slip.

2. The potential energy of a point particle is $U(x) = -x^2 + 2x^4$.
a) Find the force associated with this potential energy. b) Sketch $U(x)$ showing its essential features. c) Discuss the motion for the case $E > 0$. Find $v$ at $x = 0$, where $E$ is the total energy of the particle. d) Discuss the motion for $E < 0$. 

\[ T \quad T+\Delta T \]
\[ \Delta \theta \]
\[ o \]
3. a) Consider the force field $\vec{F} = -Ar^3\hat{r}$ where $A$ is a constant and $\hat{r}$ is the radial unit vector. Is this force conservative? If so, find the potential energy function associated with this force. b) Repeat for the force $\vec{F} = B(y^2\hat{i} - x^2\hat{j})$ where $B$ is a constant. Find the work done by $\vec{F}$ along the path shown below.