

PHYSICS 110A : CLASSICAL MECHANICS
PROBLEM SET #5

[1] A bead of mass m slides frictionlessly along a wire curve $z = x^2/2b$, where $b > 0$. The wire rotates with angular frequency ω about the \hat{z} axis.

- (a) Find the Lagrangian of this system.
- (b) Find the Hamiltonian.
- (c) Find the effective potential $U_{\text{eff}}(x)$.
- (d) Show that the motion is unbounded for $\omega^2 > \omega_c^2$ and find the critical value ω_c .
- (e) Sketch the phase curves for this system for the cases $\omega^2 < \omega_c^2$ and $\omega^2 > \omega_c^2$.
- (f) Find an expression for the period of the motion when $\omega^2 < \omega_c^2$.
- (g) Find the force of constraint which keeps the bead on the wire.

[2] Thornton and Marion problem 7-34.

[3] Thornton and Marion problem 7-37.