

PHY422/820: Classical Mechanics

FS 2019

Midterm #2 Preparation

November 2, 2019

Problem P4 – Isotropic Oscillator

A particle of mass m with angular momentum l is bound by a central force $\vec{F}(\vec{r}) = -k\vec{r}$ with $k > 0$. This force causes the particle to oscillate as an *isotropic* oscillator because the spring constant k is independent of the direction.

1. Sketch the potential energy $V(r)$ and the effective potential $V_{\text{eff}}(r)$.
2. Find the radius of a circular orbit for this potential. Will this orbit be stable or unstable?
3. Describe the possible orbits of the mass m in *Cartesian* coordinates.