The Kepler problem

Characterizing the different types of orbits in a central potential $V(r) \propto -r^{-1}$, and discussing the various law's of Kepler.



1 Problem

In this assignment you're supposed to discuss the motion/orbits of a particle in a central potential

$$V(r) = -\frac{k}{r},\tag{1}$$

for some positive constant k. This is the topic of sections 3.7 and 3.8 in Goldstein (you might need to look also at the earlier sections 3.5 and 3.6). The idea is that you should discuss the possible orbits one may have; hyperbolic, parabolic, eliptic, and circular. What determines the type of orbit? You'll need to define quantities like *eccentricity*, *perihelion*, *aphelion*, *semi-major axis*, and *major axis*. It is recommended to visualize the results with some plots.

Apart from the above, discuss also the content of the Kepler's laws.