PHYS 305 – Homework #3 **Due: Sep. 23, 2024**

1. The force from a real spring is nonlinear with an approximate force given by

$$\mathbf{F} = -k\mathbf{r} + \frac{q}{r^3}\mathbf{r}$$

where k and q are constants, $\mathbf{r}$ is the vector displacement from the origin with magnitude r. Use that $k/m = 1$, where m is the mass of the object connected to the spring. Solve for the two-dimensional orbits in order to determine how the orbits depend on q/m. Use initial conditions such that when $q = 0$, the orbit is circular.

2. Solve the 4-body problem for the motion of the Sun, Earth, Jupiter and Moon. Make a plot and a video showing the trajectories. Simulate long enough that Jupiter does at least one full orbit around the Sun.