# Coding Challenge 9

**Bonus!** Plot the change in specific energy of the satellite vs. time.

E = $|\vec{v}|^2 - 2\frac{GM}{|\vec{r}|}$ [J/kg]

- **Propagate a two body orbit for one orbital period.**
  - $\vec{F} = \frac{-GMm}{|\vec{r}|^3}\vec{r}$, where M is the mass of the planet, and m is the mass of the orbiting satellite.
  - G = 6.6743*10$^{-20}$ [km^3 s^-2 kg^-1]
  - M = 5.972*10$^{24}$ [kg]
  - m = 20 [kg]
  - $\vec{r}$(t = 0) = [10000, 0, 1000]$^T$ [km]
  - $\vec{v}$(t = 0) = [0, 7.5574, 0]$^T$ [km/s]
  - Time bounds: [0, T] [s]
  - T = $2\pi\sqrt{\frac{a^3}{GM}}$
  - a = $-GM * (|\vec{v}|^2 - 2\frac{GM}{|\vec{r}|})^{-1}$