AerE 351 Homework 1 Spring 2024
(due Feb 2)

1. A spacecraft is in a circular orbit about the earth at a radius of 9000 km. Assume a non-rotating coordinate frame *XY* defined in the orbital plane with the origin located at the center of the earth. When the spacecraft crosses the positive *X* axis, it uses its thrusters to change its speed instantaneously. Consider the two following separate cases:

   a) The spacecraft speed is increased by 400 m/s. What are the resulting perigee and apogee altitudes.

   b) The spacecraft speed is decreased by 400 m/s. What are the resulting perigee and apogee altitudes.

   c) Draw the initial circular orbit and the resulting orbits of a) and b) in the same figure. Label the orbits and include the coordinate axes *XY*.

2. Problem 1.10. Instead of the vectors given in the textbook, assume the following

$$\mathbf{r}^T = [0 \quad -2 \quad 0]$$

$$\mathbf{v}^T = \left[1/\sqrt{2} \quad 1/\sqrt{2} \quad 0\right]$$

3. Problem 1.13

   a) Determine what the textbook requires.
   b) Find the flight path angle γ at the time of observation.
   c) Determine whether the spacecraft will impact the ground. Ignore atmospheric effects.

4. Problem 1.14