This problem will be graded on a 0 - 20 scale with the score added to the grade on the first examination. The required analysis is a further development of the Earth - Jupiter problem from HW Set 4. Assume that the Earth and Jupiter are in co-planar circular orbits with the mean radial distance from the Sun to Jupiter at 5.20 AU. You are to analyze the transfer using the patched-conic approximation. Begin in a geocentric parking orbit at 300 nmi find the velocity change needed needed to escape Earth’s gravity along a (heliocentric) orbit that will encounter Jupiter. The heliocentric orbit should be Hohmann-like at Earth departure but will be a (nominal) free-return orbit that returns to Earth at first opportunity. You have previously analyzed the initial velocity impulse, as well as the required geometry between Earth-Sun and Jupiter at departure, now however, we are not in the purely Hohmann case.

Now proceed to consider the encounter at Jupiter. Find the phase angle adjustment so that we will pass in front of Jupiter with a peri-Jove radius of 5 planetary radii (the mean radius of Jupiter is about 11.2 times that of Earth, while its mass is about 318 times that of Earth). Compute the velocity impulse (in km/s) required at peri-Jove to circularize at that altitude.

Suppose the rocket motor does not work (at all) and we continue through peri-Jove along the (Jovian) hyperbolic orbit. Describe the resulting heliocentric orbit after this encounter. Will we return to the Earth?

Briefly describe how you might modify the calculations to produce a path that would return to Earth should the rocket motor fail before we reached Jupiter.