16.346 Astrodynamics
Fall 2008

Exercises 07

A spacecraft is in orbit about a planet whose gravitational constant is $\mu = 12$. At some instant of time, when the vehicle is at the point P_1 for which $\mathbf{r}_1 = 4\,\mathbf{i}_x$, a velocity change $\Delta\mathbf{v}_1$ is made to place the vehicle in a new orbit to intercept a target at the point P_2 for which $\mathbf{r}_2 = 4\,\mathbf{i}_x + 4\sqrt{3}\,\mathbf{i}_y$. The velocity at P_1, before the impulse, is $\mathbf{v}_0 = \frac{2}{3}\sqrt{3}\,\mathbf{i}_y$.

1. Calculate the elements a, p and h of the orbit before the impulse.
2. Calculate the optimum $\Delta\mathbf{v}_1$ by first using an appropriate iteration algorithm to obtain the orbital parameter. Then determine the corresponding chordal and extended radial components of the optimum velocity The resulting velocity vector should be
$$\mathbf{v}_1 = \mathbf{i}_x + \sqrt{3}\,\mathbf{i}_y$$
3. Find the new orbital elements.
4. Illustrate the calculations with an appropriate vector diagram.