16.346 Astrodynamics
Fall 2008

Exercises 04

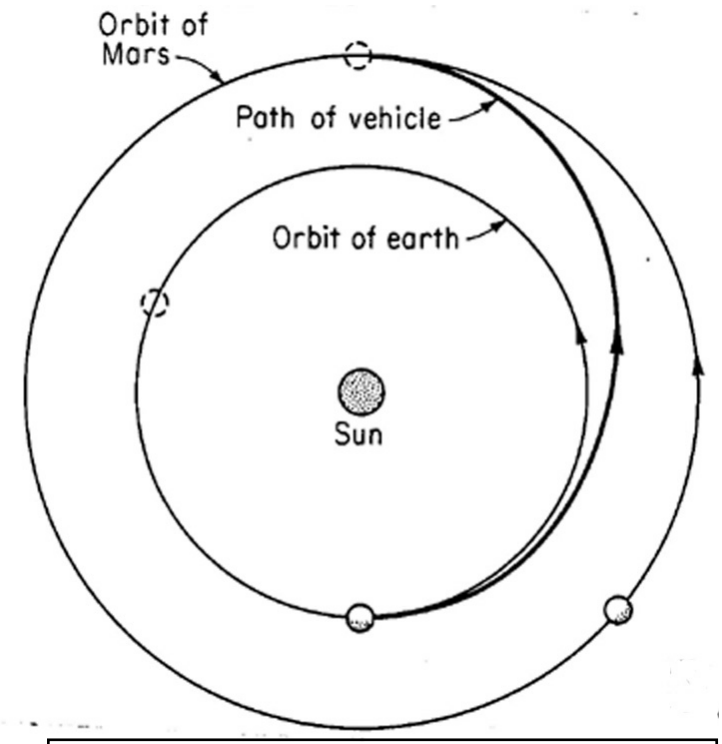

Fig. 9.3 from *An Introduction to the Mathematics and Methods of Astrodynamics.* Courtesy of AIAA. Used with permission.

1. The Hohmann Transfer

Consider a Hohmann Transfer orbit from earth to Mars. Assuming that the mean distance of Mars is 1.523 au and that all planet orbits are circles, find the time to travel from earth to Mars in years.

Do the same for trips to Jupiter and Pluto whose mean distances are 5.202 au and 39.517 au.

In all three cases, calculate the relative velocity between the earth and the spacecraft at departure. Also calculate the relative velocities of the spacecraft and the target planets at the times of arrival.

See Pages 427–428

2. At time $t = t_0$ the position and velocity vectors of a spacecraft are

$$\mathbf{r}_0 = -\sqrt{2}\,\mathbf{i}_x + \sqrt{2}\,\mathbf{i}_y \quad \text{and} \quad \mathbf{v}_0 = -\sqrt{\mu}\,\mathbf{i}_x$$

a. Prove that the orbit is a parabola.

b. Find the orbital parameter and the direction of the apsidal line.

c. Find the position and velocity vectors at time $t = t_1$ where

$$t_1 - t_0 = \frac{10}{3}\sqrt{\frac{2}{\mu}}$$

Do not use a calculator!