

Read Chapter 1, Chapter 3, and Chapter 8, 8.1 - 8.3.2

26. When the satellite is *at the end of the semi-minor axis*, it has several interesting properties. We can derive these properties using the basic knowledge of an elliptic orbit, the orbit equation. These must be done in the following order. For example, you can't use information in part a that you develop in part c! (Hint: draw picture)

a) show that the distance between the center of the orbit and the focus is $c = ae$

b) show that $\cos \nu = -e$ (BMW problem 1.18)

c) show $r = a$

d) show $b = a\sqrt{1 - e^2}$

e) show $\sin \phi = e$

f) show $V = V_{cir} = \sqrt{\frac{\mu}{r}} = \sqrt{\frac{\mu}{a}}$ (BMW problem 1.17)

27. Bate, Mueller, and White, problem 3.8, page 175.

There are two ways to transfer (say, inner to outer), periapsis of inner to apoapsis of outer, or apoapsis of inner to periapsis of outer. You are to calculate the *total* ΔV (DU/TU) using each method, then select the lowest value and indicate the amount (%) saved (based on the largest value)

28. Calculate the time for each of the transfer calculated in problem (27) in TU, and determine the trade-off of total fuel consumed vs time of flight. That is determine (loosely) $\frac{d\Delta V}{dTU}$, or how much extra "fuel" it costs to reduce the time.

29. Bate, Muller, and White, problem 3.6. Explain why you selected your answers.

30. A mission to Venus (0.7233 AU) from Earth (1 AU) and return is being planned using a Hohmann transfer each way.

a) determine the required fuel (ΔV) for one way and for a round trip.

b) assuming the Earth is at $\theta = 0$ at launch from Earth's orbit, determine the position (phase angle of Venus at that launch time. (Deg)

c) Determine the transfer time (in TU_{sun} and in days).

d) Determine the angular positions of Venus and Earth at arrival, and phase angle (deg)

e) Determine wait time on Venus and angular positions of Venus and Earth at return launch.

f) Determine arrival time on Earth (Total trip time) and the angular positions of Earth and Venus at that time.

Make a table that summarizes these results with time (TU) in the left column, time (days), Earth angle, Venus angle, phase angle (Venus - Earth angle).