

### Problem 3c)

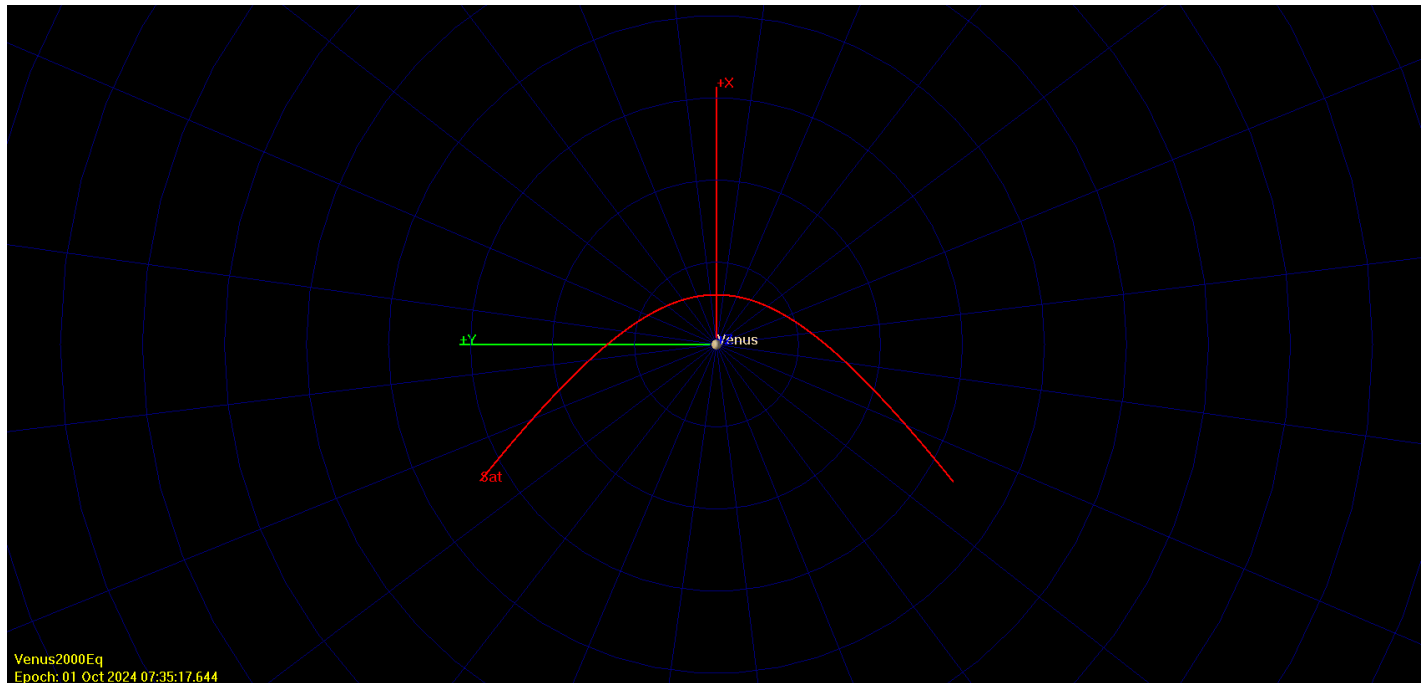


Figure 1: Orbit about Venus - GMAT

Below is a table with the orbit parameters from GMAT, when the true anomaly is at -110 degrees (Problem 3a). For consistency, the GMAT output for true anomaly was taken as the GMAT TA – 360 degrees, the GMAT output for flight path angle was the GMAT FPA - 90 degrees, and the GMAT output for Hyperbolic anomaly (HA) was converted from degrees to radians.

#### Problem 3a Data Comparison

Parameter	GMAT Output	MATLAB Output
True Anomaly [deg]	-109.95	-110
Flight Path Angle [deg]	62.36	-62.40
Specific Angular Momentum [ $\text{km}^2/\text{s}$ ]	207971.7	207971.7
Orbital Distance [km]	225420.2	225826.4
Semi Latus Rectum [km]	133141.8	133141.8
Velocity Magnitude [km/s]	1.989	1.988
Specific Energy [ $\text{km}^2/\text{s}^2$ ]	0.537	0.537
Hyperbolic Anomaly	-0.920	-0.921

The values calculated in MATLAB and GMAT are extremely close and are therefore consistent. The only differences that arise are due to the GMAT output being associated with a true anomaly that isn't exactly -110 degrees. The largest discrepancy is in orbital distance (off by 400 km) which makes sense as it is the most time sensitive value due to the velocity magnitude. The flight path

angle is also non-negative for the GMAT output (GMAT only allows for 0 -> 180 degrees). The orbital integral of motion constants match between GMAT and MATLAB.

Below is a table with the orbit parameters from GMAT, for when the distance is equal to the aim radius (Problem 3b).

**Problem 3b Data Comparison**

Parameter	GMAT Output	MATLAB Output
True Anomaly [deg]	-106.4	-106.29
Flight Path Angle [deg]	60.13	-60.06
Specific Angular Momentum [ $\text{km}^2/\text{s}$ ]	207971.7	207971.8
Orbital Distance [km]	201390.78	200718.8
Semi Latus Rectum [km]	133141.8	133141.8
Velocity Magnitude [km/s]	2.073	2.076
Specific Energy [ $\text{km}^2/\text{s}^2$ ]	0.537	0.537
Hyperbolic Anomaly	-0.854	-0.853
Aim Radii	200718.8	200718.8

The GMAT data is largely consistent with the MATLAB data from Problem 3b. The discrepancies arise due to the true anomaly's not lining up, indicating the results are not from the same exact point in time. The magnitudes of each of the parameters are close, the largest discrepancy again being between the orbital distance (off by 600 km).