Problem 3b)

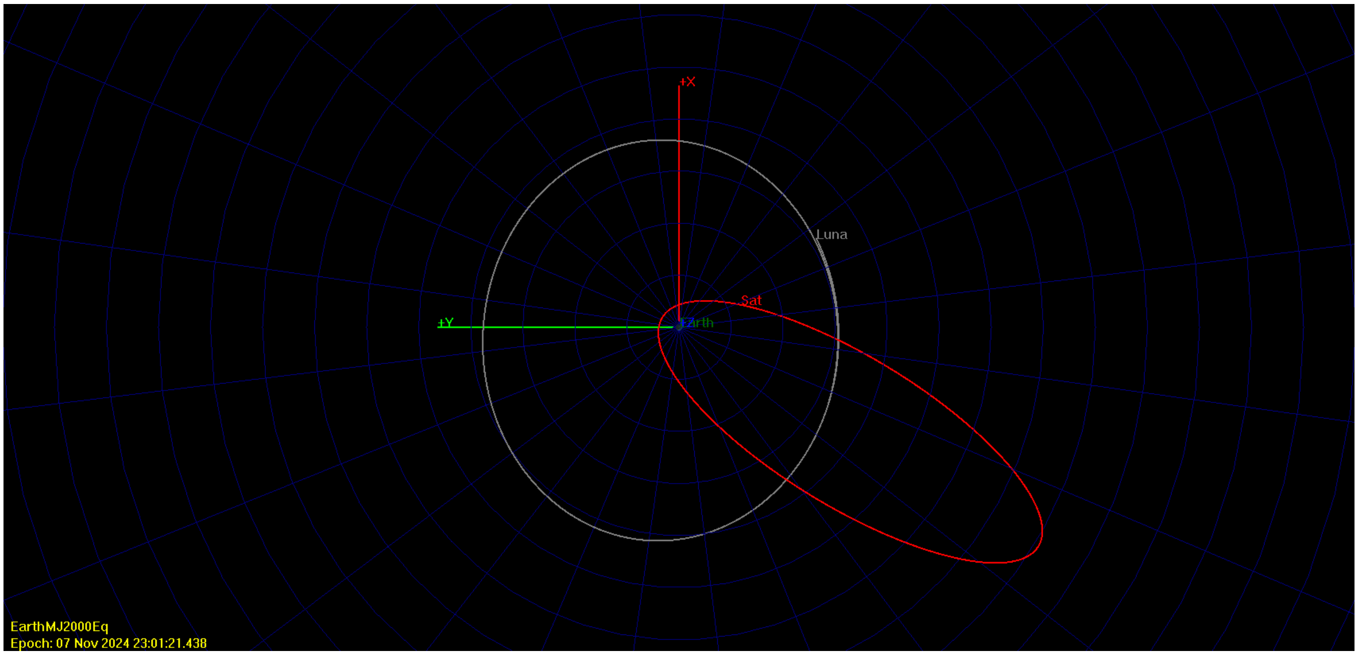


Figure 1: Orbit about Earth – Conic Propagator

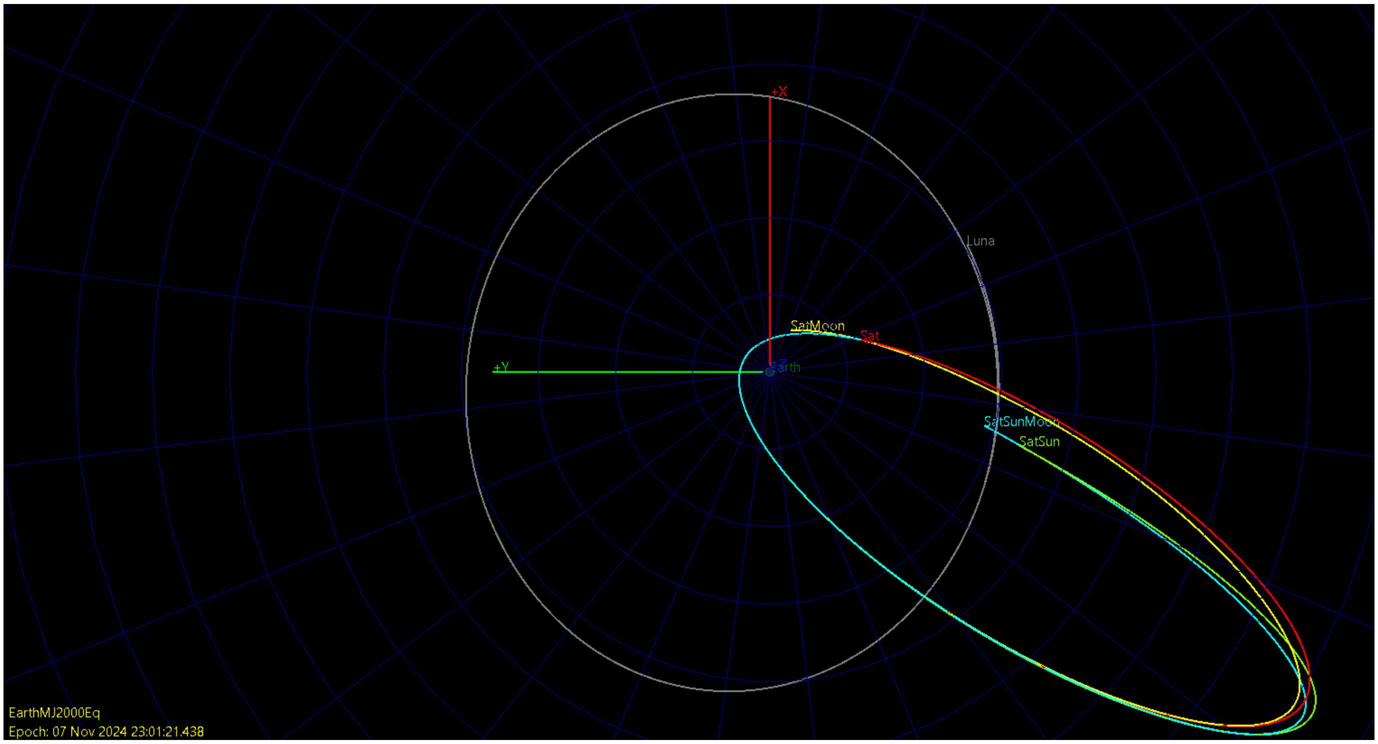
Below is a table with the orbit parameters from GMAT, where the true anomaly is 235 degrees (Problem 3).

Problem 3a/3b Data Comparison

Parameter	GMAT Output	MATLAB Output
True Anomaly [deg]	235	235
Flight Path Angle [deg]	147.435	-57.435
Orbital Distance [km]	148805.353	148805.353
Velocity Magnitude [km/s]	2.100	2.100
Mean Anomaly [deg]	351.996	-8.003 (351.996)
Eccentric Anomaly [deg]	315.157	-44.843 (315.157)
X Inertial Position [km]	44840.470	44840.470
Y Inertial Position [km]	-124443.785	-124443.785
Z Inertial Position [km]	-68162.376	-68162.376
X Inertial Velocity [km/s]	0.3951	0.3951
Y Inertial Velocity [km/s]	2.0133	2.0133
Z Inertial Velocity [km/s]	0.4482	0.4482

The values calculated in MATLAB and GMAT are consistent (the flight path angle is offset by -90 degrees, but this is due to definition).

Problem 3c)



All 4 vehicles were given the same starting condition and simulated for the same length of time. From the image above, we can see the Earth-spacecraft conic two-body relative model is NOT a good representative model for this problem. The sun (green line) significantly impacts the shape of the orbit (and hence the orbital period). The moon (yellow line) has a minor effect on the orbit but nothing of significance when compared to the impact of the sun. This orbit may be sensitive to the sun's gravity field due to how large the semi-major axis of the orbit is. When the satellite is at apoapsis (furthest point from the Earth), the Suns gravity field may be slowing down the satellite indicating that the satellite may be closest to the Sun at this location.