**Problem 1a & 1b)**

A planet with a red circle around it

Description automatically generated

Figure : Problem 1a and 1b

A screen shot of a satellite

Description automatically generated

Figure : Problem 1a and

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Orbit | **X [km]** | **Y [km]** | **Z [km]** | **Vx [km/s]** | **Vy [km/s]** | **Vz [km/s]** |
| **Initial** | 12756.2726 | 22094.51226 | 0 | -3.008299911 | 1.736842764 | 1.886057356 |
| **Final** | -29862.30988 | -4853.49961 | 23434.76917 | -0.409313734 | -2.991034821 | -1.141041319 |

The values obtained from GMAT are listed in the table above. These results match the handwritten results, confirming their accuracy. In the figures on the previous pages, the red line is the orbit from problem 1a, and the blue line is the orbit from problem 1b.

**Problem 1d)**

A diagram of a circle with lines and numbers

Description automatically generated

Figure : Problem 1d

The transfer ellipse is plotted in the figure above. The transfer arc is denoted by the red line, while the orange line comprises the rest of the transfer ellipse. Based off the orbit, it can be determined that the transfer type is a **1A** because the transfer angle is < 180 (transfer angle is 120) and the vacant focus is outside the chord and arc.