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```
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%Section - 01
%Aero 351 Homework 4: 12/04/24
```

Workspace Prep

```
format long      %Allows for more accurate decimals
close all;       %Clears all
clear all;       %Clears Workspace
clc;             %Clears Command Window
```

PART 1: Constant/Global Vars

```
mu = 398600;
muMars = 42828; %same units as earth (km)
muSun = 1.327e11;
Rearth = 6378; %km
Rmars = 3396; %km
tm = 1;
tol = 1e-8;
```

PART 2: Datetime Calcs

```
JD2000 = juliandate(2000,1,1);
JD1 = juliandate(2005,8,15);
JD2 = juliandate(2006,3,15);
dt = (JD2 - JD1)*86400; %delta t of transf in seconds

T01 = (JD1-JD2000)/36525;
T02 = (JD2-JD2000)/36525;
```

Earth State Vectors at Departure

```
PCe = AERO351planetary_elements2(3,T01); %Finds the Planetary Coes of earth
% Mean longitude - longitude of perihelion = Mean Anomaly (L - w_hat = Me)
```

```
% w_bar = w + raan

Me = PCe(6) - PCe(5);
w = PCe(5) - PCe(4); %arg of peri (deg)

E = M2E(deg2rad(Me),PCe(2)); %finds eccentric anomaly in rad
theta = E2f(E,PCe(2));

[Re,Ve] = coes2rvd(PCe(1),PCe(2),PCe(3),PCe(4),w,rad2deg(theta),muSun);
Re = Re';
Ve = Ve';
```

Mars State Vectors at Arrival

```
PCm = AERO351planetary_elements2(4,T02); %Finds the Planetary Coes of mars
% Mean longitude - longitude of perihelion = Mean Anomaly (L - w_hat = Me)
% w_bar = w + raan

Me = PCm(6) - PCm(5);
w = PCm(5) - PCm(4); %arg of peri (deg)

E = M2E(deg2rad(Me),PCm(2)); %finds eccentric anomaly in rad
theta = E2f(E,PCm(2));

[Rm,Vm] = coes2rvd(PCm(1),PCm(2),PCm(3),PCm(4),w,rad2deg(theta),muSun);
Rm = Rm';
Vm = Vm';
```

Cruise Phase Calcs

```
[V1,V2] = lambUVBi(Re,Rm,dt,tm,muSun,tol); %starting and ending velocities
%of cruise phase, also V1 & V2 is used to find Vinf 1 & 2 respectively
```

Departure Calcs

```
Rpark = Rearth + 190;
Vpark = sqrt(mu/Rpark);
%Vinf = abs(norm(V1) - norm(Ve));
Vinf = norm(V1 - Ve);
Vbo = sqrt((Vinf^2)+((2*mu)/Rpark)); %V burn out

% This stuff is all wrong lol
% ecch = 1 + (Rpark*Vinf^2)/mu;
% h_hyp = (mu*sqrt((ecch^2)-1))/Vinf;
% Vhyp = h_hyp/Rpark;

dV = abs(Vbo-Vpark); % ~3 km/s
```

Arrival Calcs

```
Rp = Rmars + 300; %km
Vinf2 = norm(V2 - Vm);
```

```
Vbo2 = sqrt((Vinf2^2)+((2*muMars)/Rp)); %V burn out

T = 35*3600; %35hrs in seconds
a = ((muMars*T^2)/(4*pi^2))^(1/3);

%vis-viva eq:
Vp = sqrt(muMars*((2/Rp)-(1/a)));

dV2 = abs(norm(Vbo2) - norm(Vp));
dVt = dV + dV2;

disp(dVt)
```

```
  37.777136989199121
```

Planetary Ephemerides from Meeus (1991:202-204) and J2000.0

Output Vector for Aero351planetary in order: planet_coes a = semimajor axis (km) ecc = eccentricity inc = inclination (degrees) raan = right ascension of the ascending node (degrees) w_hat = longitude of perihelion (degrees) L = mean longitude (degrees)

```
% Inputs:
% planet_id - planet identifier:
% 1 = Mercury
% 2 = Venus
% 3 = Earth
% 4 = Mars
% 5 = Jupiter
% 6 = Saturn
% 7 = Uranus
% 8 = Neptune
```

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