%homework 8

clc; clear all

close all

%problem 1

mu = 1;

e = [.1, .3, .5];

J2 = .003;

OMEGAdot = 1.118\*10^-6;

R = 1;

a = 1:.1:10

figure(1)

for j=1:3

for ii=1:length(a)

i(ii) = acos((OMEGAdot)/ ((3/2)\*((sqrt(mu)\*J2\*R^2)/( ((1-e(j)^2)^2)\*a(ii)^(7/2) )) ) )

end

plot(a,i)

hold on

end

title("semi major axis vs inclination");

leg = legend({'e=.1','e=.3','e=.5',});

set(leg,'location','northwest','fontsize',14)

grid on

set(gca,'fontsize',14)

xlabel( 'Semimajor Axis[DU]' )

ylabel( 'inclination [rad]' )

%problem 2

clc; clear all

mu = 398600;

Re = 6378;

%part C

r1a = 6828;

r1p = 6728;

a1 = (r1a+r1p)/2

r2 = 7278;

a2 = r2;

rptran = r1a;

ratran = r2;

atran = (r1p + r2)/2;

vTranRp = velOrbit(mu,rptran, atran);

v1a=velOrbit(mu,r1a,r1a);

deltaVa = vTranRp - v1a;

vTranRa = velOrbit(mu,ratran, atran);

v2=velOrbit(mu,r2,r2);

deltaVb = v2 - vTranRa;

deltaVtot = deltaVb + deltaVa

%part d, c is lowest delta v

e1 = (r1a/a1) - 1;

etran = (ratran/atran) - 1;

e2 = 0;

eccenVals = [e1, etran, e2];

rP = [r1p,r1a,r2];

rE = 6378.0;

semilatusRectum = [a1, atran, a2];

figure(2)

for ii = 1:length(eccenVals)

thetaVals = 0.0:0.01:2\*pi;

if ( ii == 2)

thetaVals = 0:0.01:pi;

end

if ( ii == 3)

thetaVals = 0:0.01:2\*pi;

end

radVals = semilatusRectum(ii)./(1+eccenVals(ii).\*cos(thetaVals));

xVals = radVals.\*cos(thetaVals);

yVals = radVals.\*sin(thetaVals);

plot( xVals./1000, yVals./1000, 'linewidth', 2 )

hold on

end

xVals = rE.\*cos(thetaVals);yVals = rE.\*sin(thetaVals);

plot( xVals./1000, yVals./1000, 'k', 'linewidth', 3 )

title("Minimum Delta V Hohman Transfer");

leg = legend({'orbit 1','transfer orbit','orbit 2','earth'});

set(leg,'location','northwest','fontsize',14)

axis equal

grid on

set(gca,'fontsize',14)

xlabel( 'Position Along Semi-major Axis [x1000 km]' )

ylabel( 'Position Along Semi-minor Axis [x1000 km]' )

function v = velOrbit(mu,r,a)

v = sqrt(mu\*(2/r)-(1/a));

end