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```
%----- HW 2 MATLAB code -----%  
% Romeo Perlstein, section 0101 %
```

## Q2

### Use matlab func to find orbital elements:

```
% Given:  
  
r = [3634.1 ; 5926 ; 1206.6];  
v = [-6.9049 ; 4.3136 ; 2.6163];  
mew_Earth = 398600.44;  
  
[i_param, omega_param, w_param, true_anom, ex, ey, ez, a, spef_energy] =  
    cartToOrbitalElements(r, v, mew_Earth)
```

## Q2-1

Plot the changing orbital elements as subplots

```
% Plotting constants  
tall_er_ant = (10^-13);  
step_size = 10000;  
max_time = 70000000;  
  
% Time step  
t = [0:step_size:max_time];  
  
% ODE options  
ODE_options = odeset("RelTol", tall_er_ant, "AbsTol", tall_er_ant);  
  
% Didymos Orbit information  
didymos_initial_x = -2.39573*10^8;  
didymos_initial_y = -2.35661*10^8;  
didymos_initial_z = 9.54384*10^6;  
didymos_initial_vx = 1.24732*10^1;  
didymos_initial_vy = -9.74427*10^0;  
didymos_initial_vz = -8.78661*10^-1;  
didymos_initial_state = [didymos_initial_x; didymos_initial_y;  
    didymos_initial_z; didymos_initial_vx; didymos_initial_vy;  
    didymos_initial_vz; 0; 0; 0];
```

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```

for i=1:length(t)
    [i_param(i), omega_param(i), w_param(i), true_anom(i), ex(i), ey(i),
    ez(i), a(i), spef_energy(i)] = cartToOrbitalElements(r, v, mew_Earth);
    e(i) = sqrt(ex(i)^2 + ey(i)^2 + ez(i)^2);
end
tiledlayout(2, 4)
nexttile
plot(0:length(t)-1, i_param)
title("Plot of i Value Over Time")
xlabel("Time (s)")
ylabel("Radians (rads/sec)")

nexttile
plot(0:length(t)-1, omega_param)
title("Plot of Omega Value Over Time")
xlabel("Time (s)")
ylabel("Radians (rads/sec)")

nexttile
plot(0:length(t)-1, w_param)
title("Plot of Omega Value Over Time")
xlabel("Time (s)")
ylabel("Radians (rads/sec)")

nexttile
plot(0:length(t)-1, w_param)
title("Plot of w Value Over Time")
xlabel("Time (s)")
ylabel("Radians (rads/sec)")

nexttile
plot(0:length(t)-1, true_anom)
title("Plot of True Anomaly Over Time")
xlabel("Time (s)")
ylabel("Radians (rads/sec)")

nexttile
plot(0:length(t)-1, e)
title("Plot of Magnitude of e Over time")
xlabel("Time (s)")
ylabel("Radians (rads/sec)")

nexttile
plot(0:length(t)-1, a)
title("Plot of 'a' Over time")
xlabel("Time (s)")
ylabel("")

nexttile
plot(0:length(t)-1, spef_energy)
title("Plot of a spef_energy over time")

```

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---

```
xlabel("Time (s)")
ylabel("")

i_param =

    0.349070851292407

omega_param =

    0.523592535376530

w_param =

    0.261776744891492

true_anom =

    0.261832711153479

ex =

    0.214476789865968

ey =

    0.208068417383442

ez =

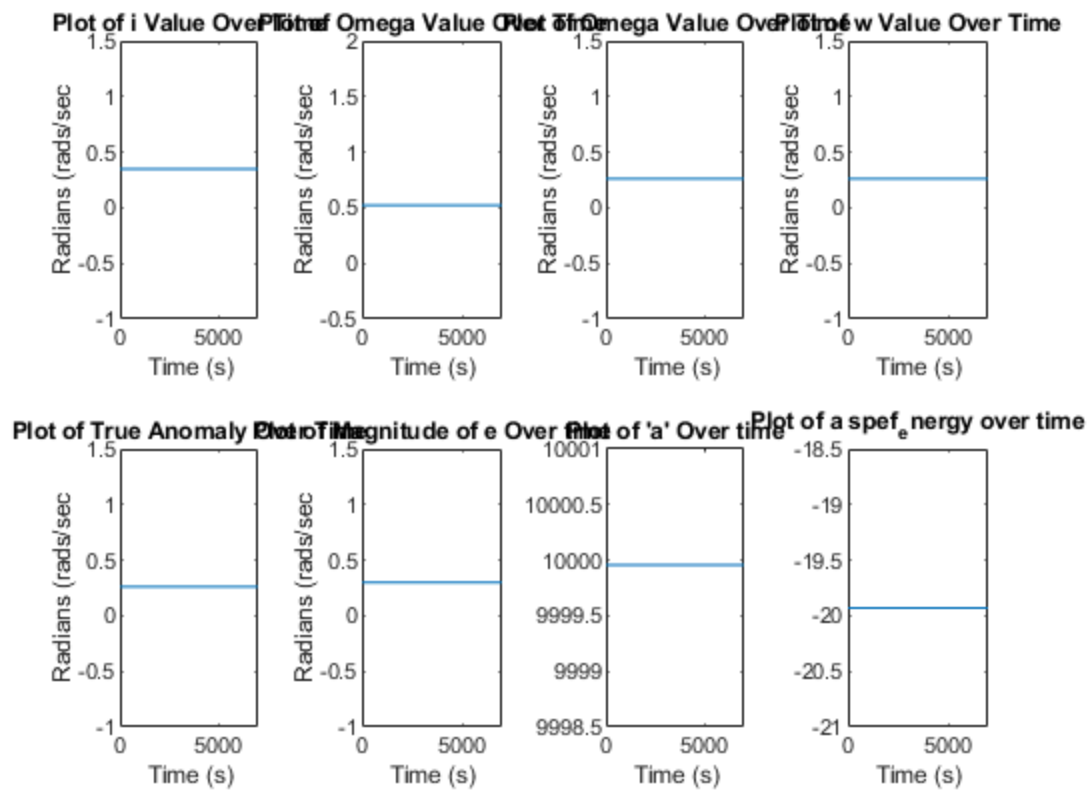
    0.026554206850339

a =

    9.999956067213976e+03

spef_energy =

    -19.930109558523867
```



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