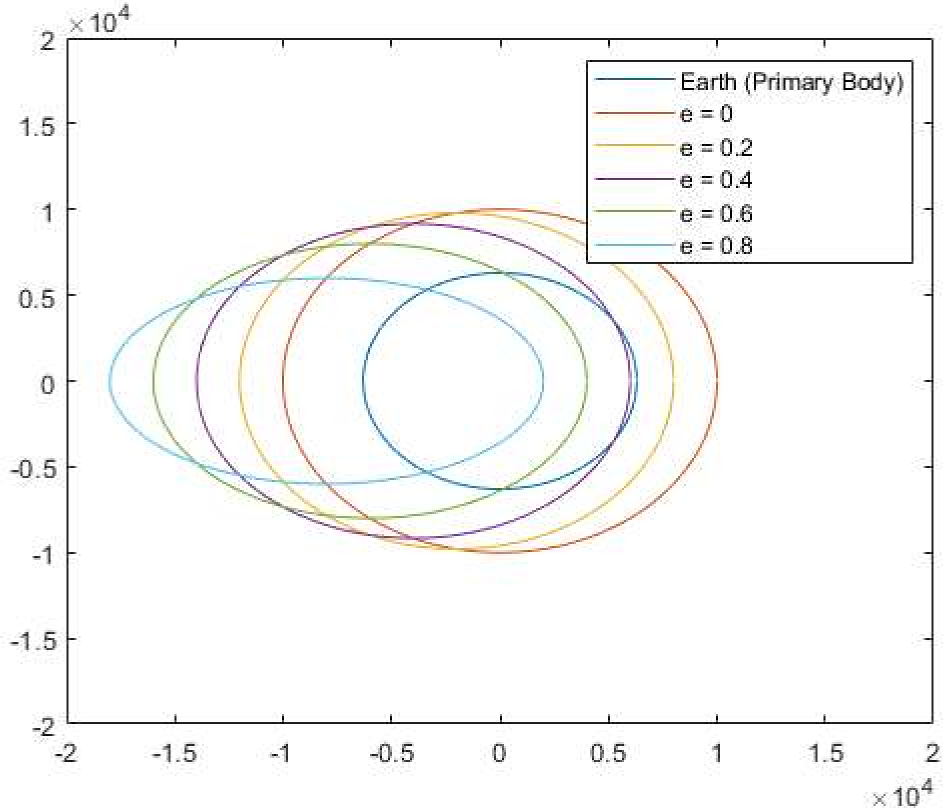
Contents


```
fig = 0;
```

Question 4

```
a = 10000;
e = [0 0.2 0.4 0.6 0.8];
ta = [1:360]*(pi/180);
re = 6300;
xe = re.*cos(ta);
ye = re.*sin(ta);

% e = 0
r = a*(1-e(1)^2)./(1+e(1)*cos(ta));
x = r.*cos(ta);
y = r.*sin(ta);

% e = 0.2
r = a*(1-e(2)^2)./(1+e(2)*cos(ta));
x1 = r.*cos(ta);
y1 = r.*sin(ta);

% e = 0.4
r = a*(1-e(3)^2)./(1+e(3)*cos(ta));
x2 = r.*cos(ta);
y2 = r.*sin(ta);

% e = 0.6
r = a*(1-e(4)^2)./(1+e(4)*cos(ta));
x3 = r.*cos(ta);
y3 = r.*sin(ta);

% e = 0.8
r = a*(1-e(5)^2)./(1+e(5)*cos(ta));
x4 = r.*cos(ta);
y4 = r.*sin(ta);

fig = 1;
figure(fig);
plot(xe,ye)
hold on
plot(x,y)
plot(x1,y1)
plot(x2,y2)
plot(x3,y3)
plot(x4,y4)
legend({'Earth (Primary Body)','e = 0','e = 0.2','e = 0.4','e = 0.6','e = 0.8'})
axis([-20000 20000 -20000 20000])

% The only viable orbits for this spacecraft are the ones with eccentricity
% of 0 and 0.2. All others will intersect with the radius of the Earth and
% crash into its surface.
```



Question 5.9

```
clc
clear all

r = [0.90000 -0.80000 1.10000];
v = [0 1.00000 0];
mu = 1;
% 5.1

h = cross(r,v);
X = [' 5.1: h = ' num2str(h)];
disp(X);

% 5.2

orbitenergy = .5*(v*v') - mu/(sqrt(r*r'));
X = [' 5.2: Energy = ' num2str(orbitenergy)];
disp(X);

% 5.3

ev = mu*(cross(v,h)) - r/(sqrt(r*r'));
X = [' 5.3: Eccentricity Vector = ' num2str(ev)];
disp(X);

% 5.4

truea = acos((dot(r,ev))/(sqrt(r*r')*sqrt(ev*ev')));
truea = rad2deg(truea);
X = [' 5.4: True Anomoly (Degrees) = +/-' num2str(truea)];
```

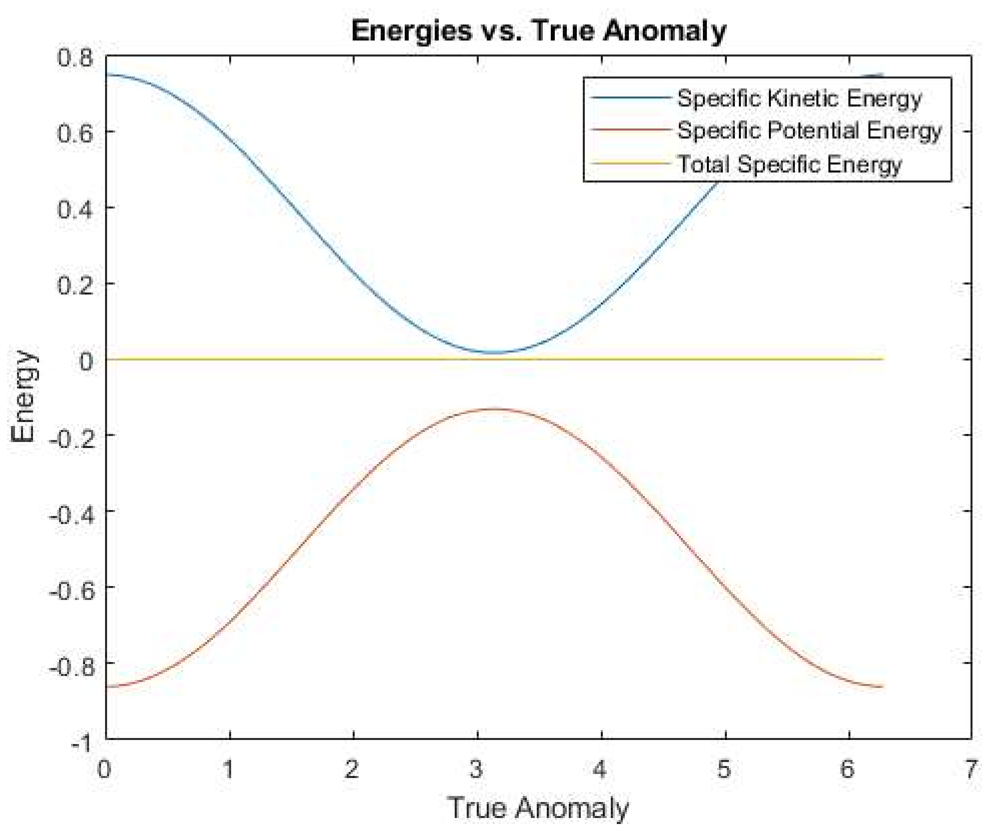
```
disp(X);

% 5.5

e = sqrt(ev*ev');
X = [' 5.5: Eccentricity = ' num2str(e)];
disp(X);

% 5.6

p = (h*h')/mu;
a = p/(1-e^2);
X = [' 5.6: Semimajor Axis = ' num2str(a)];
disp(X);

% 5.7

rp = p/(1+e);
X = [' 5.7: Periapsis = ' num2str(rp)];
disp(X);

% 5.8

ra = p/(1-e);
X = [' 5.8: Apoapsis = ' num2str(ra)];
disp(X);

% The hand calculations match the computed calculations.
```

```
 5.1: h = -1.1           0         0.9
 5.2: Energy = -0.11314
 5.3: Eccentricity Vector = 0.34817     0.49051     0.42555
 5.4: True Anomoly (Degrees) = +/-71.1107
 5.5: Eccentricity = 0.73683
 5.6: Semimajor Axis = 4.4193
 5.7: Periapsis = 1.163
 5.8: Apoapsis = 7.6756
```

Question 6

```
clc
clear all

r = [0.90000 -0.80000 1.10000];
v = [0 1.00000 0];
mu = 1;
magv = sqrt(v*v');
h = cross(r,v);
magh = sqrt(h*h');
p = (magh^2)/mu;
ev = mu*(cross(v,h)) - r/(sqrt(r*r'));
e = sqrt(ev*ev');
a = p/(1-e^2);
ta = [1:360]*(pi/180); % creating vector and converting to radians

magr = p./(1+e.*cos(ta));
v = sqrt(mu.*((2./magr)-(1/a)));
ske = (v.^2)./2; % specific kinetic energy
```

```
spe = -mu./magr; % specific potential energy
energy0 = (v(360)^2)/2 - mu/magr(360);
tse = (ske + spe) - energy0; % specific total energy

fig = 2;
figure(fig);
plot(ta,ske)
hold on
plot(ta,spe)
plot(ta,tse)
xlabel('True Anomaly')
ylabel('Energy')
title('Energies vs. True Anomaly')
legend({'Specific Kinetic Energy','Specific Potential Energy', 'Total Specific Energy'})
```



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