Two-Body Problem

My Solutions >

By solving a system of differential equations, determine the orbit of two masses using Newton's law and the

To obtain full credit, you will need to assign the position vectors of the two masses into the variables x1, y1 a masses, tspan times, and RelTol of the ode solver are pre-specified in the Learner's template.

To view an animation of the orbit itself, you will need to uncomment the graphics code and run in MATLAB c animation.

Script

Save Reset MATLAB Documentation (https://www.mathworks.com/help/)

```
e=0.7; m1=1; m2=4;
T=2*pi./(1-e).^1.5; tspan=linspace(0,T,1000);
options=odeset('RelTol',1.e-6);

%%%%% Solve differential equations for x and y and find x1,y1 and x2,y2
[t,xyuv]=ode45(@(t,xyuv) newton(xyuv),tspan,[-1,0,0,sqrt(1+e)],options);
x=xyuv(:,1); y=xyuv(:,2);
x1=m2/(m1+m2)*x; y1=m2/(m1+m2)*y;
x2=-m1/(m1+m2)*x; y2=-m1/(m1+m2)*y;
%%%%% graphics: UNCOMMENT TO RUN ON MATLAB ONLINE OR DESKTOP %%%%%%%%%%%%%
% k=0.1;
% R1=k*(m1)^(1/3); R2=k*(m2)^(1/3); %radius of masses
% theta = linspace(0,2*pi);
% figure; axis equal; hold on; set(gcf,'color','w');
% axis off;
% xlim([-2,5]); ylim([-2.5,2.5]);
% planet=fill(R1*cos(theta)+x1(1), R1*sin(theta)+y1(1),'b');
% sun=fill(R2*cos(theta)+x2(1), R2*sin(theta)+y2(1),'r');
% pause(1);
% nperiods=5; %number of periods to plot
% for j=1:nperiods
%     for i=1:length(t)
%         planet.XData=R1*cos(theta)+x1(i); planet.YData=R1*sin(theta)+y1(i);
%         sun.XData=R2*cos(theta)+x2(i); sun.YData=R2*sin(theta)+y2(i);
%         drawnow;
%     end
% end
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
function d_xyuv_dt=newton(xyuv)
x=xyuv(1); y=xyuv(2);  u=xyuv(3);  v=xyuv(4);
r=sqrt(x^2 + y^2);
d_xyuv_dt=[u; v; -x/r^3; -y/r^3];
end
```

Run Script

Previous Test: All Tests Passed

Submit

- x coordinate of mass one
- y coordinate of mass one
- x coordinate of mass two
- y coordinate of mass two

Output

```
Code ran without output.
```