Introduction to Week Five
Initial Value Problems
Systems of Differential Equations
Initial Value Problems in MATLAB
Boundary Value Problems
Quiz
Programming Assignment: The Two-Body Problem
Video: The Two-Body Problem (Part A) | Lecture 58
9 min
Reading: Circular orbits
10 min
Video: The Two-Body Problem (Part B) | Lecture 59
10 min
Ungraded External Tool: Two-Body Problem (audit)
Reading: Reference Solution to "Two-Body Problem (audit)"
1 min
Graded External Tool: Two-Body Problem
Submitted
Reading: Reference Solution to "Two-Body Problem"
1 min

Reference Solution to "Two-Body Problem"

```
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
```

Completed Go to next item
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