Math 337 Homework 07

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1. Solve the BVP

$$y'' + xy' - 3y = 3x, y(0) = 1, y(2) = 5$$

by the shooting method. Use the modified Euler method with $h = 0.1$ as the IVP solver. Plot your solution.

Solution: My code and a solution plot follow.

```
% HW07 Problem 01
%
% solve the BVP using the shooting method
% - I define the homogeneous and non-homogeneous in separate files
% - the IC are both Nuemann

% IC, BC
y0 = 1; yf = 5;
h = 0.1;
tvec = 0:h:2;

i=1;
shot1 = andy_ME(@andy_hw07_prb01_ODE,tvec,[y0;0],h,[]);
shot2 = andy_ME(@andy_hw07_prb01_ODEh,tvec,[0;1],h,[]);

theta = (yf-shot1(1,end))/shot2(1,end);

soln = shot1+theta.*shot2;
plot(tvec,soln(1,:));
xlabel('x','FontSize',20);
ylabel('y','FontSize',20);
set(gcf, 'units', 'inches', 'position', [1 1 10 10])
set(gcf,'PaperPositionMode','auto')
print('-depsc2','-zbuffer','-r200',sprintf('andy_hw07_prb01_%02g.eps',i))
system(sprintf('epstopdf andy_hw07_prb01_%02g.eps',i));
```

2. Solve the BVP

$$x^3y''' + xy' - y = -3 + \ln x, y(1) = 1, y'(2) = 1/2, y''(2) = 1/4$$

by "shooting" from the left end point and using the example given in the notes. Use the ME method with $h = 0.02$. Plot your solution

Solution: My code and a solution plot follow.

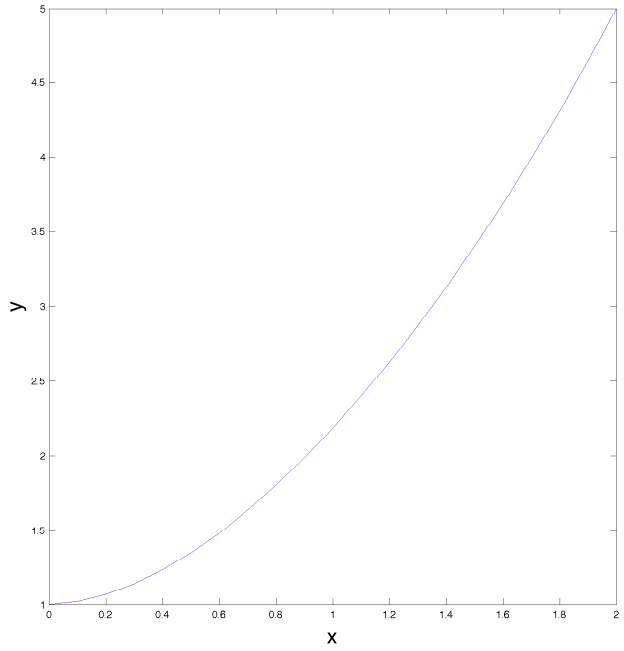

Figure 1: Solution of the BVP with the shooting method.

```
% HW07 Problem 01
%
% solve the BVP using the shooting method
% - I define the homogeneous and non-homogeneous in separate files
% - the IC are both Nuemann

% IC, BC
y0 = 1; yfp = 1/2; yfpp = 1/4;
h = 0.02;
tvec = 1:h:2;

i=1;
% solve the three IVP's
shot1 = andy_ME(@andy_hw07_prb02_ODE,tvec,[y0;0;0],h,[]);
shot2 = andy_ME(@andy_hw07_prb02_ODEh,tvec,[0;1;0],h,[]);
shot3 = andy_ME(@andy_hw07_prb02_ODEh,tvec,[0;0;1],h,[]);

% construct z
z = [shot1(:,end) shot2(:,end) shot3(:,end)];
% take just the bottom two
z = z(2:3,:);

% solve for theta,psi. call them both theta
theta = z(:,2:3)\[yfp-z(1,1);yfpp-z(2,1)];

soln = shot1+theta(1).*shot2+theta(2).*shot3;
plot(tvec,soln);
legend('y','y','ypp')
xlabel('x','FontSize',20);
ylabel('y','FontSize',20);
set(gcf, 'units', 'inches', 'position', [1 1 10 10])
set(gcf,'PaperPositionMode','auto')
print('-depsc2','-zbuffer','-r200',sprintf('andy_hw07_prb02_%02g.eps',i))
system(sprintf('epstopdf andy_hw07_prb02_%02g.eps',i));
```

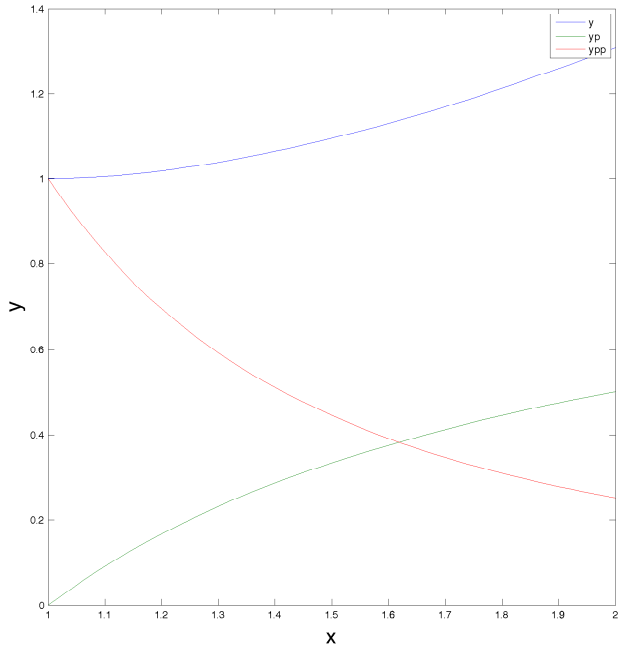

Figure 2: Solution of the BVP with the shooting method.