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%HW-3 Prb-6
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function problem6

%The given differential equation discretized using second order finite
%difference method described in Bradie's text. We converted system to
% Ax = b form, where x is vector solved for theta.
%relevent equations in uploaded published pdf file

clc %clearning screen
clear all %clearing previous stored variables
close all %closing previous plots

%Number of mesh points, size of A matrix
n = 100;

%distance between two mesh points
h = (1-0.8)/n;
%We have to plot theta for 3 values of beta
beta = [7.5, 8, 8.5];
%initializing theta matrix to store values of theta at different betas
theta = zeros(n+1, 3);
%vector containingmesh points
zy = linspace(0.8, 1, n+1);

%outer loop for 3 values of beta
for j = 1:length(beta)
    % calculating value of p, q and r
    p = -1./zy;
    q = -(beta(j)^2);
    r = -1;

    %calculating value of d,u and l for A matrix
    d = 2 + (h^2)*q;
    u = -1 + (h/2).*p;
    l = -1 - (h/2).*p;

    %initializing matrix A.
    A = zeros(n+1,n+1);

    %Dirichlet BC

    A(n+1,n+1) = 1;
    A(n+1,n) = 0;
    b(n+1) = 0;

    %Neumann BC
    A(1,1) = d;
    A(1,2) = -2;

    %initializing matrix b
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    b = -h^2*r*ones(n+1,1);

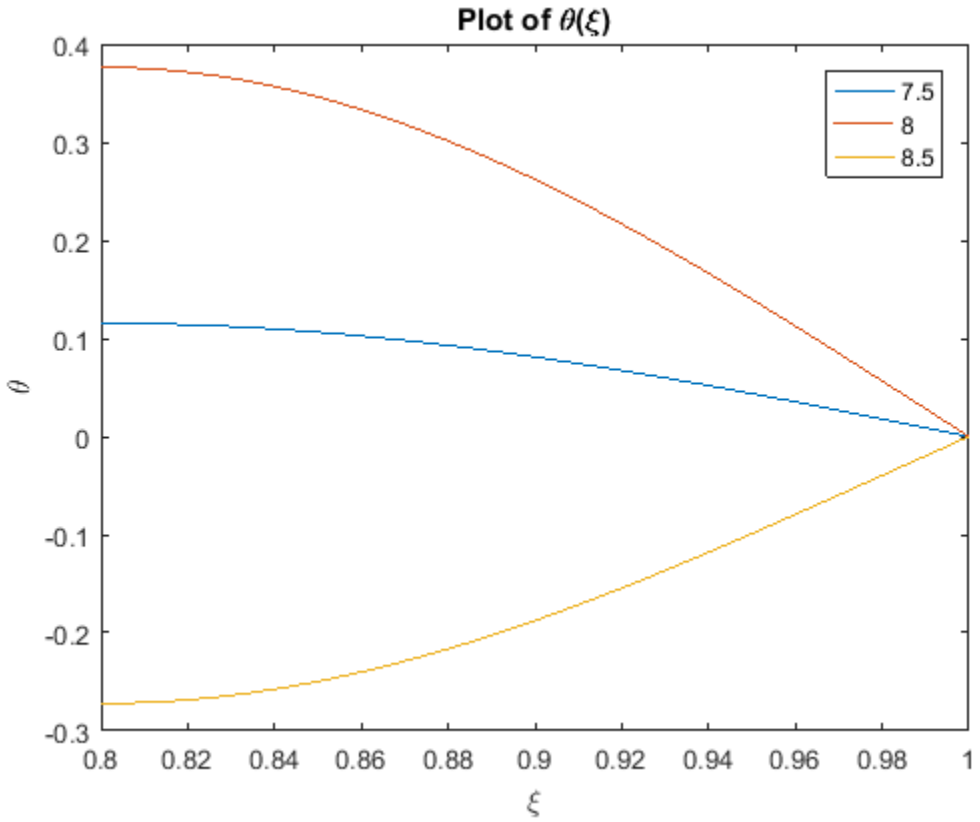
    % creating matrix A
    for i =1:n-1
        A(i+1, i)= l(i);
        A(i+1, i+1) = d;
        A(i+1, i+2) =  u(i);

    end
%calculating unknown vector x = inv(A)*b. Here unknown value if theta
theta(:,j) = A\b;

end

%plotting the results
plot(zy, theta(:,1), zy, theta(:,2),  zy, theta(:,3));
legend('7.5', '8', '8.5')
title('Plot of \theta(\xi)')
xlabel('\xi')
ylabel('\theta')

end
```



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