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```
clear all
clc

x0 = 0.001;

xf = 10;

N = 1000;

deltax = (xf-x0)/N;

x = linspace(x0, xf, N);

Ln = zeros(1, length(x));

phi = zeros(1, length(x));

Ln(1) = 1;
phi_n(1) = 0;

%dL_dx = @(x1, x2, z) x2;

%dphi_dx = @(x1, x2, z) ((z-1)/z)*x2 - (n/z)*x1;

h = deltax;
```

n = 6

```
n = 6;

dL_dx = @(x1, x2, z) x2;

dphi_dx = @(x1, x2, z) ((z-1)/z)*x2 - (n/z)*x1;

for i = 1: length(x)-1

    k1= dL_dx(Ln(i), phi(i), x(i));
    g1= dphi_dx(Ln(i), phi(i), x(i));

    k2=dL_dx(Ln(i) + 0.5*h*k1, phi(i) + 0.5*h*k1, x(i) + 0.5*h);
    g2=dphi_dx(Ln(i) + 0.5*h*g1, phi(i) + 0.5*h*g1, x(i) + 0.5*h);

    k3=dL_dx(Ln(i) + 0.5*h*k2, phi(i) + 0.5*h*k2, x(i) + 0.5*h);
    g3=dphi_dx(Ln(i) + 0.5*h*g2, phi(i) + 0.5*h*g2, x(i) + 0.5*h);

    k4=dL_dx(Ln(i) + h*k3, phi(i) + h*k3, x(i)+ h);
    g4=dphi_dx(Ln(i) + h*g3, phi(i) + h*g3, x(i)+ h);

    Ln(i+1)=Ln(i)+(1/6)*(k1+2*k2+2*k3+k4)*h;
    phi(i+1)=phi(i)+(1/6)*(g1+2*g2+2*g3+g4)*h;

end

Ln_6 = Ln;
```

n = 3.26

```
n = 3.26;

dL_dx = @(x1, x2, z) x2;

dphi_dx = @(x1, x2, z) ((z-1)/z)*x2 - (n/z)*x1;

for i = 1: length(x)-1

    k1= dL_dx(Ln(i), phi(i), x(i));
    g1= dphi_dx(Ln(i), phi(i), x(i));

    k2=dL_dx(Ln(i) + 0.5*h*k1, phi(i) + 0.5*h*k1, x(i) + 0.5*h);
    g2=dphi_dx(Ln(i) + 0.5*h*g1, phi(i) + 0.5*h*g1, x(i) + 0.5*h);

    k3=dL_dx(Ln(i) + 0.5*h*k2, phi(i) + 0.5*h*k2, x(i) + 0.5*h);
    g3=dphi_dx(Ln(i) + 0.5*h*g2, phi(i) + 0.5*h*g2, x(i) + 0.5*h);

    k4=dL_dx(Ln(i) + h*k3, phi(i) + h*k3, x(i)+ h);
    g4=dphi_dx(Ln(i) + h*g3, phi(i) + h*g3, x(i)+ h);

    Ln(i+1)=Ln(i)+(1/6)*(k1+2*k2+2*k3+k4)*h;
    phi(i+1)=phi(i)+(1/6)*(g1+2*g2+2*g3+g4)*h;

end

Ln_326 = Ln;
```

Plot

```
figure(1)
plot(x, Ln_6)
hold on
plot(x, Ln_326)
grid on
xlabel('x')
ylabel('Ln(x)')
legend('n = 6','n = 3.26')
title('HW Problem 7')
```

