Math 319 - Differential Equations II
Assignment # 5
due by 4 PM on MON Nov 24th
in the Document Holder beside SCI 386

Special Note: Please put your assignment in the document holder on the wall outside my office, and NOT under my office door!

Instructions: You are being evaluated on the presentation, as well as the correctness, of your answers. Try to answer questions in a clear, direct, and efficient way. Sloppy or incorrect use of technical terms will lower your mark.

The assignment may be done with up to 4 other classmates (i.e. total group size: no more than 5). If you collaborate with classmates, the group should hand in one document with all contributing names at the top.

1. Express the function $f(x) = x$ in an eigenfunction expansion using the orthonormal set of eigenfunctions
$$\{\Phi_n(x)\}_{n=1}^{\infty} = \left\{ \sqrt{2}\cos\left(\frac{(2n-1)}{2}\pi \ln(x)\right)\right\}_{n=1}^{\infty}.$$
These functions are orthonormal on the interval $[1, e]$ with respect to the weight function $r(x) = 1/x$. *Note: We started this problem in class.*

2. Section 11.3 #5

3. Section 11.3 #11

4. Section 11.3 #12(c)

5. Section 11.3 # 20

6. Find conditions on $h(x)$ that guarantee the existence of solutions for the BVP below.
$$x^2y''(x) + 3xy'(x) + 2y(x) = h(x)$$
$$y'(1) = 0, \qquad y'(e^{\pi}) = 0.$$