METHODS OF PARTIAL DIFFERENTIAL EQUATIONS
MATH-4500

Assignment #3 Due: March 9, 2001


2. (a) Text: p.119, #7. Solve this problem only for the boundary conditions of problem 1, that is, p. 98, #9.
   (b) Text: p. 131, #20. Solve this problem only for the boundary conditions of problem 1.

   Evaluate the generalized Fourier series expansions for each of the following:
   \[ f_1(x) = 1 \]
   \[ f_2(x) = x \]
   \[ f_3(x) = x^3 - x^2. \]
   With the first five terms in each series above, plot the curve of \( f(x) \) and its corresponding series on each set of axes. Suggestion: Make use of a Maple program, such as among those given in section 2.5 of the reference, Partial Differential Equations & Boundary Value Problems with Maple V\(^{(R)}\), by Articolo.

4. Text: p.130, #9, #10.

5. Solve the heat conduction problem with non-uniform properties
   \[
   cho \frac{\partial u}{\partial t} = \frac{\partial}{\partial x} \left( K \frac{\partial u}{\partial x} \right), \quad 0 < x < 1,
   \]
   \[ u(0, t) = 0, u(1, t) = 0, \]
   \[ u(x, 0) = f(x), \]
   where \( c\rho = 1/(1 + x)^3 \) and \( K = 1/(1 + x) \). Method: Employ the same approach as for the variable string problem. From the behavior of the terms \( T_n(t) \), obtained by separation of variables, explain why you expect the convergence of the series to be rapid.