MATH 241 — HOMEWORK 5.

due on Friday, October 9.

Textbook: *"Applied Partial Differential Equations with Fourier Series and Boundary Value Problems"* , fifth edition
by Richard Haberman

Topics:

- Chapter 2. Method of Separation of Variables
  - 2.5 Laplace's Equation: Solutions and Qualitative Properties
    - (2.5.4) Qualitative Properties of Laplaces Equation
- Chapter 3. Fourier Series
  - 3.1 Introduction
  - 3.2 Statement of Convergence Theorem
  - 3.3 Fourier Cosine and Sine Series
  - 3.4 Term by Term Differentiation of Fourier Series
  - 3.5 Term by Term Integration of Fourier Series
  - 3.6 Complex Form of Fourier Series

Fifth Homework Assignment.

Reading:

- Read Sections 2.5.4 and 3.1, 3.2, 3.3 and 3.6 from the book.
- Read your notes.

Exercises:

Problem 1. Solve the Heat Equation in a one dimensional rod ($0 < x < 1$):

$$\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2},$$

subject to the boundary conditions

$$u(0,t) = 0, \quad u(1,t) = e^{-kt},$$

$t > 0$, and initial condition

$$u(x,0) = 0.$$

(Hint: Note that $\dfrac{\sin(x)}{\sin(1)}e^{-kt}$ is a particular solution of the Heat Equation and the boundary conditions).

Problem 2. Re-do the preceding problem using the Metod of Eigenfunction Expansion.

Problems:

- Page 81: problems: 2.5.10
- Page 92: problems: 3.2.1 (f), 3.2.2 (g)
- Page 110: problems: 3.3.1 (e), 3.3.2 (a), 3.3.10, 3.3.18
- Page 120: problems: 3.4.5
- Page 129: problems: 3.6.1.