Math 319 - Differential Equations II
Pre-Reading Assignment # 2
due 10am Thu Sep 11th, via email

Reading Class notes from Sep 9th and Assignment #1.

Questions Answer the questions below to the best of your ability. Note: The first questions are math problems. The last question (on page 2) is a poll about assignment due dates. Please make sure you don't forget to answer the poll!

1. In class on Tuesday Sep 9th, we considered the parabolic PDE (vibrating string or heat equation)

$$\frac{\partial u}{\partial t} = K \frac{\partial^2 u}{\partial x^2} \tag{1}$$

with boundary conditions

$$u(0, t) = u(L, t) = 0, \text{ for } t > 0, \tag{2}$$

and initial conditions

$$u(x, 0) = f(x), \text{ for } 0 \le x \le L. \tag{3}$$

We looked for solutions by assuming that the x and t dependent portions of the solution could be separated so that we could write $u(x, t)$ as $u(x, t) = \phi(x)G(t)$. By plugging this expression into (1) and using the boundary conditions in (2), we arrived at two ODE problems:

$$\phi'' + \lambda\phi = 0, \text{ with } \phi(0) = \phi(L) = 0 \tag{4a}$$

$$G' + \lambda K G = 0. \tag{4b}$$

The ODE problem (4a) is a boundary value problem, while the ODE problem (4b) is a time-dependent problem.

In class, we didn't show how the boundary values in (4a) are derived. Your task is to show how these boundary values are obtained by plugging $u(x, t) = \phi(x)G(t)$ into the boundary values in (2).

2. Why is the ODE problem (4a) called a "boundary value problem" and not an "initial value problem"?

3. In your solution to problem #3 in Assignment #1, what are the values of λ for which there are nontrivial solutiosn? What are these nontrivial solutions?

4. Assignment Due Date Poll! Which do you prefer, **A**, **B** or **C** below? The choices are:

A: Assignments due Thursday at 5pm. This is the current arrangement.

advantages There are three consecutive days of help available in the three 24-hour periods before the due time. Marked assignments will be returned on Tuesday (the lecture following the due date).

disadvantages Assignments will include material from the four previous lectures in the 13-day periods running Thursday-Tuesday (i.e. the assignment due on Sep 25th will include material from the lectures on Sep 11th, 16th, 18th and 23rd). So there won't be much time to digest the material from the Sep 23rd lecture before the assignment needs to be handed in on Thursday. I am aware of this, of course, and so will make sure that the questions based on the material from the previous Tuesday are fairly simple.

B: Assignments due Monday at noon.

advantages The assignment can include more material from the Thursday class, and you have more time to digest the material from the lectures generating the assignment.

disadvantages There will be a tendency to not start the assignment till Friday, and no help is available from myself or the TA on Friday, Saturday or Sunday (email sometimes works, but is *not* reliable). Marked assignments will not be returned till Thursday.

C: Assignments due Friday at noon.

advantages The assignment can include some material from the Thursday class, and you have a little more time to digest the material from the lectures that generate material for the assignment. There should be no temptation to wait till the last minute to work on the assignment. Assignments will be based on material from the previous four lectures running Tuesday-Thursday (i.e. the assignment currently due on Oct 16th would instead be due on Oct 17th and would include material from the lectures on Oct 7th, 9th, 14th and 16th). Marked assignments will be returned on Tuesday (the lecture following the due date).

disadvantages I don't really see any... .