Reflection Activity

Submit responses to the following questions to the `1` slot on D2L by 11:59 pm on Monday, September 16. Any cogent response will earn you 5 points on the exam; you can earn the other 95 points on the exam itself.

1. (Required.) Compare and contrast the behavior of solutions to the transport and wave equations. Your response should make sense to someone who has taken Calculus III and knows what a partial derivative is but who hasn't taken this class.

2. (Required.) What have you found most difficult or confusing in the course so far? Write it down explicitly. Then think hard about this concept for at least half an hour—go back over your notes, the daily log, and the textbook and reread and rework material related to this sticky topic. How do you feel now?

3. (Optional.) What would you like to discuss during our review in class on Wednesday, September 18? Please be as specific as possible and, if you can, point to numbered items in the daily log, problems from problem sets, or content in the textbook.

4. (Optional.) What, if anything, do you want to change about how you are working in and approaching this course? How can I help?

Exam Content

The exam will cover material discussed in class on Days 1 through 12 including the material on finite propagation speed (up to and including Problem 13.7) but not including the semi-infinite string. Specifically, the exam will test your ability to do the following. All numbered references below are to the daily log. Various tasks may involve setting up or evaluating definite integrals (e.g., solving first-order ODE, solving nonhomogeneous transport equations, or using D'Alembert's formula); all concrete integrals will be "easy" to do symbolically and will require at most substitution, no integration by parts or any fancy Calculus II-style manipulations.

1. Prove results about definite integrals using their fundamental properties ($\int 1$) through ($\int 4$), including the fundamental theorem of calculus (Theorem 2.5, assuming that Lemma 2.7 is true—you wouldn't need to prove that lemma).

2. Solve first-order linear ODE and separable ODE, preferably using definite integrals. Solve second-order constant-coefficient linear homogeneous ODE.

3. Solve PDE that are really ODE.

4. Solve transport equations and derive from scratch the solution to the transport IVP (i.e., prove Theorem 7.1).

5. Solve a transport equation with a side condition or explain why no solution exists.

6. Solve a nonhomogeneous transport equation and derive the solution from scratch (i.e., prove Theorem 11.1).

7. Use Leibniz's rule to differentiate under the integral and use and/or prove Lemma 11.5.

8. Derive D'Alembert's formula for the solution to the wave IVP and use it to prove properties of the solution, e.g., finite propagation speed or Properties 2 or 3 on p. 306 of the textbook.

9. Make a traveling wave ansatz for a given PDE and determine the ODE that the traveling wave profile must satisfy. I will tell you if you need to solve that ODE.

10. Rescale a given PDE to simplify coefficients and reduce it to a simpler specified PDE (i.e., do things along the lines of Problems 8.4 and 8.5).

A natural question is how many problems will be on the exam. A numerical answer to this question that does not also discuss the length and difficulty of each problem (which would, more or less, require disclosing the content of each problem) will tell you very little. I expect that most students will need the full allotted time to complete an exam. There is definitely nothing wrong with you if the exam takes you all of the available time.

How to Prepare

Here are some questions for your consideration.

1. Have you completed all of the problems in the lecture notes corresponding to the material above?

2. Have you completed every problem set and checked your solutions carefully?

3. Have you completed every recommended problem from the problem sets?

4. Can you do all these problems with minimal reference to your notes, my notes, the textbook, or any other source?