MATH 302   Partial Differential Equations   Fall 2011   Exam #2

Instructions: Do your own work. You may consult your class notes and the course text. Do not consult other sources. Do not discuss generalities or specifics of the exam with anyone except me.

Turn in a complete and concise write up of your work. Show enough detail so that a peer could follow your work (both computations and reasoning). All plots should be carefully drawn either by hand or printed from technology. If you want to include a visualization that cannot be printed (such as an animation), include it as an attachment in an email with "Math 302 Exam 2" as the subject line.

The exam is due at the beginning of class on Monday, September 26.

Consider stuff moving by advection along a line (coordinatized by x for $-\infty < x < \infty$) with speed $c(x,t) = ax$ where a is a constant. Assume that the stuff is conserved and that there are no creation or destruction processes. Consider starting at time $t = 0$ with a prescribed density distribution. Set up a model for this scenario consisting of a partial differential equation together with an initial condition. Find the specific solution for this initial-value problem. Give a general interpretation of the specific solution without specifying an explicit initial condition. As part of this, describe the role of the parameter a. Also as part of this, use the specific solution to explicitly show that the stuff is conserved. Then, choose a specific nontrivial initial condition and a nontrival value for the parameter a. Give visualizations of the specific solution for those choices.