

Instructions: Do your own work. You may consult your class notes and the course text. You may also consult your texts from prerequisite courses (calculus, linear algebra, and differential equations) for reference on background mathematics. 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.

The exam is due in class on Thursday, September 17.

If you want to include animations from *Mathematica*, send me an e-mail with your *Mathematica* notebook as an attachment. Name the file you send `Math302Exam2_XX.nb` where `XX` are your initials and use “Math 302 Exam 2” as the subject line of the e-mail.

Consider the fundamental conservation law with flow by advection so $\phi = cu$. Suppose the advection parameter c depends on x so $c = c(x)$. To be specific, suppose $c(x) = x$. Assume the source term is zero (i.e. $f = 0$). Set up the general initial value problem for the density u under these assumptions. Solve the initial value problem. Describe the solution with plots and/or a physical description. For the purposes of describing the solution, you can use a specific initial condition of your own choosing.