Consider stuff with density \( u \) flowing in one dimension due to both advection and diffusion. Model this with the fundamental conservation law in one dimension with \( \phi = cu - ku_x \) and no creation or destruction processes. Assume the flow parameters \( c \) and \( k \) are uniform and constant. Take the spatial domain to be \( 0 \leq x \leq L \) and assume that the density at each end is held constant.

Set up and solve the steady-state problem for this scenario. Provide understanding and interpretation of the solution(s) with plots and/or a physical description. As part of understanding and interpreting a solution, explore the dependence on the boundary conditions and on the flow parameters.