16.901: Homework # 8
Due Date: March 2, 2pm

In this homework, you will investigate the convergence of the finite volume method applied to two-dimensional convection. Specifically, you will modify the Matlab script, **convect2d.m**

The problem to be studied in this homework will be for the square domain $-2 \leq x \leq 2$ and $-2 \leq y \leq 2$. The velocity field will be constant and given by,

$$u = 1$$
$$v = -1$$

With this velocity field, the $x = -2$ boundary and the $y = 2$ boundary will be inflow boundaries. On these boundaries, the boundary conditions are,

$$U(x, y) = e^{-10(y-1)^2}.$$

Modify the **convect2d.m** script to solve this problem. Perform simulations for grids with Nx = Ny = 20, 40, and 80, and 160. Be sure to run the simulations for a long enough time so that the steady state solution is reached. Use a CFL = 1.

For the four grids, plot the steady state solution on the bottom boundary (i.e. $y = -2$). Include the exact solution on the plot. Based on these results, what is your best guess for the order of accuracy of the method with respect to Δx?