

**Homework 5 Solution**

Matlab script `hw5_soln.m` implements a 2D pseudospectral method for the 2D inviscid vorticity eqn and produces the sequence of plots in Figs. 1 and 2. In the plots, negative contours are dashed and positive contours are solid. The contour interval on all plots is 0.05 for  $\psi$  and 10 for  $\zeta$ . One can see the initial vortex being rotated counterclockwise and deformed by the flow, stretching part of the vorticity into streamers. The vorticity starts to develop a ragged structure at the grid scale at later times and becomes underresolved at this  $N$  around  $t = 0.5$ . However, the maximum simulated vorticity remains fairly constant with time, as one would hope from an advection equation. The streamfunction looks much smoother since it is an inverse Laplacian of the vorticity, and largely just rotates counterclockwise with minor distortions in shape.

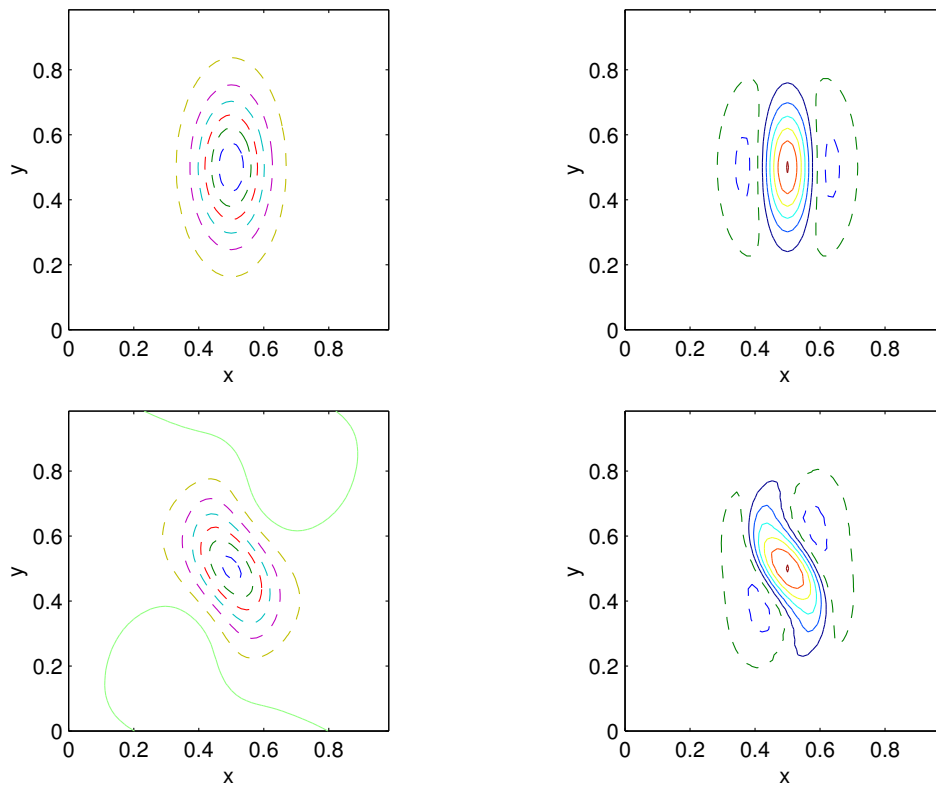


Figure 1: Streamfunction(left) and vorticity(right) at  $t = 0, 0.125$ .

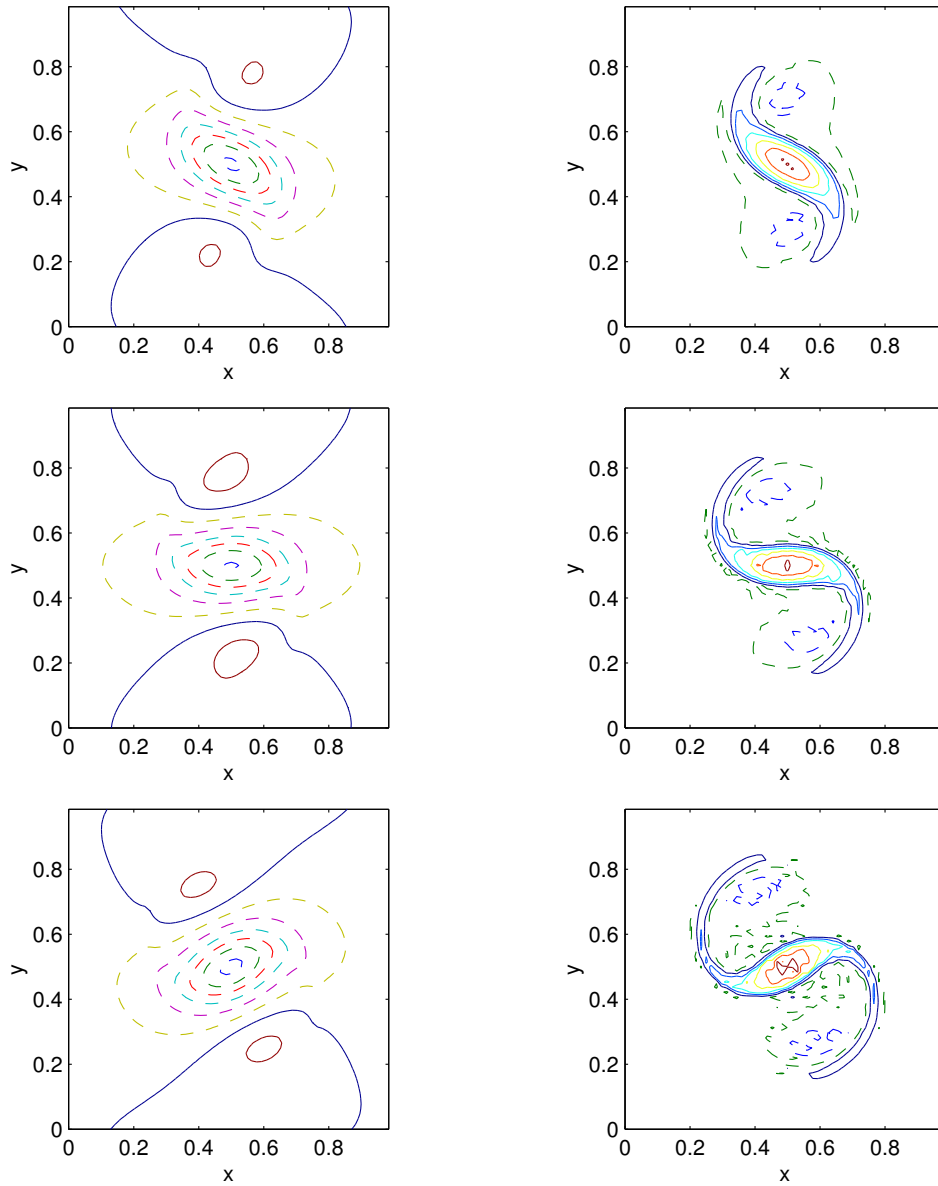


Figure 2: Streamfunction(left) and vorticity(right) at  $t = 0.25, 0.375, 0.5$ .