75 POINTS **HOMEWORK 6** **DUE: 2/25/16**

Please save your submission as HW06_[your last name].ipynb (for example, HW06_Smith.ipynb) and email it to the instructor or send a link to it on GitHub.

1. (10 points) Show that the complex potential of a 2-D doublet with strength κ and an outward dividing streamline along the positive x-axis is given by

$$W(z) = -\frac{\kappa}{2\pi}\frac{1}{z}$$

2. (20 points) Consider the following complex potential, which models flow around a corner

$$W(z) = z^n$$

a. (10 points) Show that if n is a positive integer, then the flow field is divided into $2n$ equal parts.

b. (10 points) Plot the flow for the cases $n = 2,3,4$ and include the contours of the dividing streamlines.

3. (25 points) Consider a vortex of strength $\Gamma = 2$ located at a distance $a = 1$ from an infinite wall, as shown in Figure 1.

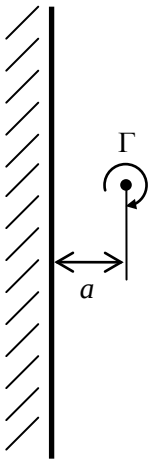

Figure 1

a. (10 points) Derive the complex potential for this flow.

b. (5 points) Derive an expression for $\frac{p(y)-p_\infty}{\rho}$ along the wall.

c. (10 points) Make a filled contour plot of $\frac{p(x,y)-p_\infty}{\rho}$ in the flow field, then plot $\frac{p(y)-p_\infty}{\rho}$ along the wall on the same plot as the analytical expression found in part b.

4. (20 points) Using the Joukowski transformation on an appropriately sized and positioned circle, produce a polar grid for the flow around a NACA 2510 airfoil (see Panton §18.11). Your result should look something like Figure 2.

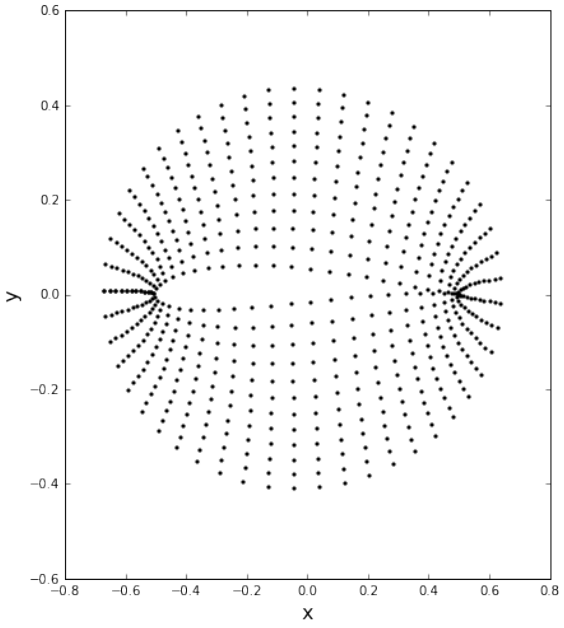

Figure 2