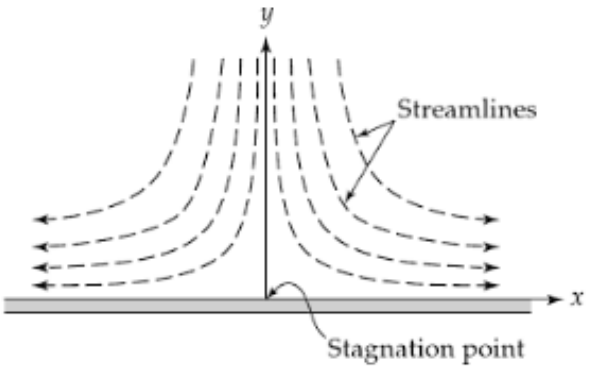
ABE 307
Homework 6
Assigned: Nov 3rd 2017
Due Date: Nov 10th 2017
Final Total Points Will be Decided Based on Problems Picked (will be < 50)

1. In a parallel one-dimensional flow in the positive x direction, the velocity varies linearly from zero at y = 0 to 100 ft/s at y = 4 ft. Determine an expression for the stream function, ψ. Also determine the y coordinate above which the volume flow rate is half the total between y = 0 and y = 4 ft. (10)

2. Potential flow near a stagnation point. (20 Points)
   a) Show that the complex potential $w = -v_0 z^2$ describes the flow near a plane stagnation point.
   b) Find the velocity components $v_x(x, y)$ and $v_y(x, y)$.
   c) Explain the physical significance of v_0



3. Steady potential flow around a stationary sphere. The potential function is given by $\phi = -v_\infty R \left[\left(\frac{r}{R}\right) + \frac{1}{2}\left(\frac{R}{r}\right)^2\right] \cos\theta$. (20 Points)
   a) Show that the velocity components are given by : $v_r = v_\infty \left[1 - \left(\frac{R}{r}\right)^3\right] \cos\theta$ and $v_\theta = -v_\infty \left[1 + \frac{1}{2}\left(\frac{R}{r}\right)^3\right] \sin\theta$
   b) Find the pressure distribution and show that at the sphere surface $P - P_\infty = \frac{1}{2}\rho v_\infty^2 \left(1 - \frac{9}{4} sin^2\theta\right)$

P_∞ is the Pressure far from the sphere.