1 Problem Class exercise 1, 17 Oct

(a) Write down the streamfunction for an isotropic ine source of strength $2\pi m > 0$ in a uniform strain flow of strength $\Gamma > 0$. Take the origin to be at the source and the strain axes to be the x- and y-axis (i.e. $u = \Gamma x, v = -\Gamma y$).

(b) Find the two stagnation points of the system.

(c) The flow approaching from $y = \pm\infty$ splits to either side of a streamline through the corresponding stagnation point. Find an equation for the dividing streamlines.

(d) Show that the separation between the two dividing streamline at $x = L$ is approximately $\frac{\pi m}{|L|\Gamma}$ when $|L| \to \infty$.

(e) Show that the flow is parallel to the x-axis when $x \to \pm\infty$ and find its (leading order) velocity at $x = L$ when $|L| \to \infty$.

(f) Calculate the flux through $x = L$ between the two dividing streamlines when $|L| \to \infty$ and give a physical explanation of the result.

(g) Sketch the motion distinguishing between fluid emitted from the source and fluid incident from $y = \pm\infty$,