

EXAMPLE FOR FINDING STREAMLINE PATTERNS

Suppose we have a velocity field given by

$\vec{u} = Ux\hat{i} + Uy\hat{j}$. We can calculate u, v at a bunch of (x, y) positions but that is tedious. Instead, we can “picture” the flow field by calculating streamlines directly.

Recall for streamlines:

$$\frac{dx}{u} = \frac{dy}{v} \text{ and upon substituting}$$

$$\frac{dx}{Ux} = \frac{dy}{-Uy} \text{ or } \int \frac{dx}{x} = \int \frac{dy}{-y} \text{ Leaving}$$

$$\ln(x) = -\ln(y) + c$$

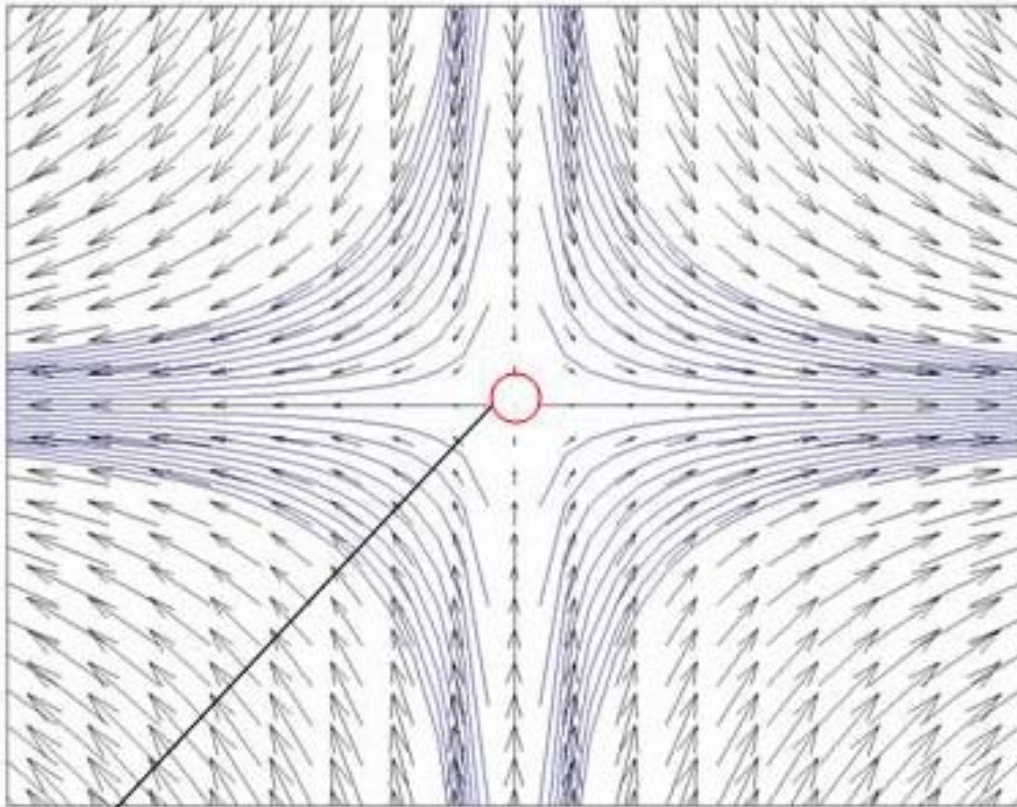
$$\ln(x) + \ln(y) = c \quad \text{a family of hyperbolas.}$$

$$\ln(xy) = c$$

$$xy = c_1$$

Note that we simply took the case of $x > 0$ and $y > 0$ if either were less than zero, we would perform a change of variables to $-x$ or $-y$ and get same result.

Now all we have to do is determine (x, y) pairs for a variety of constants. This is most easily done in Matlab



Stagnation Point at $(x,y)=(0,0)$. No flow velocity!