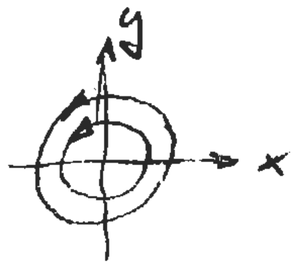
a) $u = -y \qquad v = x$

$$\frac{dy}{dx} = \frac{v}{u} = \frac{-x}{y} \rightarrow y\,dy = -x\,dx \rightarrow \frac{1}{2}y^2 = -\frac{1}{2}x^2 + C$$

$$x^2 + y^2 = 2C \qquad \text{circles of radius } \sqrt{2C}$$




b) $$\frac{Du}{Dt} = u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} = -y \cdot 0 + x \cdot (-1) = -x$$

$$\frac{Dv}{Dt} = u\frac{\partial v}{\partial x} + v\frac{\partial v}{\partial y} = -y \cdot 1 + x \cdot 0 = -y$$

using momentum eq'n: $$\frac{\partial p}{\partial x} = -\rho\frac{Du}{Dt} = \rho x$$

$$\frac{\partial p}{\partial y} = -\rho\frac{Dv}{Dt} = \rho y$$

$$\nabla p = \frac{\partial p}{\partial x}\hat{i} + \frac{\partial p}{\partial y}\hat{j} = \rho x\,\hat{i} + \rho y\,\hat{j}$$

c) $$\left.\begin{aligned}\frac{\partial p}{\partial x} &= \rho x \\ \frac{\partial p}{\partial y} &= \rho y\end{aligned}\right\} \quad p = \frac{1}{2}\rho(x^2 + y^2) + \phi$$