Problem 115E

A particular planar, incompressible flow is given by:

$$\psi = Axyt$$

where A is constant in time and space.

(a) Sketch the streamlines for this flow at a particular instant in time (say $t = 1$). What is the typical equation for such a streamline?

(b) Write down expressions for the velocity components, $u(x, y, t)$ and $v(x, y, t)$.

(c) Confirm that the **pathline** for a particle whose position is x_0, y_0 at time $t = 0$ is given by

$$x = x_0 exp(At^2/2) \quad ; \quad y = y_0 exp(-At^2/2)$$

(d) What are the Eulerian and Lagrangian accelerations at $t \neq 0$ in terms of x_0, y_0 and t?