7 (a)

$$\frac{\partial u}{\partial t} + (u \cdot \nabla) u = -\nabla p + Re^{-1} \nabla^2 u$$

$$\nabla \cdot u = \frac{\partial u_x}{\partial x} + \frac{\partial u_y}{\partial y} = 0 \quad , \quad Re = \frac{\rho u L}{v}$$

$$-\nabla p = \alpha$$

$$\nabla \cdot u = \frac{\partial(\alpha Re(1-y^2)/2)}{\partial x} + 0 = 0 + 0 = 0$$

$$\Rightarrow \frac{\alpha}{2} \frac{\rho L}{v} \frac{\partial u(1-y^2)}{\partial t} = \frac{\partial u}{\partial t}$$

$$(u \cdot \nabla) u = 0$$

$$\nabla^2 u = 0$$

$$\rightarrow \frac{\alpha}{2} \frac{\rho L}{v} \frac{\partial u(1-y^2)}{\partial t} = \alpha$$

(c) can not

need SIMPLE algorithm

$$w^{n+\frac{1}{2}} = w^n + \Delta t \left(-(u^n \cdot \nabla) w^n + \frac{1}{Re} \nabla^2 w^n \right)$$

$$\frac{w^{n+1} - w^{n+\frac{1}{2}}}{\Delta t} = -u^{n+1} \cdot \vec{\nabla} \leftarrow \text{Corrector}$$

We need to know the boundary condition w satisfies in order to solve for w^{n+1} that contains a correction involving u