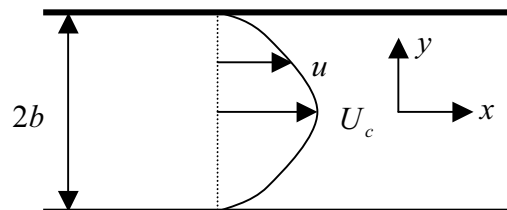


**2.20 Problem Set 5A**

Name: \_\_\_\_\_

1. Supplementary Problem Ia1.
2. Supplementary Problem Ia2.
3. Supplementary Problem Ia3.
4. Supplementary Problem Ia4.
5. Supplementary Problem Ia6.
6. Calculate the vorticity magnitude of the two-dimensional flow field described in polar coordinates by the equations  $v_\theta = \Omega r$ ,  $v_r = 0$ , in which  $\Omega$  is a constant. Sketch the flow streamlines using arrows to indicate the direction of the flow.
7. When a viscous, incompressible fluid flows between two plates and the flow is laminar (no turbulence) and two-dimensional, the velocity profile is parabolic and given by

$$u(x, y) = U_c (1 - y^2 / b^2)$$



- (a) Calculate the shear stress  $\tau = \tau(x, y)$  and the vorticity vector  $\vec{\omega} = \omega_x \hat{i} + \omega_y \hat{j} + \omega_z \hat{k}$ .
- (b) Write an equation relating the shear stress to the magnitude of the vorticity.