NAME: ________________________ **ROLL #:** __________ **Sec#:**___

ESO212 Fluid Mechanics & Rate Processes **July-Nov 2011**

Quiz 3 Paper **B** **30 minutes; 10 points**

• 2 marks for a correct answer. *Negative marking*: 0.5 marks will be deducted per wrong answer.

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1. A line vortex is located at $x = 3, y = 3$, and the velocity component v_θ at $x = 0, y = 0$ is $\frac{1}{3}\,m/s$. The values of v_r and v_θ (in m/s) at $x = 1, y = 1$ are respectively given by:

   (a) 0, 2 (b) 1/2, 0 (c) 0, 1/2 (d) 0, 0

2. For uniform, 2-D, potential flow past a circular cylinder (as shown in figure 1), the velocity components at points A and B are given by:

   (a) Point A: $v_r = 2U, v_\theta = 0$ Point B: $v_r = 0, v_\theta = 0$.
   (b) Point A: $v_r = 0, v_\theta = 0$ Point B: $v_r = 0, v_\theta = 2U$
   (c) Point A: $v_r = 0, v_\theta = 0$ Point B: $v_r = -2U, v_\theta = -2U$
   (d) Point A: $v_r = 0, v_\theta = 0$ Point B: $v_r = 0, v_\theta = -2U$

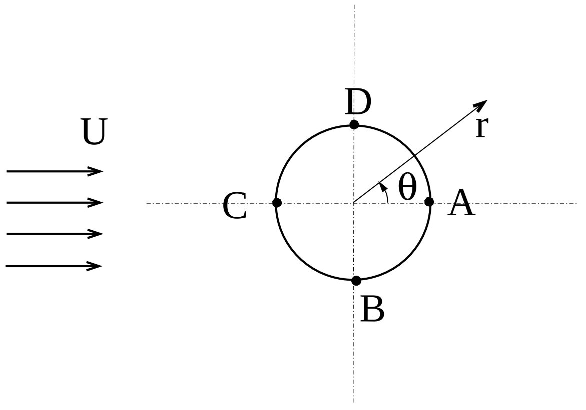

Figure 1: **Problem 2 and 3**

3. For uniform, 2-D, potential flow past a circular cylinder (as shown in figure 1), the pressures at various points (as shown in the figure) satisfy:

   (a) $p_A > p_B$, $p_C < p_B$

   (b) $p_A > p_B$, $p_C > p_D$

   (c) $p_C > p_B$, $p_D > p_B$

   (d) $p_A < p_C$, $p_B > p_D$

4. Which of the following statements are **TRUE** for 2-D potential flows:

   (P) Vorticity is nonzero in a potential flow.

   (Q) The zero normal velocity condition can be satisfied by the velocity field on solid surfaces.

   (R) Streamlines and equipotentials are orthogonal.

   (S) Streamlines and equipotentials are parallel.

   (a) P and S (b) R and Q (c) P and Q (d) R and P

5. Consider the two configurations shown in figure 2, wherein three identical plates (of infinitesimal thickness, length L and width W) are joined along the width (in arrangement A) and along the length (in arrangement B). There is steady, uniform, boundary-layer flow **over the top** surface of these two arrangements (hatched surfaces in the figure) with identical uniform velocity outside the boundary layer. The drag forces F_A (for arrangement A) and F_B (for arrangement B) are related as:

   (a) $F_A = \sqrt{3}F_B$ (b) $F_A = F_B$ (c) $F_A = 3F_B$ (d) $F_A = F_B/\sqrt{3}$

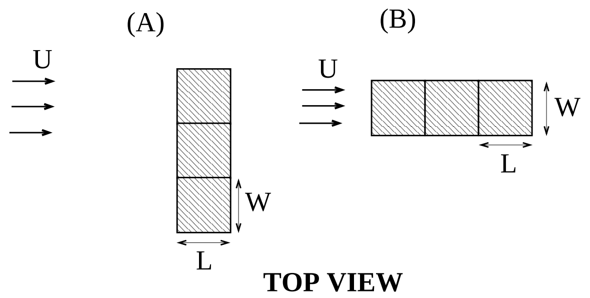

Figure 2: **Problem 4**