Florida International University
CWR 3201 Fluid Mechanics, Fall 2019
Final Exam

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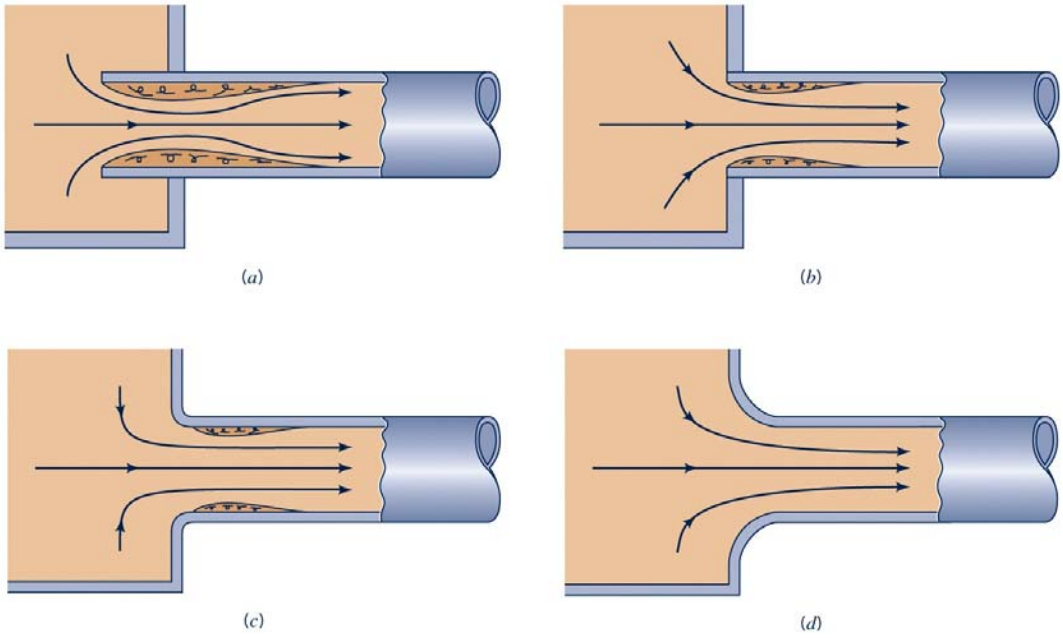
TA: Mohammad R. Safaei, Ph.D.

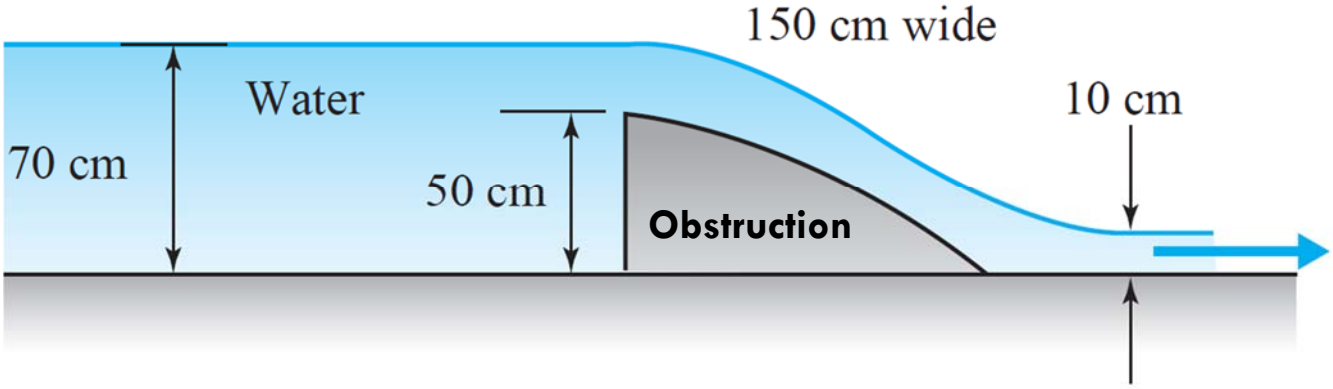
Student Name: _____ Panther ID_____

- ✓ **You will have 2 hours to complete the exam. The exam is closed book and closed notes**
- ✓ **Only one page (front and back) with handwritten equations are allowed (no photocopies or artificially reduced text will be allowed)**
- ✓ **No cell phones or any type of communication device will be allowed.**

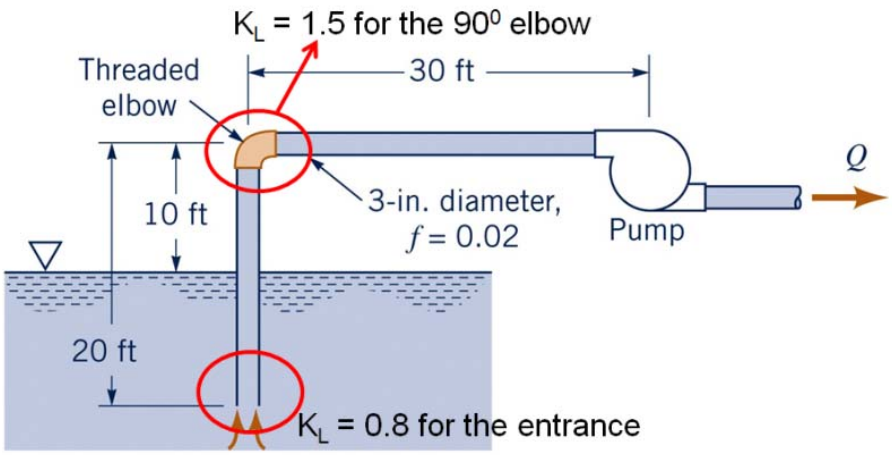
1. **(5 points)** Four different entrance flow conditions are presented below. Which one of the five options correctly lists the local loss coefficient (*K*) of the four entrance flow conditions **from the largest to smallest**?
   a. (b)-(c)-(d)-(e)
   b. (a)-(b)-(c)-(d)
   c. (d)-(b)-(c)-(a)
   d. (d)-(c)-(b)-(a)
   e. (a)-(c)-(d)-(b)



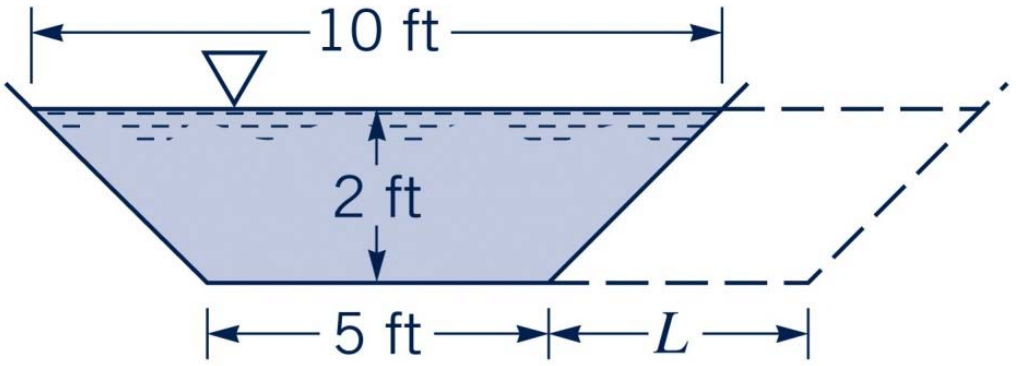
2. (20 points) **Neglecting viscous effects** and assuming uniform velocity profiles, find the horizontal force component acting on the obstruction shown in the figure below. Note that the channel width is 150 cm.



3. (**20 points**) Water at 40°F is pumped from a lake as shown in the figure below. Consider that the atmospheric pressure is 14.7 psi (absolute) and the vapor pressure at 40°F is 0.127 psi (absolute). Also, consider that f = 0.02, K = 1.5 for the 90^0 elbow and K = 0.8 for the pipe entrance. What is the maximum flowrate possible without cavitation occurring? Assume that the specific weight of water is $\gamma_w = 62.4$ lb/ft^3

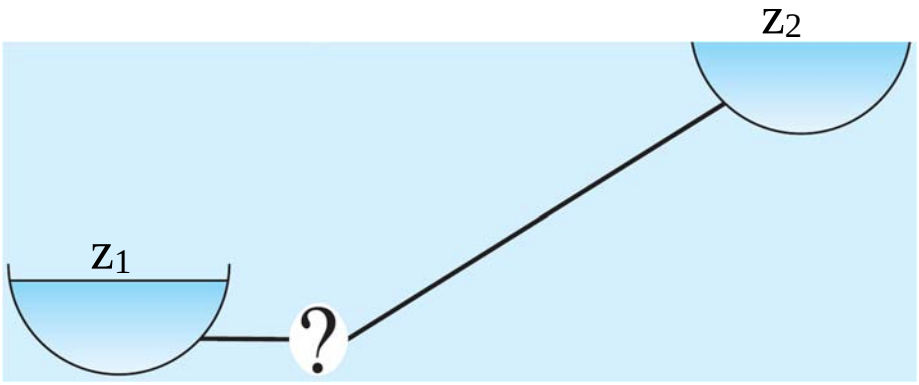


4. **(20 points)** The canal shown in the figure below is to be widened so that it can carry twice the amount of water. Determine the additional width, ***L***, required if all other parameters (i.e., flow depth, bottom slope, surface material, side slope) are to remain the same.



5. **(20 points)** Water is pumped between two reservoirs in a pipeline with the following characteristics: D = 300 mm, L = 70 m, f = 0.025, ΣK = 2.5. The radial-flow pump characteristic curve is approximated by the formula $H_P = 22.9 + 10.7Q - 111Q^2$, where H_P is in meters and Q is in m^3/s.

   If $z_2 - z_1$ = 74 m, and the minimum required flow discharge is 0.20 m^3/s, determine the minimum number of pumps you would use. Would you use pumps in parallel or in series? Justify your answer.



6. **(15 points)** The initial pressure in the gasoline tank below right before acceleration is p = 20 kPa. What is the force of the gasoline acting on the 4-cm-diameter plug when the tank is accelerated at the rate of $\mathbf{a}$ = 5 m/s^2. The density of gasoline is 680 kg/m^3 (S = 0.68).