

Florida International University
CWR 3201 Fluid Mechanics, Fall 2020
Final Exam

Instructor: Arturo S. Leon, Ph.D., P.E., D.WRE

Student Name: _____

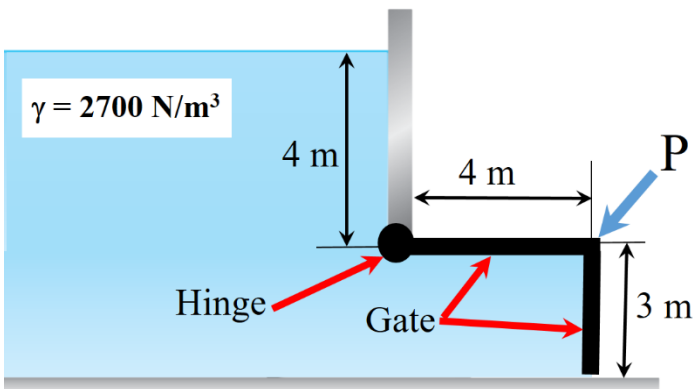
Date: 12/11/2020

Panther ID: _____

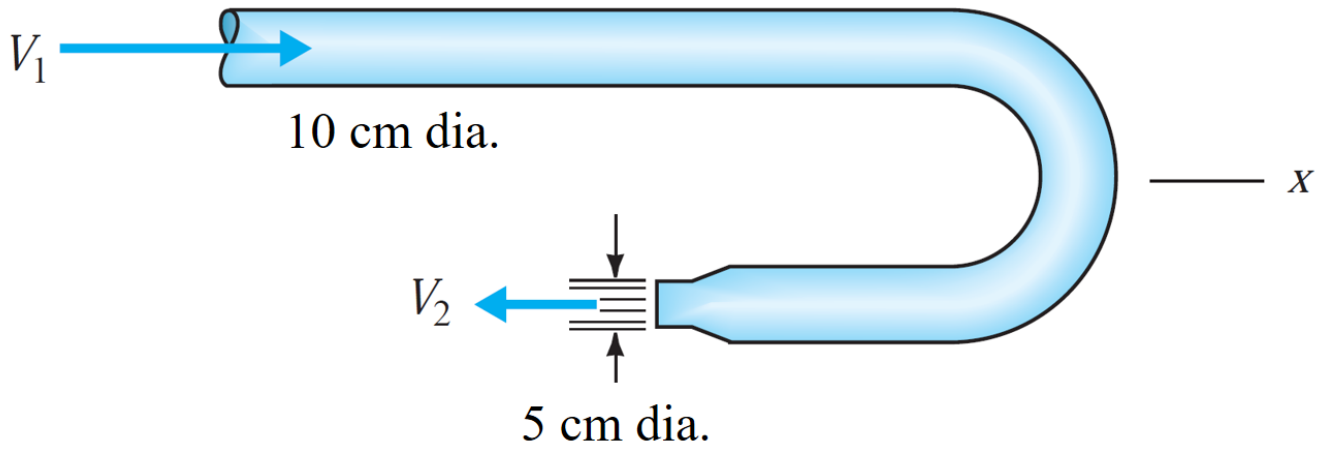
- ✓ You will have 1 hour 50 minutes to complete the exam. You will have an extra 10 minutes to scan your solution and upload it to Canvas [Assignment "Upload your Final Exam Solution HERE"]. A submission after 2:00 pm will be considered LATE.
- ✓ The exam is closed book and closed notes. You can use the two-page formula sheet provided via Canvas. Only the two pages (front and back) with handwritten equations are allowed.

Put your **full name** on **ALL** pages of your scratch paper containing your solution **AND** upload your solution as a **SINGLE PDF** file (2 points).

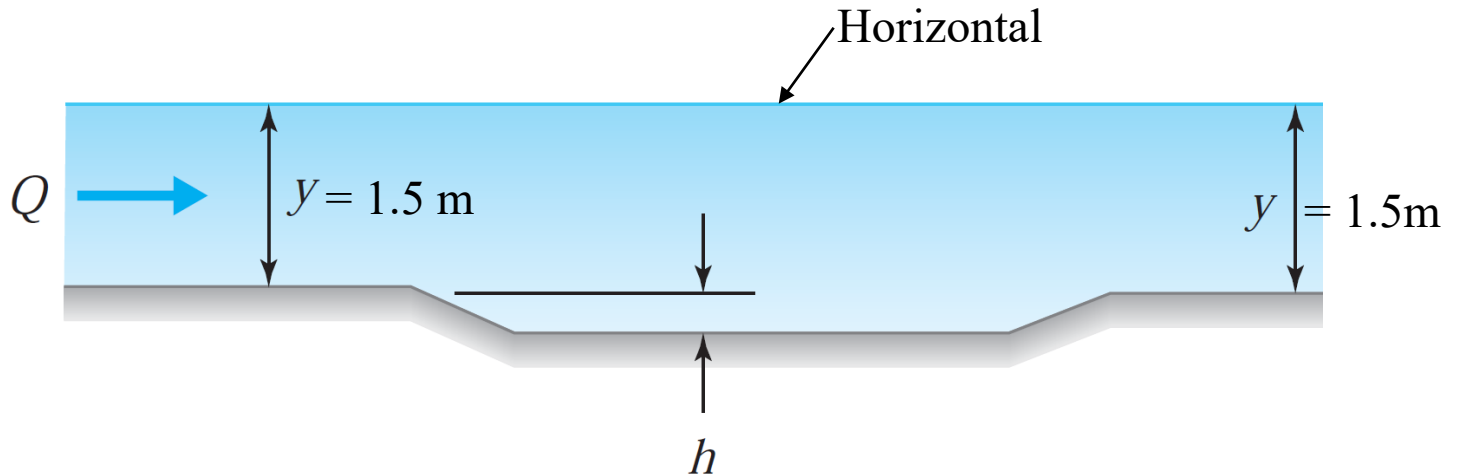
1. **(18 points)** The gate below is closed, as shown in the figure below. What is the horizontal and vertical force of the liquid acting on the gate below? The gate width is 5 m. The **liquid has a specific weight of 2700 N/m^3** .



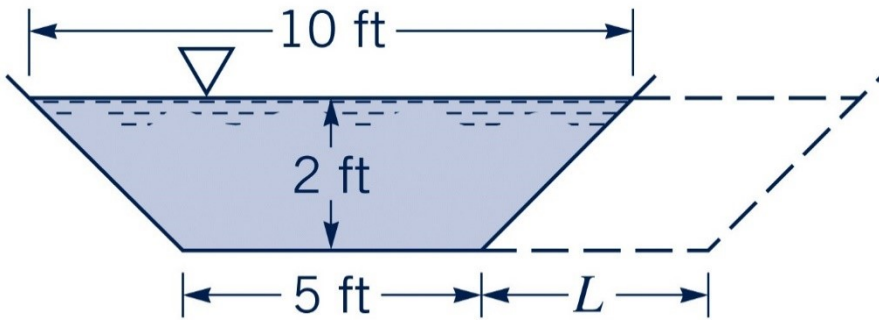
2. (20 points) Find V_1 (upstream velocity) if the x -direction force of the water on the horizontal bend shown below is 20 kN. Neglect head losses. **Hint:** The bend is horizontal, which means that the entire pipe has the same elevation.



3. (20 points) Water flows in a 3 m wide rectangular channel. At a transition section, the **channel width** is decreased to 2.5 m for a short distance, and then is increased back to the original **channel width** of 3 m. Find “ h ” (channel bottom elevation drop) in the figure below to maintain a horizontal water surface through the transition. **Hint:** The water elevation through the transition is horizontal, as shown in the figure below. The water depth upstream of the transition (y) is 1.5 m and the flow discharge Q is $6 \text{ m}^3/\text{s}$. **Neglect head losses.**



4. (20 points). The canal shown below is to be widened so that the **water flow discharge can be tripled** (i.e., flow discharge after widening is three times the initial flow discharge). 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) The trapezoidal channel below carries a discharge of $90 \text{ m}^3/\text{s}$ of water with a velocity of 2 m/s . The water height of the channel must be 6.2 m . If the channel is designed for **maximum hydraulic efficiency** conditions, what should be the channel bottom (b) and the side slopes (z) of the trapezoidal channel? **Hint:** The left and right side slopes of the channel (z) are the same.

Derivative rule for a power function: $\frac{dx^n}{dm} = nx^{n-1} \frac{dx}{dm}$

