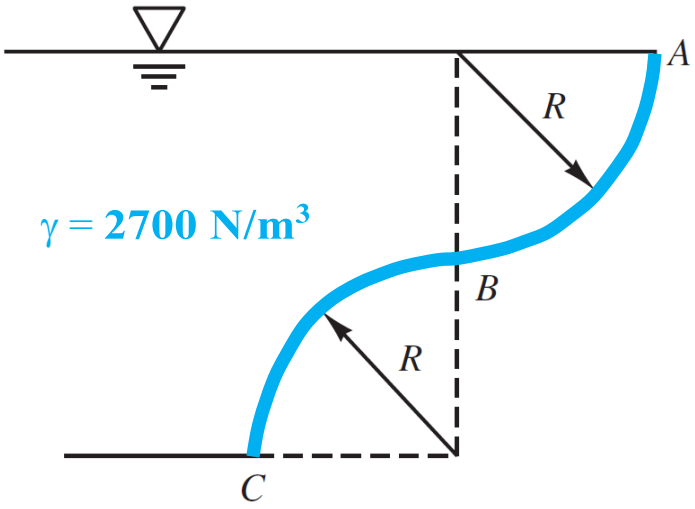
Florida International University
CWR 3201 Fluid Mechanics, Fall 2021
Final Exam

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

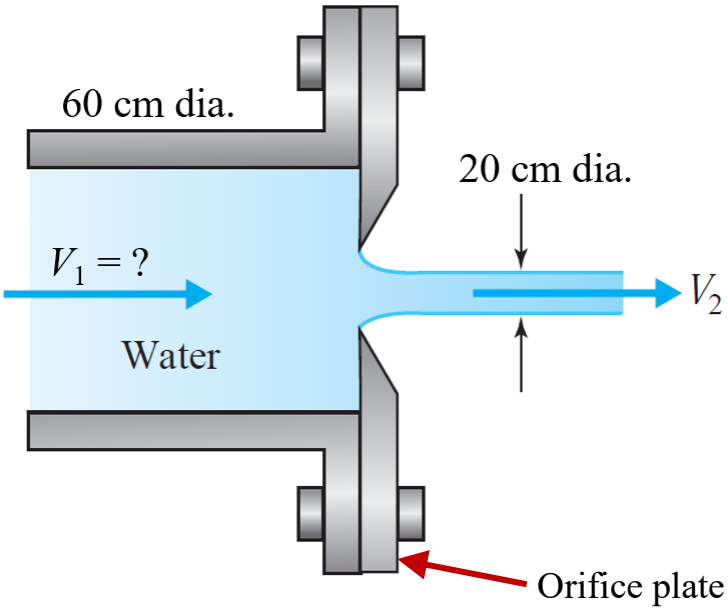
Student Name: _____ **Panther ID:** _____

- ✓ 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.
- ✓ The final exam consists of five questions; however, the **grading will be based on four questions only**. If five problems are solved, the grading will consider the 4 solutions with the highest scores.

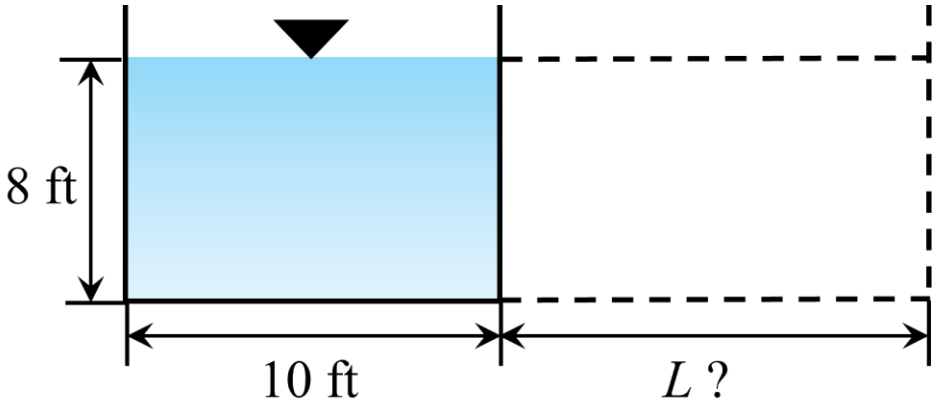
1. **(25 points)** Calculate the horizontal and vertical forces of the liquid (γ = **2700 N/m^3**) acting on the curved gate *ABC*. Assume R = 2 m and the gate width is 5 m.



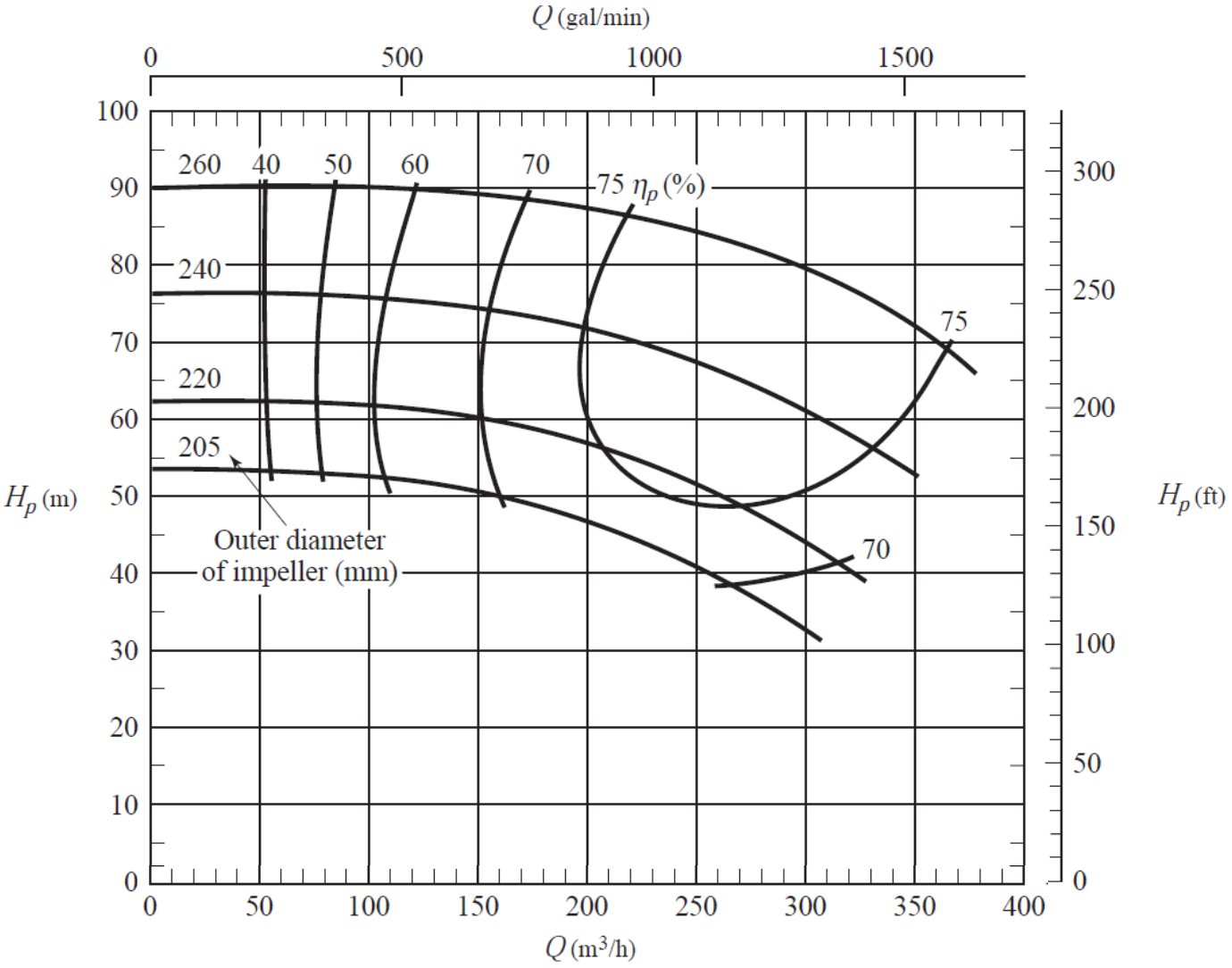
2. **(25 points)** What is the water velocity V_1 inside the pipe if the force needed to hold the orifice plate shown in the figure below is 50,000 N? **Hint:** The orifice plate is circular.



3. **(25 points)** The rectangular 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) are to remain the same.



4. **(25 points)** The **240**-mm-diameter pump represented in the figure below is used to move **water** in a piping system. The demand or system curve is $H_p(\text{m}) = 70 + 2500Q^2$, where ***Q* is in cubic meters per second**. Find the flow discharge (m^3/s) and pump head (m) if **two pumps in parallel** are used.



5. **(25 points)** The channel below carries a discharge of 30 m^3/s of water with a velocity of 1.5 m/s. If the channel is designed for **maximum hydraulic efficiency** conditions, what should be the bottom (***b***) and the height (***y***) of the channel?

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