Erich Schimpf 2nd Test Reflection

For exam 2, I felt much more confident going in than I had for the first exam, which I feel really helped me break down the exam into chunks. The first thing I did, as you can see by my annotated test, was to write above each problem the concept it is covering. From here, I chose to break the system into 2 main parts- The pressurized tank and pipe, and the channel for transporting logs. Some problems were dependent on information contrived from previous problems, but most were fairly independent from each other. The first things I tackled were the depth of the channel, largest logs that can be transported, and drag force on the logs.

After, I switched focus to the other system, and tackled the blind force on the tank, the forces on the pipes, the flow nozzle, and the water hammer. This was the most logical method of tackling the problem for me, and helped me progress through the problem.

Part A

The first thing I did with part A was draw a cross section of the channel, annotated with the vales given by table 14.3 in the book. From here, I outlined the main equations I would need, and selected the units required. The table greatly reduced the stress of isolating variables in the area equation, basically providing all the variables in functions of y.
From there, I just plugged in the knows and was able to determine the correct answer.

Open channel depth (y)

Correct equation	1/2
Area and Hydraulic radius	1/ 2

Part B

This was one of the sections I definitely struggled with, and it took me some time to even figure out a plan of attack. Unfortunately, I overlooked the valve and only considered the bend in the pipe, which I suspect will lose me the majority of the points. I also overlooked the weight of the pipe, which adds into the force in the y direction. I did use Bernoulli's in this equation, but overlooked finding the pressure difference between the bottom of the tank and the end of the pipe. I feel like this aspect is something I lacked understanding of going into the exam, and would have benefited from further studying the application of the equations.

Pipe-elbow forces

Free body diagram and correct forces	.5/3
Force in x	.6/3
Force in y (weight)	0/3

Part C

Part C was the second problem I attempted, and felt very confident with my answers on. I started by drawing a cross sectional diagram, and identifying the equations necessary. Originally, I made an incorrect assumption that the max side length would be equal to the bottom of the channel, and that the variable I was solving for was the max length of the log. When I tried applying this however, I was stumped that the "x" canceled out on each side of the equation. Ultimately, I realized that the length of the log is irrelevant as it itself exists on both sides of the equation, as the length is something that is constantly submerged. I then set up the equation with the assumption that I was solving for the width and height of the log. The cross-sectional area became x^2, while the submerged area became .4*x. This gave me a quadratic which was easily solved using symbolab.

For the stability, I drew a diagram showing the CG, CB, MC and MB, then applied those numbers to the equation provided, proving stability.

Largest wood log

Size	1/2
Stable?	½

Part D

On part D, I started by drawing a cross sectional diagram of the flow nozzle, and calculating the 2 diameters with the .5 ratio. Originally, I mistakenly used the smaller diameter to determine v1, which gave me a much larger pressure drop and Reynolds number. I was able to correct this on my second attempt of the problem where I used my previously established 13.62 f/s velocity. I recalculated my Reynolds number, which was identical to the solutions, and plugged it back into the equation. The Delta P I found was slightly higher than the solutions, and I feel like that is likely due to a slightly higher velocity going through the pipe than the solution found. My number was 2700 lb/ft, while the solutions was a little over 2100 ft/s.

Other than the minor discrepancy with the Delta P, I executed this problem identically than that of the solution.

Flow-nozzle flowmeter pressure drop

Right equation and A1/A2	1/2
C value	½

Part E

Part E was definitely the most challenging for me. I selected the correct equations, was able to get units to cancel, but somehow still got a strange answer. I attempted the problem twice, once with metric and once with standard, and both times got a similar wave velocity that was one decimal spot larger than the solutions, with the same numerical value. Ie 14293 vs the solutions 1429.3. This is very confusing to me and I have spent considerable time trying to figure out how this happened, and if it was just a coincidence that happened under both metric and imperial.

I did yield a wave velocity in f/s and M/s, and the pressure increase was calculated the same way, albeit with differing results.

Water hammer pressure increase

Wave velocity (units?)	.75/2
Pressure increase	.6/2

Part F

For part F, I started by calculating Reynolds Number and determining CD. I was able to determine this algebraically and correctly off the bat, rather than estimating as the solution does at first. For area, I assumed the log to be stuck perpendicular, which seams to be slightly different from the solutions. My area was half the largest size as the problem dictated, by the max length of the bottom of the channel. I believe this is the main source of error between my solution and the answer keys, and I am still not sure how the key got to this conclusion. Regardless, the equations used to reach the solution were identical.

Drag force on a stuck log

Correct area	.5/3
Correct velocity	1/3
How Cd was obtained?	1/3

Part G

Recognizing the tank pressure as one of the instances where I would have to run Bernoulli's, I actually calculated the pressure inside the tank in part B mistakenly. I ultimately made a mistake in calculating this pressure, which severely impacted my answer for this question. After this however, I recognized this as a straight forward gamma H equation, and found my force the same way as on the key. Unfortunately for me I misunderstood the meaning of the location of the force, and neglected to include the equation to calculate that and only estimated via rule of thumb.

Force on the flange

Magnitude	.5/2
Location	0/2

Final actual values of the results .65/1

WRITING RUBRIC (Applied to the whole test, not to particular problems)

Purpose	0.5/0.5/10.0
Drawings	1.0/1.0/10.0
Sources	0.75/1.0/10.0
Design considerations	1.0/1.0/10.0
Data and variables	0.5/0.5/10.0
Procedure	1.8/2.0/10.0
Calculations	2.0/2.0/10.0
Summary	0.5/0.5/10.0
Materials	0.5/0.5/10.0
Analysis	1.0/1.0/10.0
TOTAL	9.55/10.0/10.0

10.0+ (80/10)*(2/2 + 3/3 + 2/2 + 2/2 + 2/2 + 3/3 + 2/2 + 1/1) = 90

9.55+ (80/10)*(2/2+1.1/3+2/2+2/2+1.35/2+2.5/3+.5/2+.65/1)=55.75

62%