Fundamentals of Fluid Mechanics B Questions and Answers

Question by AME536B Student

Can you please omit problem 1 of homework 9? This problem asked for a proof whose intermediate steps were all clever mathematical manipulations rather than utilizing fluids concepts.

OK, this problem will be omitted.

Question by AME536B Student

Can you please omit question 2 of homework 6?
In the exam, it would be time consuming to rederive these equations to determine the different assumptions and approaches to boundary layer theory each solution uses.

I don't see why this question should be omitted. You should remember what assumptions were made in the derivation of each equation and what they entail. This is important to know for a fluid dynamicist.

Question by AME536A Student

Can you please omit Question #2 of Homework #8? It is a proof that tests less our understanding of fluids and instead is more of a time-heavy mathematical manipulation using Reynold's Transport Theorem.

No, this question will remain because it is a very important problem in fluid dynamics. A fluid dynamicist should know how to derive the integral form from the differential form.

Question by AME536B Student

For Homework 9, Question 2, I am having trouble determining the velocity in the y-direction in the boundary layer. After integration I get:

$v(x,y) = \ldots + C$

where C is the constant of integration. However, from our aforementioned boundary conditions, we will run into issues as there is no value for C that will satisfy both boundary conditions at the wall and at the boundary layer edge. Can you please provide a recommendation on where I might have made my mistake?

Keep in mind our polynomial for u is not exact. If it would be exact, u would never reach free stream and v would never become zero even infinitely far from the plate (although u would become very close to freestream and v very close to zero, they would never reach these values). Thus, find the integration constant by specifying $v = 0$ at the surface and don't worry about whether $v = 0$ at the boundary layer edge.

Question by AME536A Student

I have a question about prob#2 (a) in the assignment of 7. If the fluid density is not uniform, will the three order polynomial fit, $\frac{u}{u_\infty}$, obtained from what is the uniform density become different?

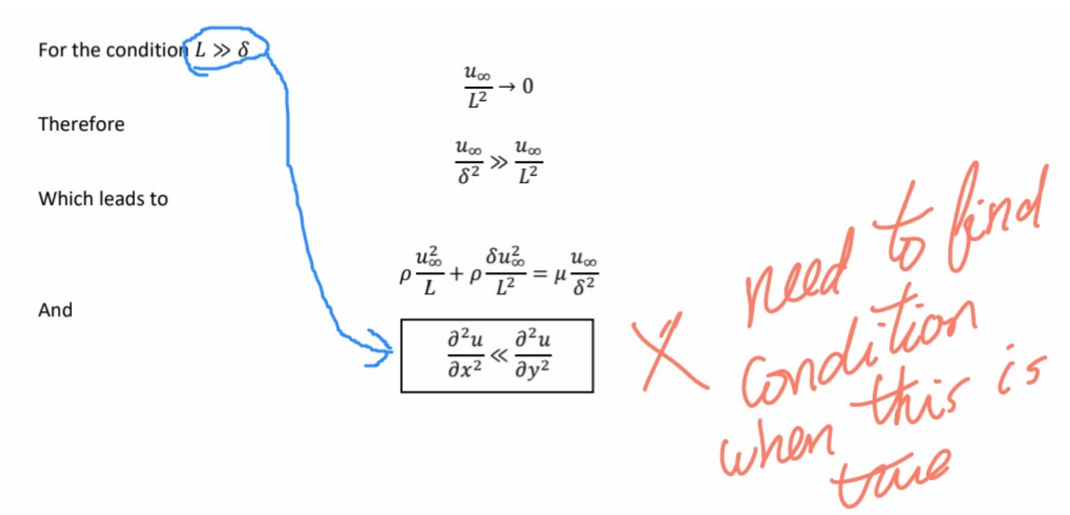
If the density is not uniform, then you can not use the polynomial fit expression for u given in the tables.

Question by AME536A Student

If you don`t mind, could you please give me a hint how to solve the problem?

Follow the steps shown in class for the displacement thickness and submit revisions to your assignment to get feedback.

Question by AME536B Student



For Hw8 Question 6 Part A, you asked to find the condition where $\mu\frac{\partial^2 u}{\partial x^2}$ is negligible. In my attached Hw I gave the condition $L >> \delta$, is this sufficient or is a more thorough explanation necessary?
Thank you

There are a few problems here. The first is that your answer "$\partial_x^2 u \ll \partial_y^2 u$" is not a proper answer to what is asked in the question. If what you meant is that this would occur when $L \gg \delta$, then this should be the answer highlighted. But this is also not what is sought here. You should find a condition based on the freestream flow properties. Another issue is that the length scale you use to approximate the derivative along x is not in practice the length of the plate: it may be much less. Redo this problem so you get rid of these concerns. I gave a hint in class on how to approach this. See the recorded lectures.

Question by AME536A Student

I have a question about prob#1 in the assignment of 8. Can I define δ as the difference between the two symmetric inflection points of u?

This is not the best way of doing it because it will measure much less than the jet height. The Q&A is finished for this term: the exam is in less than 24 hours. Good luck!

Question by AME536B Student

Dr. Parent, any idea when will you be adding the final grades to UAccess?

I added them already more than 1 week ago. Let me check why you can not see them.

Question by AME536B Student

Will homework submissions be physical again or via D2L?

They have to be submitted in class on the due date, not on the D2L.

Question by AME536A Student

I can't make it to office hours today but I have a question about HW3Q4. I worked through mass and momentum conservation to achieve the following equation:

$v_\theta = -v_\theta ln(r) + C_1 r + C_2$

I then used the following boundary conditions: $v_\theta = 0$ at $r = R_2$ and $v_\theta = \omega R_1$ at $r = R_1$ After solving for C_1 and C_2 and then plugging back into the above equation and solving for v_θ I didn't get the answer given on the assignment. I'm wondering if there is something wrong with my boundary conditions or if my error is in my equation? Thank you for your time!

There are 2 ways to solve this problem. One which is not exact but close enough (the first answer given) and the other which is exact and does not get rid of any term (the second answer given). However, your expression for v_θ does not match any of the 2 solutions. The error is thus in the process of finding v_θ.

Question by AME536B Student

HW4, Problem 3A:

Looking at mom-con in y direction, is assuming that the body forces in the y direction are negligible a crummy assumption?

You should keep the gravitational effects within the y momentum equation.

Question by AME536A Student

Looking at problem 2 from HW5, I have some questions about order of magnitude analysis. In a previous example from class, we looked at the Stoke's Flow through a pipe with changing diameter. For this problem, we found u_s and v_s or the "scale velocities" in the x and y-direction. My question is, is this necessary for all order of magnitude analyses that contain more than one velocity vector?

In this case, I would not worry about scale velocities in x and y direction. This will make things more complicated then they need to be. You should rather start this by providing an order of magnitude estimate of the largest viscous terms (in any dimension) close and far from the sphere. So, the direction in which they point is not important here. Then, compare these approximate viscous terms to an approximation of the convection terms. Hint: focus on the length scales.