Zach Swain 4/2/18
MEEG 332
Coding Challenge 2

Part 1

Define a function in a very similar manner to Dr. Feser's example provided in lecture making relevant definitions, but making dyvect_dt a three-column vector.

Use ode45( ) to evaluate the ODE, using the given n span and initial conditions. Isolate each column as f, f', f". Evaluate where y1=0, y2=0, y3=0.5 as prompted. Plot solutions y1, y2, y3 vs. n for given initial conditions.

Evaluate y2 at 100, where it is horizontal, equivalent to the value at infinity. Run the script again after making a small alteration the third column entry in the y0 definition. Note the change in y2(100). If it got closer to 1, continue changing the initial condition in the same direction; if it got further from 1, begin changing the initial condition in the opposite direction as the original change. Record a range of values that will output y2(100) = 1.0000.

Use an initial guess of .5 as used before. Make necessary definitions such as n, y0, and y2(via ode45) to begin setting up a while loop. Find the difference between the y2(infinity) obtained using your initial guess and 1. If that difference is greater than zero, enter the appropriate while loop. Originally, the adjustments made to approximate which alpha will give y2(infinity)=1 were done in very tiny increments to provide precise results, but iterating ~1.68 million times proved to be fairly time-consuming at around 5-10 min. This needed to be optimized. Instead of making all adjustments from your initial guess at the same step size, much courser adjustments were made while possible – and incrementally so. So as the step size was gradually being refined, the difference between the current alpha value being looped and 1 was also decreasing as it honed in on a precise alpha result. This provided a run time of a mater of seconds to achieve a resulting alpha. If the difference between the y2(infinity) obtained using your initial guess and 1 is less than zero, then copy & paste the above-zero code and make the relevant necessary +,-,<,> adjustments.

Part 2

Make relevant if statements to reflect the piecewise functions defining f' as provided for u/U. Overlay that function with the y2=f' found as the ODE solution on a plot vs. n.

Part 3

As there are no fluid properties provided, the value of ν cannot be determined, and the displacement thickness cannot be determined as instructed by using the given expression involving A. Use trapz( ) to evaluate the A integral using the y2 profile calculated.

Part 4

Since ν cannot be determined, the momentum thickness cannot be determined as instructed by using the given expression involving B. Use trapz( ) to evaluate the B integral using the y2 profile calculated.