

Mathematics/Physics Seminar
Spring 2017

Hwk #5: Introduction to boundary layer problems

Due: March 15, 2017

An example of a singular perturbation problem: analysis of a boundary value problem exhibiting boundary layer behavior. Using asymptotic matching in order to recover integration constants. Numerical verification using Mathematica. The material relevant to this homework is in Section 9.1 in Bender.

1) a) Problem 9.4, part b), in Bender.

b) Use *Mathematica* to plot the outer and inner solutions to the problem (on the same graph), for $\varepsilon = .05$. Plot also the numerical solution to the problem found by *Mathematica* (use *Mathematica*'s `NDSolve` command), along with the uniform approximation found from combining the inner and outer solutions. How large does the error become (between the numerical solution and the approximate analytical solution) in the region of largest error? How would you characterize the accuracy of the boundary layer analysis?