Math 46: Applied Math: Homework 4

due Wed Apr 28 ... but best if do relevant questions after each lecture

Most of this HW set covers material on Midterm 1, so is time well spent. Some of it is deliberate review. In initial-layer problems: keep in mind that the ICs will fix all unknowns in the inner approximation, and only then can you find the unknown in the outer approximation.

p.100-104: #12. a–d only. Excellent review of the complete *model* → *nondimensionalize* → *perturbation series* route. Please state how many dimensionless parameters remain in the problem after part c (& give each one a greek letter!) In d you'll need to watch out for a special value of a (not small) parameter.

#10. This is an exploration of perturbation in a different setting. How sensitive is the solution to $A\mathbf{x} = \mathbf{b}$ to changes in the matrix elements? That's what you'll discover. For exact solution you will find plain old simultaneous equations easier here than augmented matrix. Also answer: i) For what value of ε does all hell break loose? (Is 0.01 near this?) ii) Write a 2-term perturbation expansion (in ε) for x, y. By roughly what factor do small ε changes from zero get amplified?

p.121-123: #10. Whether there's a boundary layer at each end is determined by the outer approximation, weirdly. (First please check errata).

p.133-135: (Initial layers)

#1. This is a 'baby' initial layer problem: a rapidly-responding linear system being driven by a slower function. Please state what order the uniform convergence of the residual is.

#3.

p.141-142: (WKB)

#1 (rewrite λ in terms of more usual ε)

#2.

#3.

p.148-150: (Asymptotics of integrals)

#11. easy.

#13. Do at least 3 terms, and you get a BONUS for spotting the pattern and writing the general term.