

Physics 129a
Problem Set Number 3
Due Tuesday, October 20, 2009

Reading: Finish reading the note (posted on the course web page) on “Integral Equations”. The note includes a proper proof of the theorem on the existence and properties of eigenvalues of a symmetric kernel (as well as the Arzela theorem that is used in the proof). I encourage you to read this carefully as an example of how the proofs of the theorems we quote may be accomplished.

9. Consider the following simple integral equation:

$$f(x) = x^2 + \lambda \int_0^1 xyf(y)dy. \quad (4)$$

- (a) Find the Neumann series solution, to order λ^2 . For what values of λ do you expect the Neumann series to be convergent? If you aren't sure from what you have done so far, try doing the rest of the problem and come back to this.
 - (b) Find the Fredholm series solution, to order λ^2 .
 - (c) This is a degenerate kernel, so find the solution according to our method for degenerate kernels.
10. Practice with a proof: Exercise 9 in the Integral Equations course note.
11. Numerical solution of Volterra's equation: Exercise 14 in the Integral Equations course note.
12. A Volterra's equation: Exercise 20 in the Integral Equations course note.
13. Some more Volterra's equations: Exercise 22 in the Integral Equations course note.