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Activity 11 Due Monday, November 13 before class

1. A more realistic ODE describing heat transfer in the rod, that also accounts for radiative transfer, is

Note that this is a nonlinear ODE. Modify my matlab code to solve this BVP with the same parameters and BCs. Use σ= 0.01. Plot the resulting solution.

1. Consider constructing the analytic solution to the BVP

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We’ll use the guessing method as done in class.

1. Start with *w* = 1. What function(s) *u* satisfies the DE? How many solutions must there be?
2. Now solve the ODE with *w* = 4. Recall that the general solution is the linear combination of two linearly independent solutions.
3. Impose the boundary conditions to determine the solutions to the BVP.
4. Use matlab to plot the solutions.
5. Now solve the problem numerically using the shooting method. Plot the solutions and compare to iv).
6. Students taking the course for graduate credit only:
7. Consider the original heat equation (σ=0) with fixed temperature at *x = L* (Dirichlet condition) but with a “free” end at *x* = 0. This means that since we are considering steady-state (long time equilibrium), convection must equal conduction at the *x* = 0 end of the rod. Set up the heat balance there to determine the boundary condition at *x* = 0.
8. Solve this new BVP using the shooting method. Plot the solution.
9. Interpret the solution. Does it make sense?