

18.085 MATLAB 1

printouts and short conclusion due Monday Sept 17

This homework is about convection-diffusion, an important equation. There will be a boundary layer of rapid change at one endpoint when the conditions are $u(0) = u(1) = 0$ and the u' convection term dominates. The exact solution to $-Du'' + u' = 1$ is $u = x - (\exp(x/D) - 1)/(\exp(1/D) - 1)$.

- 1) Graph that exact solution for $D = 1/25$
- 2) Approximate $-Du''$ as usual by DK/h^2 (try 3 different values of h)
- 3) Approximate u' by centered and forward and backward differences (same h)
- 4) With $\mathbf{f} = \mathbf{ones}(n,1)$ solve the matrix equations and label graphs of u
- 5) Write a SHORT conclusion from your tests—which method(s) to use?