Finite Difference Methods for a Singularly Perturbed Problem

In this homework, we consider finite difference methods for the boundary value problem

$$-\epsilon u'' - u' = 0, \qquad u(0) = 0, \qquad u(1) = 1.$$

for small ϵ. Note that in the limit case $\epsilon = 0$, the differential equation reduces to $u' = 0$ which has no solution satisfying both boundary conditions. Without extra care, this can lead to unacceptable numerical solutions.

All subsequent assignments are interrelated and concerned with this problem.