4515 Exam 1

1. Compute the eigenfunctions and eigenvalues for $-\Delta\phi = \lambda\phi$ on the semi circular domain $0 < \theta < \pi$ and $0 < r < 1$.
   - **1.1.** Homogeneous Dirichlet conditions all round the boundary.
   - **1.2.** Homogenous Dirichlet boundary conditions on the circular boundary and homogeneous Neumann conditions on the straight edge(s).
   - **1.3.** Homogeneous Neumann conditions on the circular boundary and homogeneous Dirichlet conditions on the straight edge(s).
2. Compute the eigenfunctions and eigenvalues of $-\Delta\phi = \lambda\phi$ with Dirichlet boundry conditions on the circular cylinder $0 < r < r_{max}$, $0 \le \theta < 2\pi$, and $0 < z < z_{max}$. Do the pieces in the order θ, z, then r.
3. For each of the problems in Q1 plot the four eigenfunctions with the lowest eigenvalues.