Math 4163
Assignment 1

Consider the differential equation

$$\frac{d^2\phi}{dx^2} + \lambda\phi = 0$$

Determine the eigenvalues λ and corresponding eigenfunctions ϕ if ϕ satisfies the following boundary conditions, where L is a given number. Analyze three cases: $\lambda > 0$, $\lambda = 0$, and $\lambda < 0$.

(1) $\frac{d\phi}{dx}(0) = 0$ and $\frac{d\phi}{dx}(L) = 0$.

(2) $\frac{d\phi}{dx}(0) = 0$ and $\phi(L) = 0$.

(Note: in class, I considered the problem where $L = 1$, and the boundary conditions were $\phi(0) = 0$ and $\phi(1) = 0$, and I only had time to do the cases when $\lambda > 0$ and $\lambda = 0$. You can see all three cases worked out, for a general value of L, on pages 38 to 42 of section 2.3 of the text.)