PHY 711 – Problem Set # 16

Continue reading Chapter 7 in **Fetter and Walecka**.

Consider the differential equation

$$\left(-\frac{d^2}{dx^2} - \lambda\right)\phi(x) = F_0 \sin\left(\frac{\pi x}{L}\right),$$ (1)

where $\phi(x = 0) = 0$ and $\frac{d\phi}{dx}(0) = 0$ and where λ, F_0, and L are constants.

1. Show that the solution takes the form

$$\phi(x) = \frac{F_0}{\frac{\pi^2}{L^2} - \lambda}\left(\sin\left(\frac{\pi x}{L}\right) - \frac{\pi}{\sqrt{\lambda}L}\sin(\sqrt{\lambda}x)\right).$$ (2)

2. Use the method of Laplace transforms to verify this solution.