PHY 711 – Assignment #16

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

1. Consider a displacement function $u(x,t)$ representing a one-dimensional traveling wave (either transverse or longitudinal) which is a solution of the one-dimensional wave equation with wave speed c:

$$\frac{\partial^2 u}{\partial x^2} - \frac{1}{c^2}\frac{\partial^2 u}{\partial t^2} = 0.$$

If the initial conditions for the wave displacement $u(x,t)$ are given by

$$u(x,0) = U_0 e^{-(x-x_0)^2/\sigma^2},$$

and

$$\frac{\partial u}{\partial t}(x,0) = V_0 \left(\frac{x}{\mu}\right)^3 e^{-(x/\mu)^4},$$

find the form of $u(x,t)$ for $t > 0$. Express your result in terms of the constants U_0, V_0, σ, μ, x_0, and c.