1. Calculate the exact reflection and transmission coefficients, without assuming $\mu_1 = \mu_2 \approx \mu_\circ$. Confirm that $I_R + I_T = I_\circ$.

2. While deriving the reflection and transmission coefficients for normal incidence, it was assumed (implicitly) that the reflected and the transmitted waves have the same polarization as the incident wave (along $\hat{x}$ or $\hat{\imath}$). Prove that it must be so.

   [Hint: Let the polarization vectors of the transmitted and the reflected waves be

   $$\hat{n}_T = \cos\theta_T \hat{\imath} + \sin\theta_T \hat{\jmath},\ \hat{n}_R = \cos\theta_R \hat{\imath} + \sin\theta_R \hat{\jmath}.$$

   and prove from the boundary conditions that $\theta_T = \theta_R = 0$.]

3. Suppose $Ae^{iax} + Be^{ibx} = Ce^{icx}$ for some nonzero constants A, B, C, a, b, c, and for all x. Prove that $a = b = c$ and $A + B = C$.

4. How does the wave equation transform under Galilean transformation? What about Lorentz transformation?