

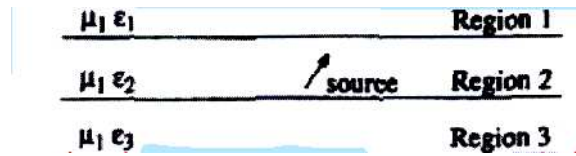
## Homework Set No. 2

**Problem 1:** In Section 2.1 of the handout entitled "Dyadic Green's Function," complete the steps that lead to (45).

**Problem 2:** (WKB approximation) Consider an inhomogeneous medium with permittivity function  $\varepsilon(\vec{r}) = \varepsilon(z)$ .

- a) Derive the wave equation.
- b) For an electric field of the form  $\vec{E}(r) = \hat{y}E_y(z)e^{ik_x x}$  find a differential equation for  $E_y(z)$ .
- c) The WKB (Wentzel-Karmers-Brillouin) method can be applied when  $\varepsilon$  is a slowly varying function of  $z$ . Expressing  $E_y(z) = F(z)e^{i\phi(z)}$ , find a differential equation in terms of  $F$  and  $\phi$ .
- d) Noting that  $f(z)$  is also a slowly varying function of  $z$ , find a solution for  $E_y(z)$ .

**Problem 3:** Derive the Dyadic Green's function for the medium shown below with the source in Region 2.



**Problem 4:** Derive the Ewald-Oseen extinction theorem for scalar functions satisfying the scalar wave equation.