EE 340(04) Quiz 5

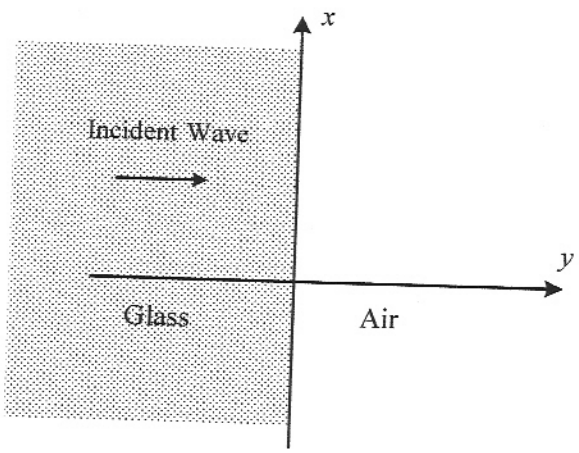
Name:

I.D. Number: KEY

A uniform plane wave is normally incident from glass ($\varepsilon_r = 2.25$, $\mu_r = 1$) onto air. The glass/air boundary is located at $y = 0$ (see figure). The incident electric field is given by:

$\vec{E}_i = \vec{a}_x 6\cos(2\times10^8 t - y)$ V/m

Develop an expression for the *average* Poynting's vector in air.



$$\Gamma = \frac{\eta_2 - \eta_1}{\eta_2 + \eta_1} = \frac{\frac{1}{1} - \frac{1}{1.5}}{\frac{1}{1} + \frac{1}{1.5}} = 0.2,$$

$$\tau = \frac{2\eta_2}{\eta_2 + \eta_1} = 1.2$$

$$\vec{E}_t = \vec{a}_x 6 \times 1.2 \cos(2\times10^8 t - \beta_2 y)$$

$$\vec{E}_{ts} = \vec{a}_x 7.2\, e^{-j\beta_2 y}$$

$$\vec{H}_{ts} = -\vec{a}_z \frac{7.2}{377} e^{-j\beta_2 y}$$

$$\vec{P}_{avg} = \frac{1}{2} Re(\vec{E} \times \vec{H}^*) = \frac{1}{2} Re\left(\vec{a}_y \frac{7.2^2}{377} e^{-j\beta_2 y} e^{j\beta_2 y}\right)$$

$$= \vec{a}_y\ 0.069\ W/m^2.$$