Quiz 3

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E&M II
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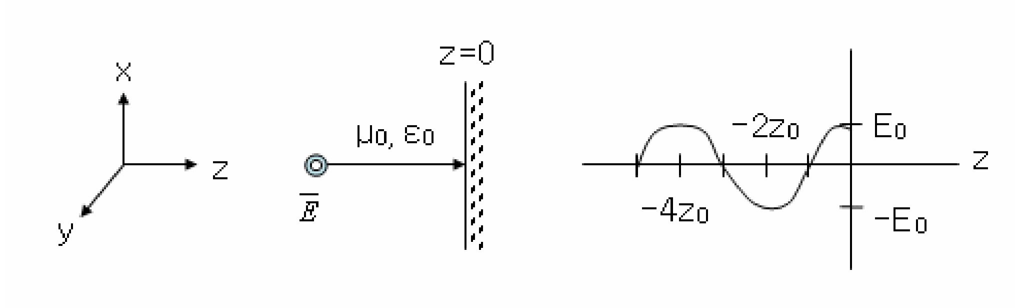
Name:

Prob. 1(3)

A plane EM wave having $\overline{E} = \overline{y}E(z,t) = \overline{y}E_0 \exp(-jkz)\exp(j\omega t)$ is normally incident from a vacuum to a perfect conductor, and Re[$E(z,t)$] at t = t_0 is shown below.



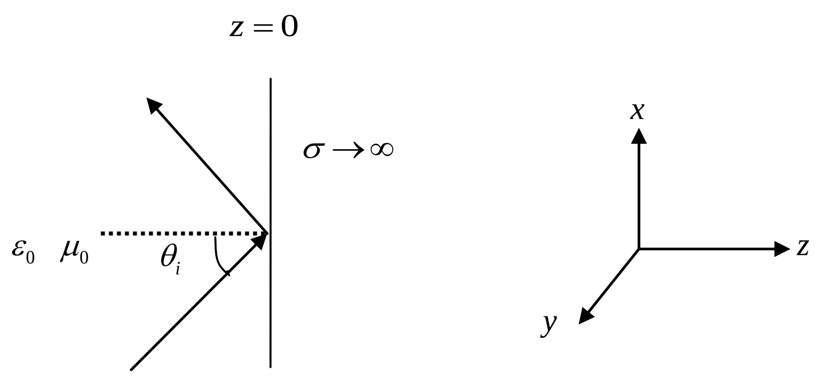
(a) Sketch Re[$E_r(z,t)$] at t = t_0 for the reflected electric field wave.

(b) Sketch Re[$E_{total}(z,t)$] at t = t_0 for the total electric field wave.

(c) Sketch Re[$E_{total}(z,t)$] at $t = t_0 + \pi/(2\omega)$ for the total electric field wave.

Prob. 2(3)

A plane wave is obliquely incident on a perfect conductor as shown below and has the E-field given as $\overline{E_i} = \left(\bar{x}/\sqrt{2} + \bar{y} - \bar{z}/\sqrt{2} \right) \exp(-jx)\exp(-jz)$.



(a) Decompose the E-field into parallel $(E_{\parallel})$ and perpendicular $(E_{\perp})$ polarizations.

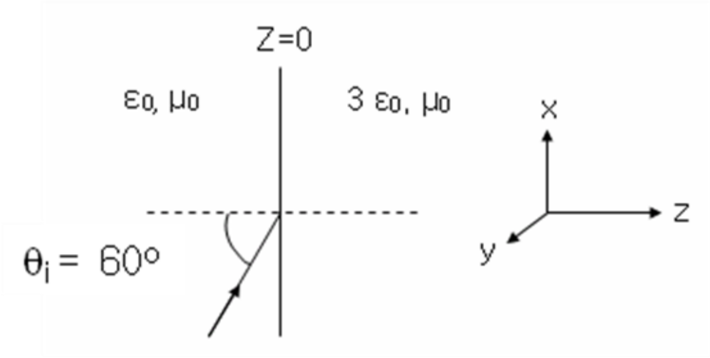
(b) What is the reflected E-field?

(c) Determine the surface charge density induced at the interface.

Prob. 3 (3)

An EM wave whose E-field given as $\overline{E_i} = \left(\overline{x} + \overline{y} - \overline{z}/\sqrt{3} \right) \exp(-jx)\exp(-j\beta_z z)$

(x and z have the unit of meter) is obliquely incident on a dielectric interface as shown below.



(a) Determine β_z.

(b) What is θ_t, the transmission angle?

(c) What is the expression for the reflected E-field that has only the parallel polarization?