Problem 6

$$\nabla \times \left(\nabla \times \vec{E} = -\frac{\partial B}{\partial t}\right) \quad \nabla \times \left(\nabla \times \vec{B} = \mu_0 \vec{J} + \mu_0 \epsilon_0 \frac{\partial \vec{E}}{\partial t}\right)$$

$$\nabla(\nabla \cdot \vec{E}) - \nabla^2 \vec{E} = -\frac{\partial}{\partial t} \nabla \times \vec{B}$$

$$\nabla(\cancel{\rho / \epsilon_0}) - \nabla^2 \vec{E} = -\frac{\partial}{\partial t} \mu_0 \epsilon_0 \frac{\partial \vec{E}}{\partial t} - \cancel{\nabla \times \mu \vec{J}}$$

0

Do Third

$$\nabla^2 \vec{E} - \mu_0 \epsilon_0 \frac{\partial^2 E}{\partial t^2} = 0$$

$$\nabla \times \nabla \times B = \mu_0 \cancel{\nabla \times \vec{J}} + \mu_0 \epsilon_0 \nabla \times \frac{\partial \vec{E}}{\partial t}$$

Do second

$$\nabla(\nabla \cdot \vec{B}) - \nabla^2 \vec{B} = \mu_0 \epsilon_0 - \frac{\partial}{\partial t} \frac{\partial \vec{B}}{\partial t}$$

$$\nabla^2 \vec{B} - \mu_0 \epsilon_0 \frac{\partial^2 E}{\partial t^2} = 0$$

We established that

$$\frac{\partial^2 f}{\partial z^2} - b^2 \frac{\partial^2 f}{\partial t^2} = 0 \quad \text{Gives a wave}$$

Do first

$f(b(z - vt))$ where $b^2 = \frac{1}{v^2}$

How about 3D?

Also if $f \to A\cos$

$$A\cos(bz - bvt) = A\cos(kz - \omega t)$$

$$T = \frac{1}{f} = \frac{2\pi}{\omega} \qquad k = \frac{2\pi}{\lambda}$$