## Faraday's Law

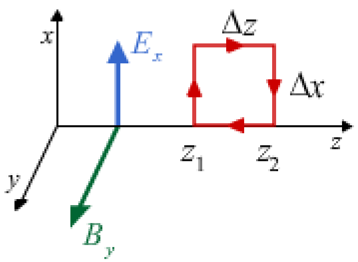
$$\oint \vec{E}\cdot d\vec{l} = -\frac{d}{dt}\int \vec{B}\cdot d\vec{A}$$

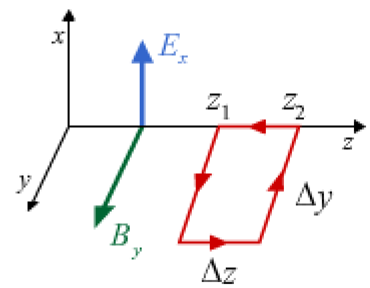
Plane Wave Solution

$$\vec{E} \rightarrow \vec{E}(z,t)$$
$$\vec{B} \rightarrow \vec{B}(z,t)$$

## Modified Ampere's Law

$$\oint \vec{B}\cdot d\vec{l} = \mu_o \varepsilon_o \frac{d}{dt}\int \vec{E}\cdot d\vec{A}$$




$$\frac{\partial E_x}{\partial z} = -\frac{\partial B_y}{\partial t}$$

$$\frac{\partial B_y}{\partial z} = -\mu_o \varepsilon_o \frac{\partial E_x}{\partial t}$$

$$\frac{\partial^2 E_x}{\partial z^2} = -\frac{\partial}{\partial z}\frac{\partial B_y}{\partial t}$$

$$\frac{\partial}{\partial t}\frac{\partial B_y}{\partial z} = -\mu_o \varepsilon_o \frac{\partial^2 E_x}{\partial t^2}$$

$$\frac{\partial^2 E_x}{\partial z^2} = \mu_o \varepsilon_o \frac{\partial^2 E_x}{\partial t^2}$$

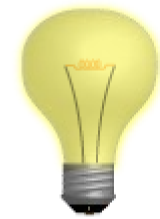
## Wave Equation

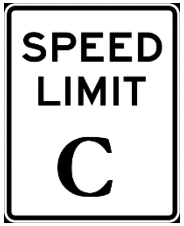
$$\frac{\partial^2 E_x}{\partial z^2} = \mu_o \varepsilon_o \frac{\partial^2 E_x}{\partial t^2}$$

## Speed of Electromagnetic Wave

$$v = \frac{1}{\sqrt{\mu_o \varepsilon_o}} = c = 3.00\times 10^8 \text{ m/s}$$

Speed of Light !






## Special Relativity (1905)

Speed of Light is Constant

Albert Einstein

"How can light move at the same velocity in any inertial frame of reference? That's really trippy. "

see PHYS 225