Electromagnetic Plane Wave (2)

- Faraday's law, $\oint \vec{E} \cdot d\vec{\ell} = -\frac{d\Phi_B}{dt}$,
  applied to loop in (x, y)-plane becomes
  $$[E_y(x+dx,t) - E_y(x,t)]dy = -\frac{\partial}{\partial t} B_z(x,t)dxdy$$
  $$\Rightarrow \quad \frac{\partial}{\partial x} E_y(x,t) = -\frac{\partial}{\partial t} B_z(x,t) \qquad \text{(F)}$$

- Ampère's law, $\oint \vec{B} \cdot d\vec{\ell} = \mu_0 \epsilon_0 \frac{d\Phi_E}{dt}$,
  applied to loop in (x, z)-plane becomes
  $$[-B_z(x+dx,t) + B_z(x,t)]dz = \mu_0 \epsilon_0 \frac{\partial}{\partial t} E_y(x,t)dxdz$$
  $$\Rightarrow \quad -\frac{\partial}{\partial x} B_z(x,t) = \mu_0 \epsilon_0 \frac{\partial}{\partial t} E_y(x,t) \qquad \text{(A)}$$