$$\operatorname{div}\vec{E} = \vec{\nabla}\cdot\vec{E} = \frac{\partial E_x}{\partial x} + \frac{\partial E_y}{\partial y} + \frac{\partial E_z}{\partial z}$$

$$E_x = E_{x_m} e^{i(\omega t - k_x x - k_y y - k_z z)}, \quad E_y = \dots, \quad E_z = \dots$$

$$\frac{\partial E_x}{\partial x} = E_x(-ik_x) \qquad \frac{\partial E_y}{\partial y} = E_y(-ik_y) \qquad \frac{\partial E_z}{\partial z} = E_z e(-ik_z)$$

$$\operatorname{div}\vec{E} = -iE_x k_x - iE_y k_y - iE_z k_z = -i\vec{k}\cdot E$$

$$\frac{\partial \vec{E}}{\partial t} = \frac{\partial}{\partial t}\left[E_{x_m} e^{i(\omega t - \vec{k}\cdot\vec{r})}\right]\vec{e}_x + \frac{\partial}{\partial t}\left[E_{y_m} e^{i(\omega t - \vec{k}\cdot\vec{r})}\right]\vec{e}_y + \frac{\partial}{\partial t}\left[E_{z_m} e^{i(\omega t - \vec{k}\cdot\vec{r})}\right]\vec{e}_z$$

$$= i\omega E_x \vec{e}_x + i\omega E_y \vec{e}_y + i\omega E_z \vec{e}_z = i\omega\vec{E}$$

$$\operatorname{rot}\vec{E} = \left(\frac{\partial E_z}{\partial y} - \frac{\partial E_y}{\partial z}\right)\vec{e}_x + \left(\frac{\partial E_x}{\partial z} - \frac{\partial E_z}{\partial x}\right)\vec{e}_y + \left(\frac{\partial E_y}{\partial x} - \frac{\partial E_x}{\partial y}\right)\vec{e}_z$$

$$\frac{\partial E_z}{\partial y} = \frac{\partial}{\partial y}\left[E_{z_m} e^{i(\omega t - k_x x - k_y y - k_z z)}\right] = E_z(-ik_y)$$

$$= -i\vec{k}\times\vec{E}$$