8.4

$$\vec{E} = \mathrm{Re}\left[\tilde{\vec{E}}\, e^{-i\omega t + i\vec{k}\cdot\vec{r}}\right] \quad \vec{B} = \mathrm{Re}\left[\tilde{\vec{B}}\, e^{-i\omega t + i\vec{k}\cdot\vec{r}}\right]$$

$$\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

$$\left(\frac{\partial E_z}{\partial y} - \frac{\partial E_y}{\partial z}\right)\hat{x} + \left(\frac{\partial E_x}{\partial z} - \frac{\partial E_z}{\partial x}\right)\hat{y} + \left(\frac{\partial E_y}{\partial x} - \frac{\partial E_x}{\partial y}\right)\hat{z} = \frac{-\partial \vec{B}}{\partial t}$$

$$\mathrm{Re}\left[\left[(i k_y \tilde{E}_z - i k_z \tilde{E}_y)\hat{x} + (i k_z \tilde{E}_x - i k_x \tilde{E}_z)\hat{y} + (i k_x \tilde{E}_y - i k_y \tilde{E}_x)\hat{z}\right]\cancel{e^{-i\omega t + i\vec{k}\cdot\vec{r}}} = -(-i\omega)\tilde{\vec{B}}\,\cancel{e^{-i\omega t + i\vec{k}\cdot\vec{r}}}\right]$$

assume $\tilde{\vec{E}}$ + $\tilde{\vec{B}}$ are complex

$$i(\vec{k} \times \tilde{\vec{E}}) = i\omega\tilde{\vec{B}} \qquad \omega = ck$$

$$\tilde{\vec{B}} = \frac{1}{c}\frac{\vec{k}}{k} \times \tilde{\vec{E}} \longrightarrow \boxed{\tilde{\vec{B}} = \frac{1}{c}\hat{k} \times \tilde{\vec{E}}}$$

The real and complex equations are simply releted by taking the real component of the complex equation

$$\boxed{\mathrm{Re}\left[\tilde{\vec{B}} = \frac{1}{c}\hat{k} \times \tilde{\vec{E}}\right] \Longrightarrow \vec{B} = \frac{1}{c}\hat{k} \times \vec{E}}$$