9-9) a. $\vec{E} = E_0 \hat{z} \cos(kx + \omega t + \delta)$

$$\frac{\omega}{k} = c$$

$$\vec{B} = \frac{E_0}{c}(+\hat{y}) \cos(kx + \omega t + \delta)$$

use $\vec{B_0} = \frac{1}{c}(\hat{k} \times \vec{E}_0)$

$\hat{k} \equiv$ unit vector in the direction of propagation

b. Wave is traveling toward (1,1,1) from the origin

$$\hat{k} = \frac{1}{\sqrt{3}}(1,1,1)$$

$\hat{n} \equiv$ polarization unit vector

$$\hat{n} \cdot \hat{k} = 0$$

$$(n_x, n_y, n_z) \cdot \left(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right) = 0$$

$$\boxed{n_x + n_y + n_z = 0}$$

$$\hat{n} \cdot \hat{n} = 1$$

$$n_x^2 + n_y^2 + n_z^2 = 1$$

$n_y = 0$ Given

$$\therefore \quad n_x + n_z = 0$$

$$n_x = -n_z$$

$$n_x^2 + (-n_x)^2 = 1$$

$$2n_x^2 = 1$$

$$n_x = \pm \frac{1}{\sqrt{2}}$$

$$\boxed{\therefore \ \hat{n} = \left(\frac{1}{\sqrt{2}}, 0, -\frac{1}{\sqrt{2}} \right)}$$

$$\boxed{\vec{k} = \frac{\omega}{c} \hat{k} = \frac{\omega}{c} \frac{1}{\sqrt{3}} (1,1,1)}$$

$$\vec{E} = E_0 \hat{n} \cos(\vec{k} \cdot \vec{r} - \omega t)$$

$$\vec{B} = \frac{E_0}{c} (\hat{k} \times \hat{n}) \cos(\vec{k} \cdot \vec{r} - \omega t)$$

$$\hat{k} \times \hat{n} = \frac{\omega}{\sqrt{3}c} (1,1,1) \times \frac{(1,0,-1)}{\sqrt{2}}$$

$$= \frac{\omega}{\sqrt{6}c} \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ 1 & 1 & 1 \\ 1 & 0 & -1 \end{vmatrix}$$

$$= \frac{\omega}{\sqrt{6}c} \left(-\hat{x} + 2\hat{y} - \hat{z} \right)$$

$$= \frac{\omega}{\sqrt{6}c} \left(-\hat{x} + 2\hat{y} - \hat{z} \right)$$