$\therefore \bigstar$ turns to:

13) $\nabla(\nabla\cdot\vec{E}) - \nabla\times\nabla\times\vec{E} + k_o^2 n^2 \vec{E} + \nabla(\nabla \ln\mu \cdot \vec{E}) - (\nabla \ln\mu \cdot \nabla)\vec{E} + (\vec{E}\cdot\nabla)\nabla\ln\mu + E\times(\nabla\times\nabla \ln\mu$
$+ (\nabla \ln\epsilon \cdot \nabla)\vec{E} + (\vec{E}\cdot\nabla)\nabla\ln\varepsilon + \nabla\ln\varepsilon \times (\nabla\times\vec{E}) = 0$

To simplify the expression in order to identify usable identities,
let $\nabla \ln\mu = \vec{A}$ and $\nabla\ln\varepsilon = \vec{B}$

14) $\nabla(\nabla\cdot\vec{E}) - \nabla\times\nabla\times\vec{E} + k_o^2 n^2\vec{E} + \nabla(\vec{A}\cdot\vec{E}) - (\vec{A}\cdot\nabla)\vec{E} + (\vec{E}\cdot\nabla)\vec{A} + \vec{E}\times(\nabla\times\vec{A})$
$+ (\vec{B}\cdot\nabla)\vec{E} + \underline{(\vec{E}\cdot\nabla)\vec{B}} + \vec{B}\times(\nabla\times\vec{E}) = 0$

since we have $(\vec{E}\cdot\nabla)\vec{B}$, we can use (5) rearranged:
$(\vec{E}\cdot\nabla)\vec{B} = \vec{E}(\nabla\cdot\vec{B}) - \vec{B}(\nabla\cdot\vec{E}) + (\vec{B}\cdot\nabla)\vec{E} - \nabla\times(\vec{E}\times\vec{B})$

$\therefore$ 13) becomes:

15) $\nabla(\nabla\cdot\vec{E}) - \nabla\times\nabla\times\vec{E} + k_o^2 n^2\vec{E} + \nabla(\vec{A}\cdot\vec{E}) - (\vec{A}\cdot\nabla)\vec{E} + (\vec{E}\cdot\nabla)\vec{A} + \vec{E}\times(\nabla\times\vec{A})$
$+ (\vec{B}\cdot\nabla)\vec{E} + \vec{E}(\nabla\cdot\vec{B}) - \vec{B}(\nabla\cdot\vec{E}) + (\vec{B}\cdot\nabla)\vec{E} - \nabla\times(\vec{E}\times\vec{B}) + \vec{B}\times(\nabla\times\vec{E}) = 0$

Now, using (2) $\nabla\cdot(\psi\vec{A}) = \nabla\psi\cdot\vec{A} + \psi\nabla\cdot\vec{A}$, we can expand as follows:

$$\vec{E}(\vec{r}) = \vec{e}(\vec{r})e^{-jk_o s(\vec{r})}, \quad \text{let } \psi = e^{-jk_o s(\vec{r})} \text{ and } \vec{A} = \vec{e}(\vec{r})$$

$$\therefore \nabla\cdot\vec{E} = \nabla e^{-jk_o s(\vec{r})}\cdot\vec{e}(\vec{r}) + e^{-jk_o s(\vec{r})}\nabla\cdot\vec{e}(\vec{r})$$

We also know that $\nabla e^{-jk_o s} = -jk_o(\nabla s)e^{-jk_o s}$

$$\therefore \nabla\cdot\vec{E} = -jk_o(\nabla s)e^{-jk_o s}\cdot\vec{e} + e^{-jk_o s}\nabla\cdot\vec{e}$$

Using (3), $\nabla\times(\psi\vec{A}) = \nabla\psi\times\vec{A} + \psi\nabla\times\vec{A}$, we can also expand as follows:

$$\nabla\times\vec{E} = \nabla e^{-jk_o s}\times\vec{e} + e^{-jk_o s}\nabla\times\vec{e}$$

$$\therefore \nabla\times\vec{E} = -jk_o(\nabla s)e^{-jk_o s}\vec{e} + e^{-jk_o s}\nabla\cdot\vec{e}$$