6. 9-1 $\vec{E} = 4\hat{x} + \hat{y} - 3\hat{z}$

plane defined by $2x + y + z = 1 = u$

$\nabla u = 2\hat{x} + \hat{y} + \hat{z}$ $\quad |\nabla u| = \sqrt{2^2+1^2+1^2} = \sqrt{6}$

So $\hat{n} = \frac{\nabla u}{|\nabla u|} = \frac{1}{\sqrt{6}}(2\hat{x} + \hat{y} + \hat{z})$

$\vec{E}_n = (\vec{E}\cdot\hat{n})\hat{n} = \left[(4\hat{x} + \hat{y} - 3\hat{z}) \cdot \frac{1}{\sqrt{6}}(2\hat{x} + \hat{y} + \hat{z})\right]\hat{n}$

$= \frac{1}{\sqrt{6}}[8 + 1 - 3]\hat{n} = \sqrt{6}\,\hat{n} = \sqrt{6}\,\frac{1}{\sqrt{6}}(2\hat{x} + \hat{y} + \hat{z})$

So $\vec{E}_n = \underline{2\hat{x} + \hat{y} + \hat{z}}$

$\vec{E}_t = \vec{E} - \vec{E}_n = (4\hat{x} + \hat{y} - 3\hat{z}) - (2\hat{x} + \hat{y} + \hat{z}) = \underline{2\hat{x} - 4\hat{z}}$

7. 9-4 $\tan\alpha_1 = \frac{E_{1t}}{E_{1n}}$ $\quad \tan\alpha_2 = \frac{E_{1t}}{E_{1n} + \sigma/\varepsilon_0}$

$\frac{\tan\alpha_1}{\tan\alpha_2} = \frac{E_{1n} + \sigma/\varepsilon_0}{E_{1n}} = 1 + \frac{\sigma}{\varepsilon_0 E_{1n}} = 1 + \frac{\sigma}{\varepsilon_0 E_1 \cos\alpha_1}$

So $\tan\alpha_2 = \dfrac{\tan\alpha_1}{1 + \frac{\sigma}{\varepsilon_0 E_1 \cos\alpha_1}}$