1.3

1. $E_\rho = \frac{\lambda}{2\pi\varepsilon_0 a}\sin\theta = \frac{\lambda}{2\pi\varepsilon_0 a}\frac{1/2\,L}{\sqrt{a^2+(1/2\,L)^2}}$

Taylor series: $\frac{z}{\sqrt{z^2+R^2}} = \left(1+\frac{R^2}{z}\right)^{-1/2}$

$$\frac{\lambda}{2\pi\varepsilon_0 a}\frac{1/2\,L}{\sqrt{a^2+(1/2\,L)^2}} = \frac{\lambda}{2\pi\varepsilon_0 a}\left(1+\frac{a^2}{(1/2\,L)^2}\right)^{-1/2}$$

As $L \to \infty$,

$$\frac{\lambda}{2\pi\varepsilon_0 a}(1+0) = \frac{\lambda}{2\pi\varepsilon_0 a} = \frac{Q}{2\pi\varepsilon_0 a L}$$

2. $E = \frac{\sigma_0}{\pi\varepsilon_0}\tan^{-1}\left(\frac{w^2}{4z\sqrt{z^2+w^2/2}}\right)$

Taylor Series: $\frac{\sqrt{b^2}\,\pi}{2b} + \cancel{O(z^2)}^{\,0} + \left(-\cancel{\frac{\sqrt{b^2}/z}{b}}^{\,0} + \cancel{O(z^2)}^{\,0}\right)$

At $z=0$,

$$E = \frac{\sigma_0}{\pi\varepsilon_0}\left(\frac{\pi}{2}\right) = \frac{\sigma_0}{2\varepsilon_0}$$