

Soluções:

$$a) \vec{E} = \frac{Q}{4\pi\epsilon_0} \left(\frac{1}{z^2} - \frac{z}{(z^2+R^2)^{3/2}} \right) \vec{e}_z$$

$$b) \phi(z) = \frac{Q}{4\pi\epsilon_0} \left(\frac{1}{z} - \frac{1}{\sqrt{z^2+R^2}} \right)$$

$$c) \phi(z) \simeq \frac{Q}{8\pi\epsilon_0} \frac{R^2}{z^3}$$

$$d) \vec{F} = 0$$