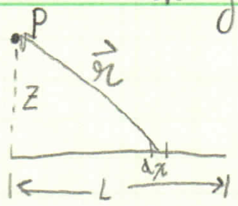
2.3



$$\vec{\mathscr{r}} = -x\hat{x} + z\hat{z}$$
$$\mathscr{r} = \sqrt{x^2+z^2}$$
$$\hat{\mathscr{r}} = \frac{-x\hat{x}+z\hat{z}}{\sqrt{x^2+z^2}}$$

Same problem as Example 2, but w/ new bound $x \in [0, L]$ instead of $x \in [-L, L]$ so,

$$E = k\lambda \left[z\hat{z} \int_0^L \frac{1}{(z^2+x^2)^{3/2}}\,dx - \hat{x} \int_0^L \frac{x}{(z^2+x^2)^{3/2}}\,dx \right]$$

$$= k\lambda \left[z\hat{z} \left(\frac{x}{z^2\sqrt{z^2+x^2}} \right)\Big|_0^L - \hat{x} \left(-\frac{1}{\sqrt{z^2+x^2}} \right)\Big|_0^L \right]$$

$$= k\lambda \left[z\hat{z} \left(\frac{L}{z^2\sqrt{z^2+L^2}} \right) + \hat{x} \left(\frac{1}{\sqrt{z^2+L^2}} - \frac{1}{z} \right) \right]$$

$$= k\lambda \left[\left(\frac{L}{z\sqrt{z^2+x^2}} \right)\hat{z} + \left(\frac{z - \sqrt{z^2+L^2}}{z\sqrt{z^2+L^2}} \right)\hat{x} \right]$$

$$= k\lambda \frac{(z - \sqrt{z^2+L^2})\hat{x} + L\hat{z}}{z\sqrt{z^2+L^2}}$$