1) chg density $\lambda = Q/L$

2) dq on small piece dy: $dq = \dfrac{Q}{L} dy$

3) charge runs along y axis

$$\vec{r}_{src} = \langle 0, y, 0 \rangle$$

$$\vec{r}_{obs} = \langle x, 0, 0 \rangle$$

$$d\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{dq}{|\vec{r}|^2} \hat{r}$$

$$dq = \frac{Q}{L} dy$$

$$\vec{r} = \vec{r}_{obs} - \vec{r}_{src} = \langle x, -y, 0 \rangle$$

$$|\vec{r}| = (x^2 + y^2)^{1/2}$$

$$\hat{r} = \frac{\langle x, -y, 0 \rangle}{(x^2 + y^2)^{1/2}}$$

$$d\vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{Q}{L} \frac{dy}{(x^2+y^2)^{3/2}} \langle x, -y, 0 \rangle$$

4) $\int$ Bounds? $y = 0 \longrightarrow y = L$

$$\vec{E} = \int_0^L \frac{1}{4\pi\varepsilon_0} \frac{Q}{L} \frac{dy}{(x^2+y^2)^{3/2}} \langle x, -y, 0 \rangle$$