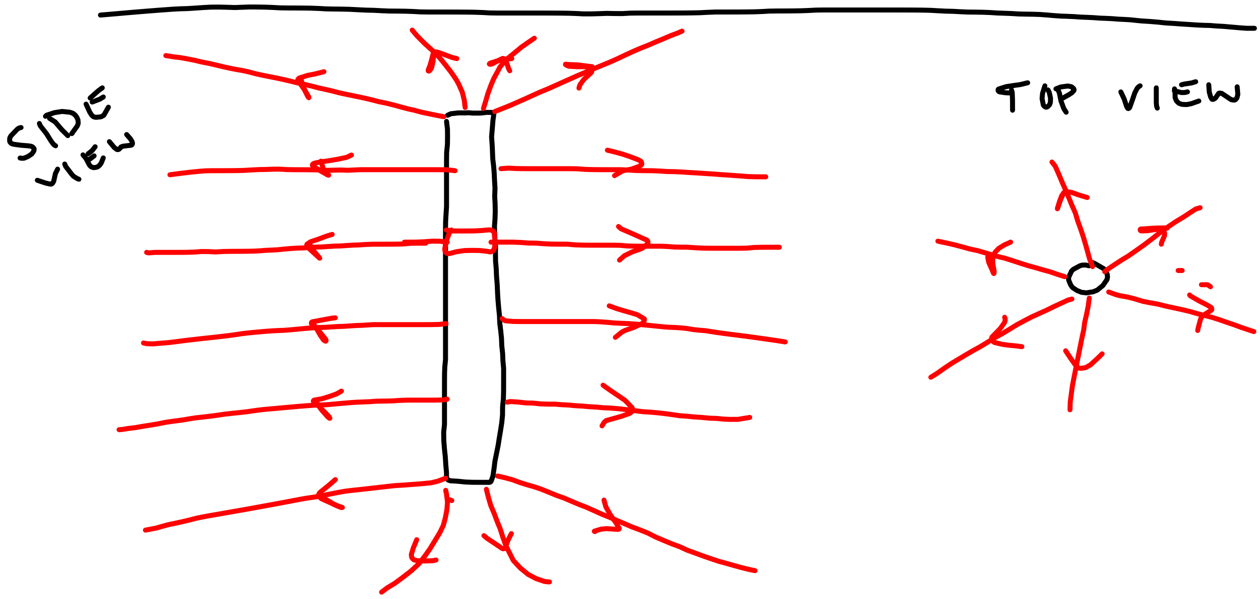
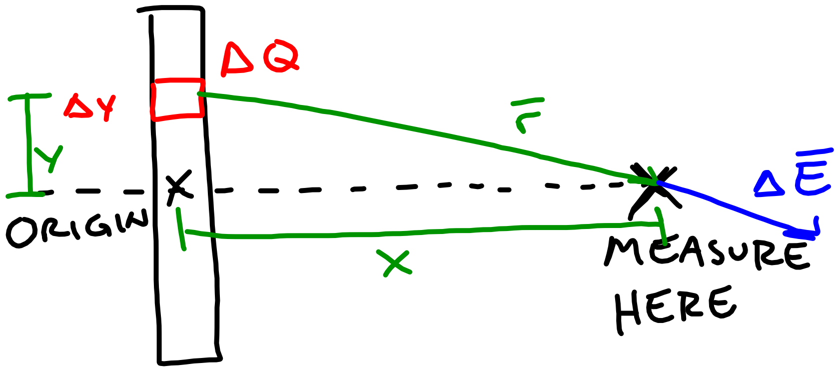
UNIFORMLY CHARGED THIN ROD





$$\bar{r} = \langle \text{observation location} \rangle - \langle \text{source} \rangle$$

$$= \langle x, \emptyset, \emptyset \rangle - \langle \emptyset, y, \emptyset \rangle$$

$$= \langle x, -y, \emptyset \rangle$$

$$|\bar{r}| = [x^2 + (-y)^2]^{1/2}$$

c.f. Pythagorean theorem

$$\hat{r} = \frac{\bar{r}}{|\bar{r}|} = \frac{\langle x, -y, \emptyset \rangle}{[x^2 + (-y)^2]^{1/2}}$$

Scalar Part

$$\frac{1}{4\pi\varepsilon_0} \frac{\Delta Q}{|\bar{r}|^2} = \frac{1}{4\pi\varepsilon_0} \frac{\Delta Q}{[x^2 + (-y)^2]}$$

Find $\overline{E}$

$$\Delta \overline{E} = \frac{1}{4\pi\varepsilon_0} \frac{\Delta Q}{|\overline{r}|^2} \hat{r}$$

$$= \frac{1}{4\pi\varepsilon_0} \frac{\Delta Q}{[x^2+(-y)^2]} \frac{\langle x, -y, \varnothing \rangle}{[x^2+(-y)^2]^{1/2}}$$

$$= \frac{1}{4\pi\varepsilon_0} \frac{\Delta Q}{[x^2+(-y)^2]^{3/2}} \langle x, -y, \varnothing \rangle$$

Break into components:

$$\Delta E_x = \frac{1}{4\pi\varepsilon_0} \frac{x \Delta Q}{(x^2+y^2)^{3/2}}$$

$$\Delta E_y = \frac{1}{4\pi\varepsilon_0} \frac{(-y) \Delta Q}{(x^2+y^2)^{3/2}}$$

$$\Delta E_z = \varnothing$$