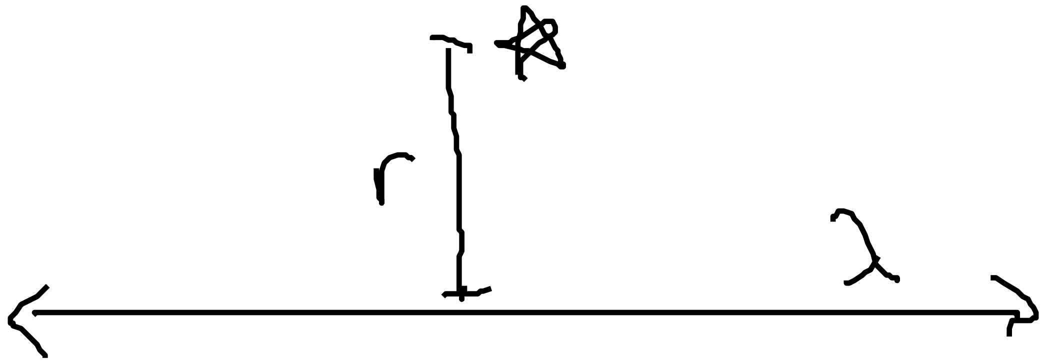


$$\vec{E} = \frac{2k\lambda}{r} \text{ away from line}$$

outside a charge distribution
w/ ∞ cylindrical symmetry

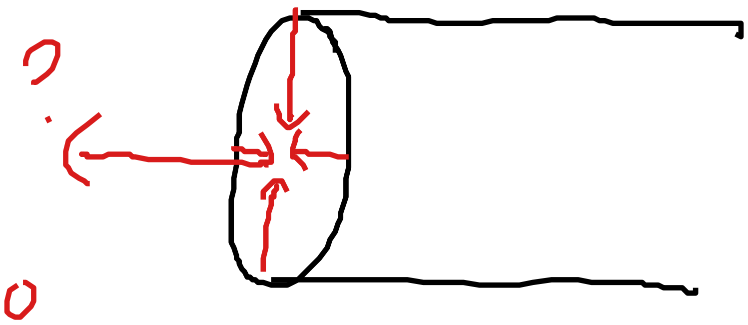
$$\vec{E} = \frac{2k\lambda}{r} \text{ as if collapsed}$$

that cylinder to a line

inside a ∞ cylindrical shell

$$\vec{E} = 0$$

Suppose it isn't



no because symmetry

If there's a field line inside shell, then there's nowhere for it to go

$\vec{E}$ inside a <u>finite</u> cylindrical shell is <u>not</u> necessarily zero

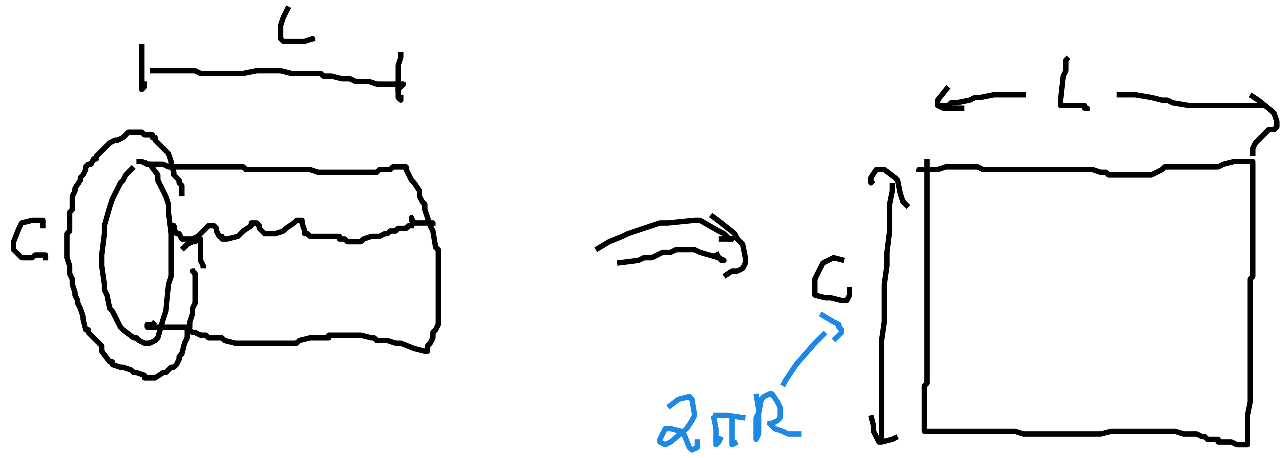
∞ cylindrical shell

radius $R = 0.2\,m$

$\sigma = -4\ \mu C/m^2$

What is $\vec{E}$ a distance $r > R$ away?

$$E = \frac{2k\lambda}{r} \qquad \text{"}\lambda\text{"} = \frac{Q}{L}$$



$$\text{Area} = 2\pi R L$$

$$Q = \sigma\, 2\pi R L$$

$$\frac{Q}{L} = \sigma\, 2\pi R = \lambda$$

4

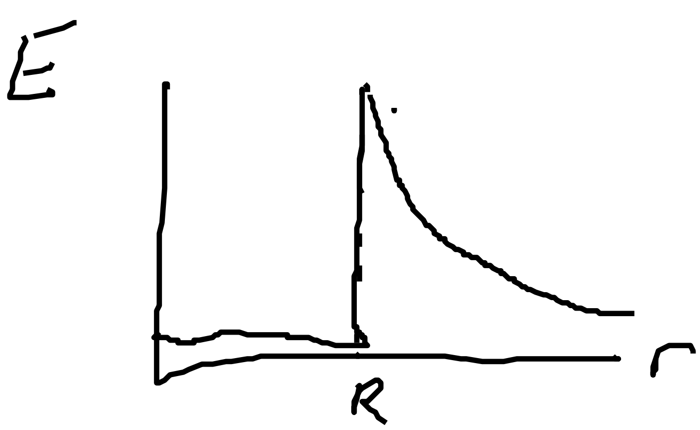
$$E = \frac{2k\sigma\, 2\pi R}{r}$$

$$= \frac{4\pi k \sigma R}{r}$$

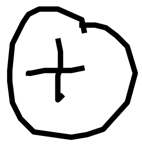
$$= \frac{4\pi(9\times10^9)(-4\times10^{-6})(0.2)}{r}$$

$$= -\frac{9.05\times10^4}{r} \qquad r > R$$

$$= 0 \qquad r < R$$



$$E \sim \frac{1}{d^3}$$

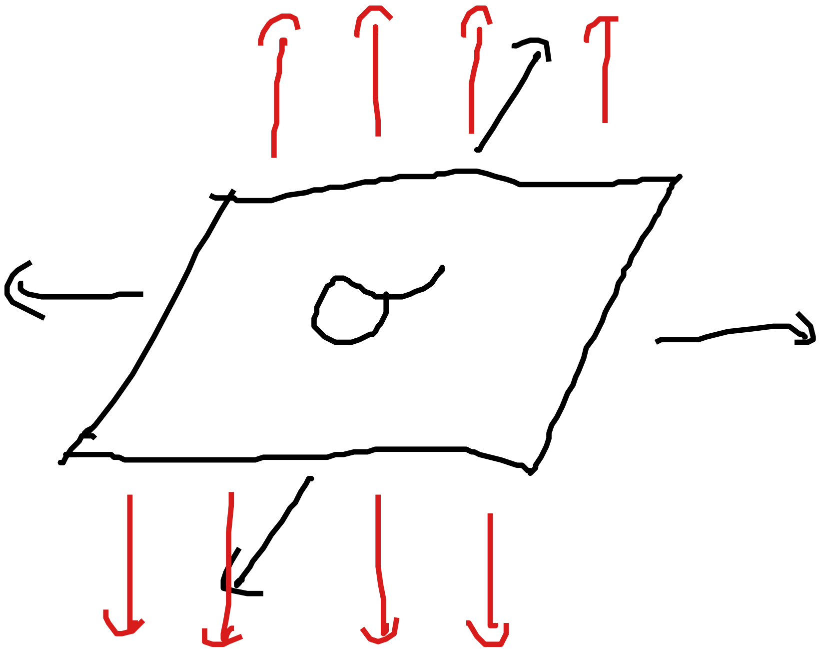


$$E \sim \frac{1}{d^2}$$

$$E \sim \frac{1}{d}$$

dies away
more slowly
than a finite
charge distribution

Infinite Plane

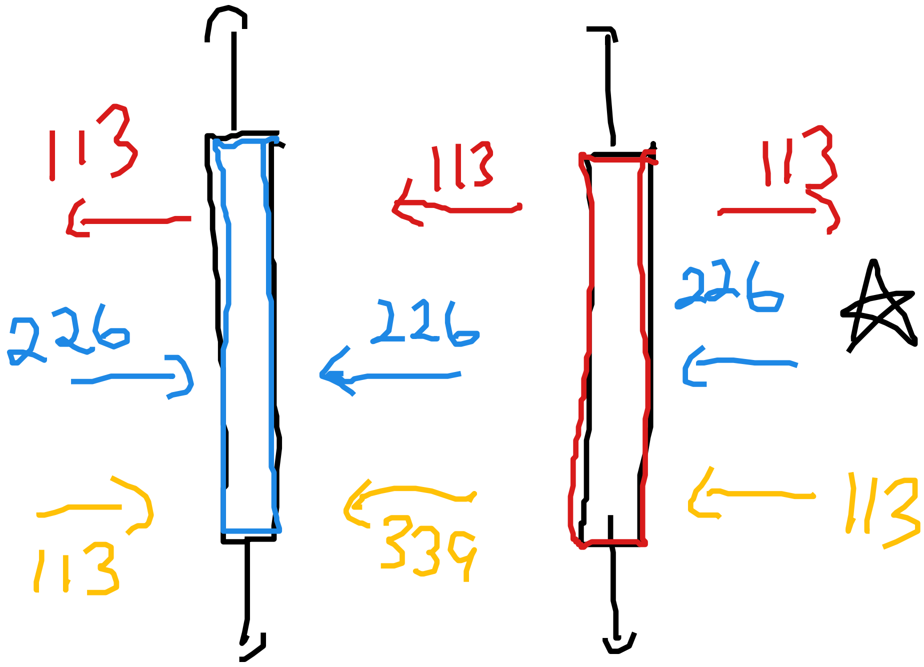


Electric field of an σ plane is constant.

$$E = 2\pi k\sigma = \frac{\sigma}{2\epsilon_0}$$

$$\epsilon_0 = \frac{1}{4\pi k}$$

$$= 8.85\times10^{-12}\ \frac{C^2}{Nm^2}$$



$\sigma = -4\frac{nC}{m^2}$ $\qquad$ $+2\frac{nC}{m^2}$

$$2\pi k\left(2\frac{nC}{m^2}\right) = 2\pi\left(9\times10^{9}\right)\left(2\times10^{-9}\right) = 113$$

$$2\pi k\left(4\frac{nC}{m^2}\right) = 226$$