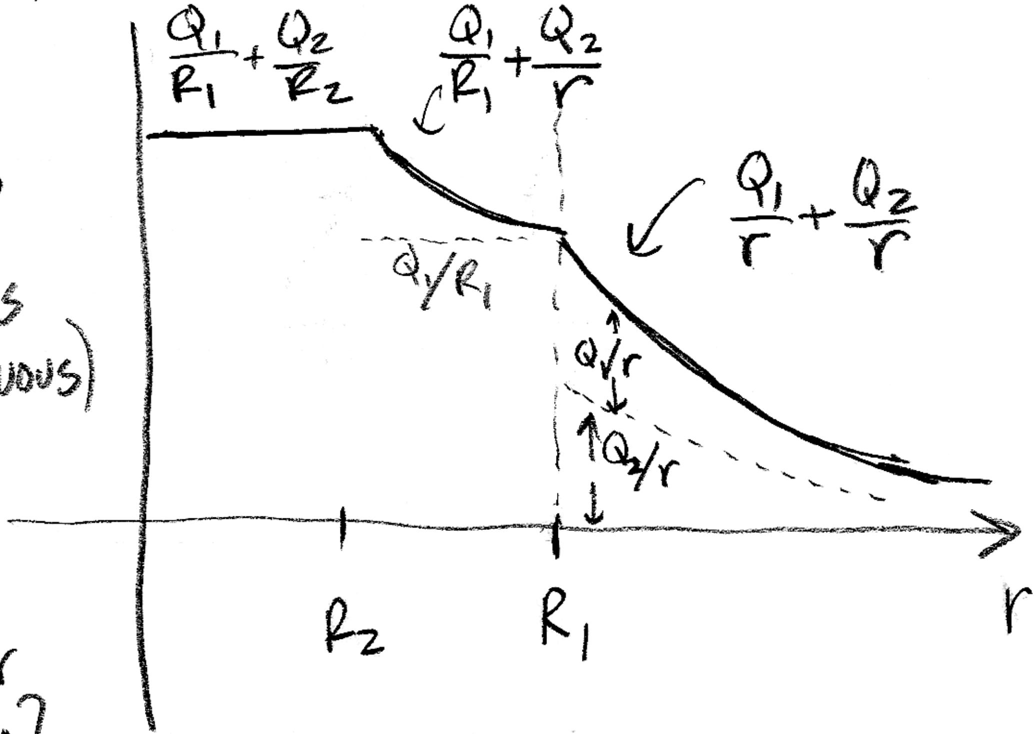
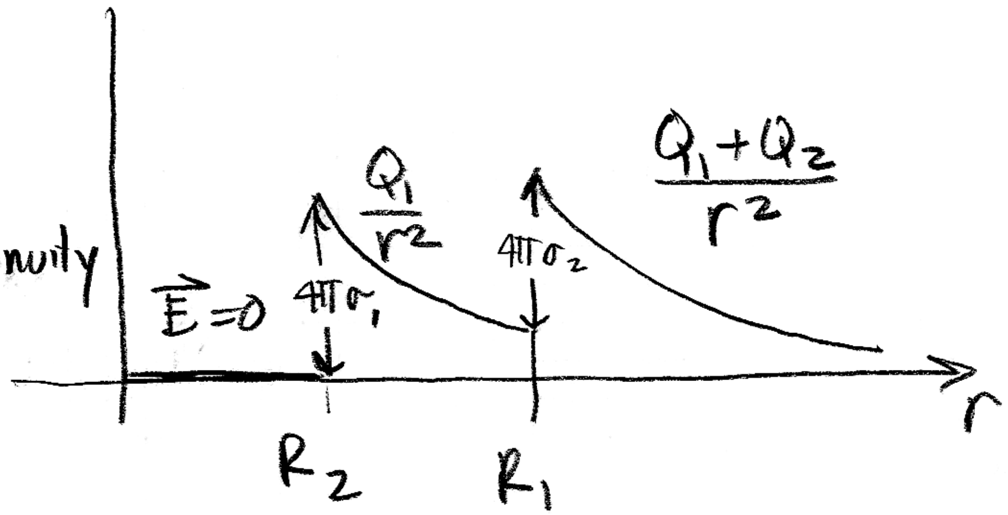
φ (always continuous)

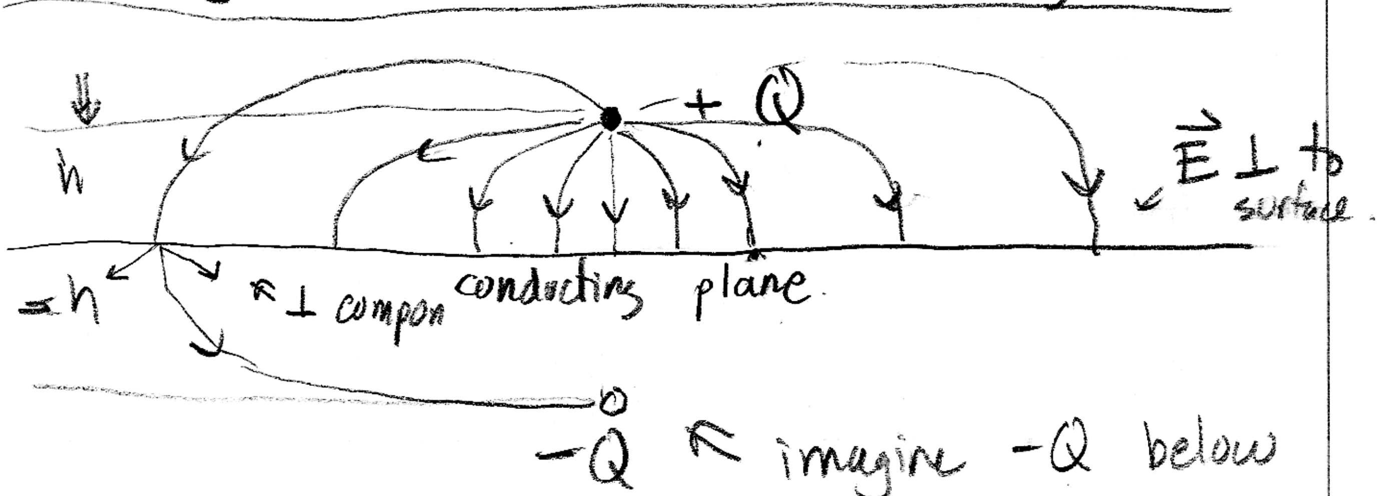


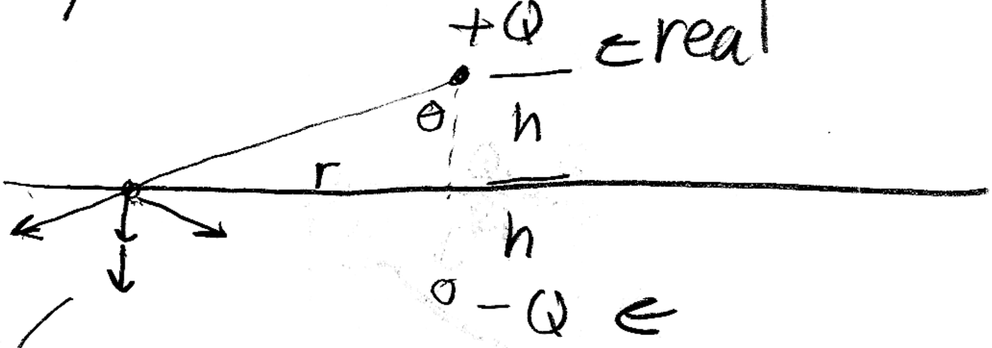
what if φ_1 and/or φ_2 given?

E_r (discontinuity at surface charge)



Charge Above a Conducting Plane

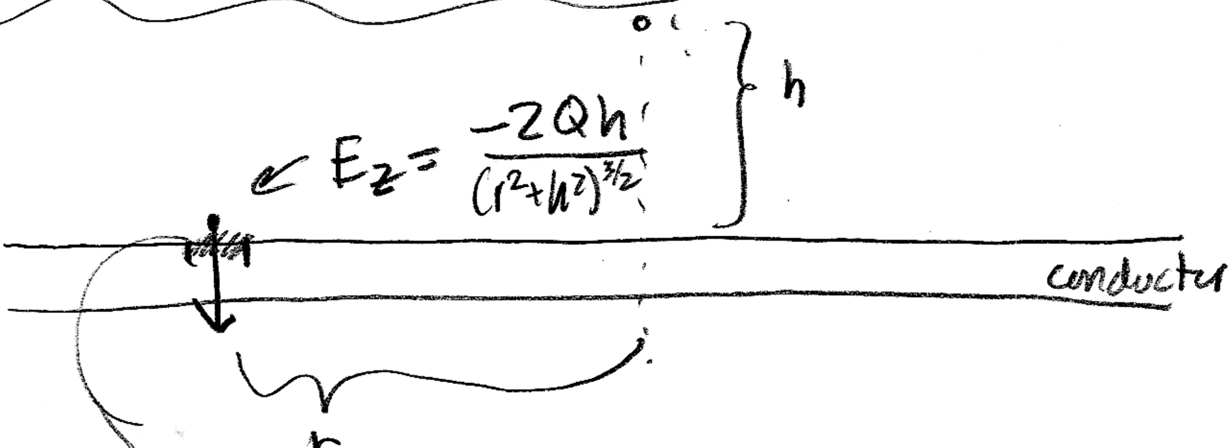




$$E_z = -2|\vec{E}|\cos\theta \qquad \cos\theta = \frac{h}{\sqrt{r^2+h^2}}$$

$$|\vec{E}| = \frac{Q}{r^2+h^2}$$

$$E_z = \frac{-2Qh}{(r^2+h^2)^{3/2}}$$



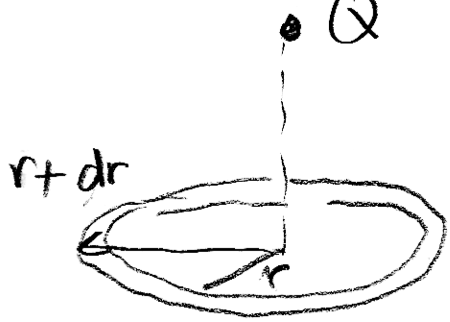
$$\leftarrow E_z = \frac{-2Qh}{(r^2+h^2)^{3/2}}$$

$$4\pi\sigma = E_z$$

$$\sigma = \frac{-2Qh}{4\pi(r^2+h^2)^{3/2}}$$

what is total charge?

symmetric about ⊥ dropped from charge down..



$$dA = 2\pi r\,dr$$

$$dq = \frac{-2\pi \cdot 2}{4\pi} \frac{Qhr\,dr}{(h^2+r^2)^{3/2}}$$

$$dq = -Qh \frac{r\,dr}{(h^2+r^2)^{3/2}}$$

$$q = \int dq = -Qh \int_0^\infty \frac{r\,dr}{(h^2+r^2)^{3/2}}$$

$$= -Qh \,\frac{1}{2}\left(\frac{1}{\left(-\frac{1}{2}\right)}\right) \frac{1}{(h^2+r^2)^{1/2}} \Bigg|_0^\infty$$

↑ $\frac{1}{2}\cdot 2dr$ ↑ for power, $-\frac{1}{2}$

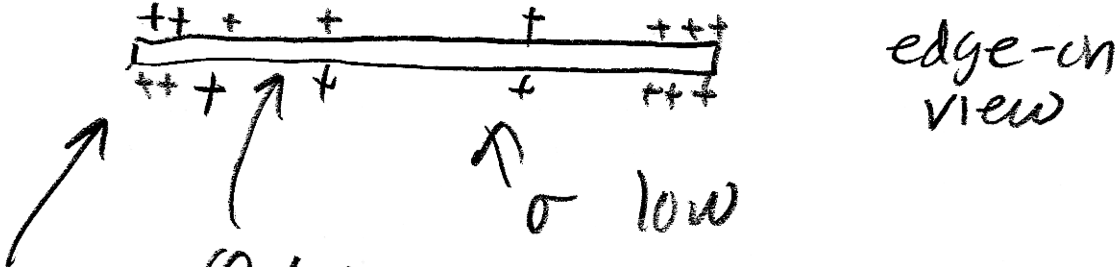
$$= Qh \cdot \left[0 - \frac{1}{h}\right] = -Q$$

Finite conductor : horizontal line no longer an equipotential, "image" fails to solve problem...

"Real Work"

Imagine conducting disk at a constant potential...

charge tries to spread out!



σ big

$\rho \neq 0$

$\rho > 0$ (Q on it...)