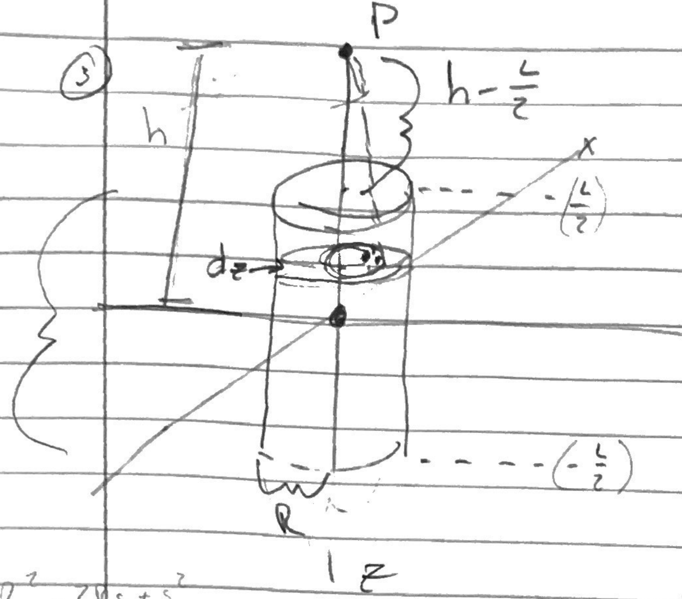
Re-do

(3)



No symmetry so no Gauss!

$$V = \frac{1}{4\pi\varepsilon}\int \frac{\rho}{\mathscr{r}}\,d\tau$$

$$\vec{\mathscr{r}} = \vec{r} - \vec{r}'$$

$$\vec{\mathscr{r}} = (h - z)\hat{z} + (R - s)\hat{s}$$

$$\mathscr{r} = \sqrt{(h-z)^2 + (R-s)^2}$$

$R^2 - 2Rs + s^2$

$$V = \frac{1}{4\pi\varepsilon_0}\iiint \frac{\rho}{\sqrt{(h-z)^2+(R-s)^2}}\, s\, dz\, ds\, d\phi$$

$$V = \frac{\rho_0(2\pi)}{4\pi\varepsilon_0}\int_0^R\int_{-L/2}^{h} \frac{s}{\sqrt{(h-z)^2+(R-s)^2}}\,dz\,ds$$

a) $$V = \frac{\rho_0}{\varepsilon_0}\int_0^R\int_{-L/2}^{h} \frac{s}{\sqrt{(h-z)^2+(R-s)^2}}\,dz\,ds$$

b) $$V = \frac{\rho_0}{\varepsilon_0}\int^R\int_{-L/2}^{h} \frac{R-u}{\sqrt{a^2+u^2}}\,dz(-du)$$

$u = R - s$

$s = R - u$

$\frac{du}{ds} = -1$

$$V = \frac{\rho}{-\varepsilon_0}\int\left[\int_0^R \frac{R\,du}{\sqrt{a^2+u^2}} - \int_0^R \frac{u\,du}{\sqrt{a^2+u^2}}\right]dz$$

$$V = -\rho_0/\varepsilon_0 \int \Big[$$