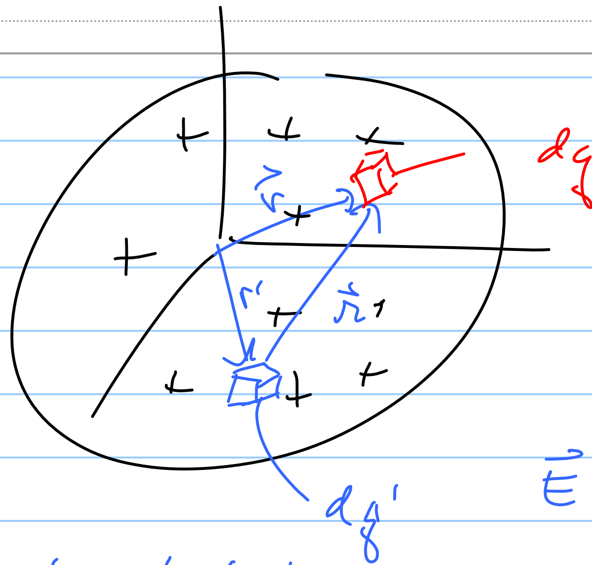
2.43



$\rho\, r^2 \sin\theta\, dr\, d\theta\, d\varphi$

$d\vec{F} = dq\, \vec{E}$

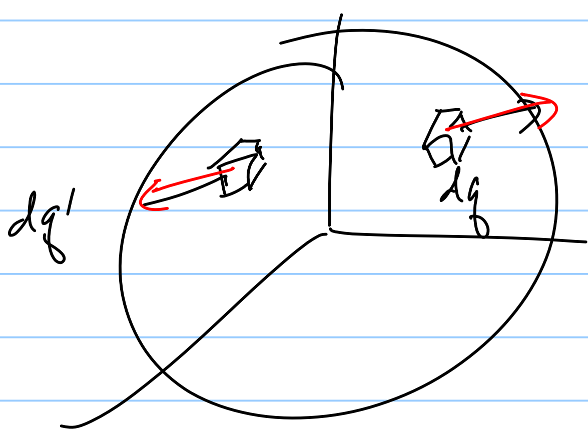
sum over all dq

$\int dF =$

$\vec{E} = \int k \frac{dq'}{\mathscr{r}^2}\hat{\mathscr{r}}$

lower hemisphere

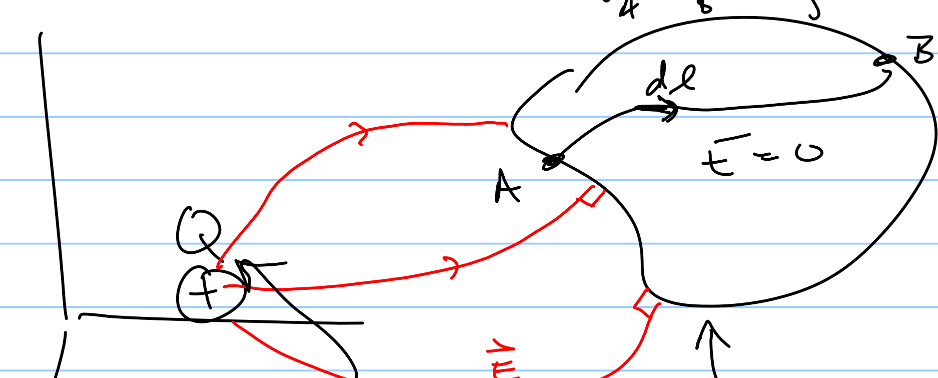
$dq' = \rho\, r' \sin\theta'\, d\theta'\, d\varphi'$



$F = dq\, E_{tot}$

both lower & upper

$V_A - V_B = -\int \vec{E}\cdot d\vec{l}$



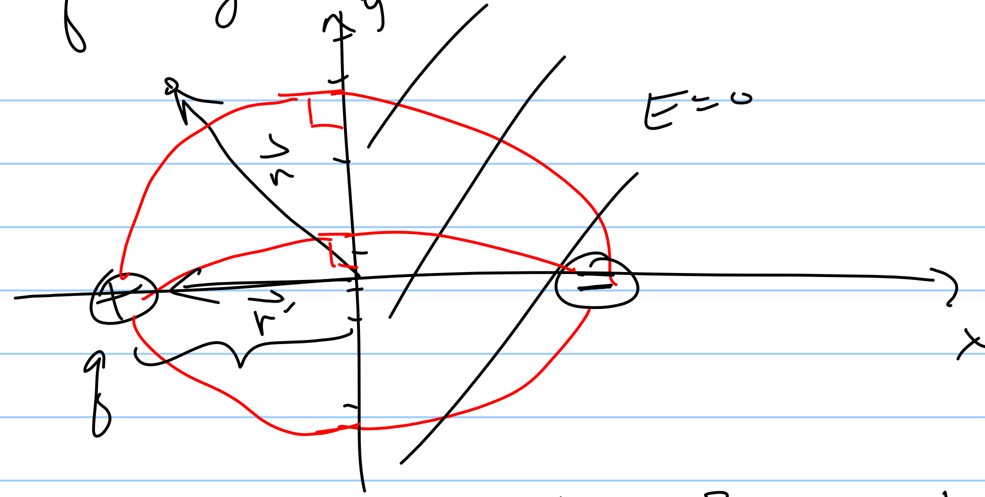
given ρ

& boundary conditions

find σ

Solve $\nabla^2 V = -\rho/\epsilon_0$ P.D.E.

Method of images



Satisfy bndry condition & $\nabla^2 V = 0$ where there is no charge

$$V = \frac{kq_1}{r_1} + \frac{kq_2}{r_2}$$

$$r_1 = |\vec{r} - \vec{r}_1'|$$

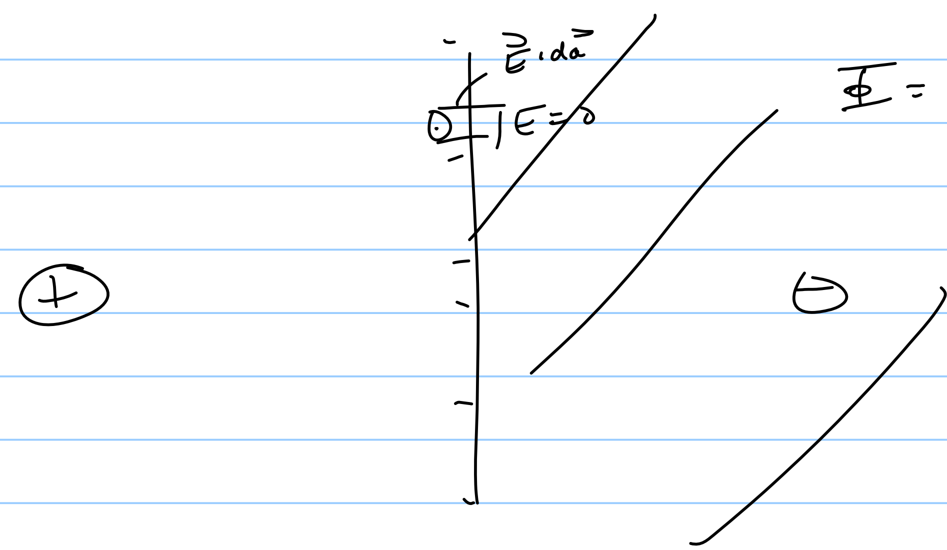
$$\vec{r} = x\hat{x} + y\hat{y} + z\hat{z}$$

$$\vec{r}_1' = -d\hat{x} + 0\hat{y} + 0z$$

$$\vec{r}_2' = +d\hat{x} + 0\hat{y} + 0\hat{z}$$

$$r_1 = \sqrt{(x+d)^2 + y^2 + z^2} \qquad r_2 = \sqrt{(x-d)^2 + y^2 + z^2}$$

$$\vec{E} = -\vec{\nabla} V = -\left(\hat{x}\frac{\partial V}{\partial x} + \hat{y}\frac{\partial}{\partial y}V + \hat{z}\frac{\partial}{\partial z}V\right)$$



$$\Phi = EA = \frac{\sigma A}{\epsilon_0}$$