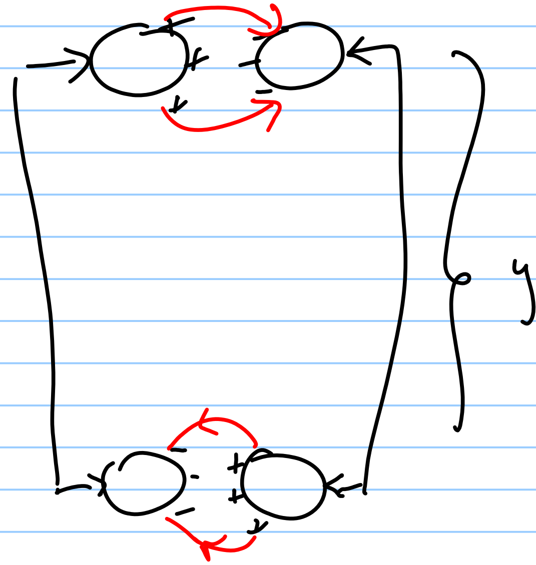
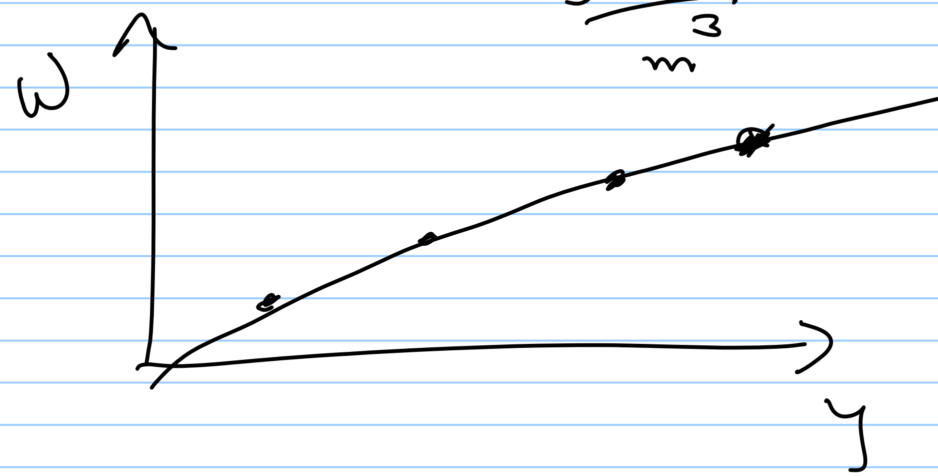


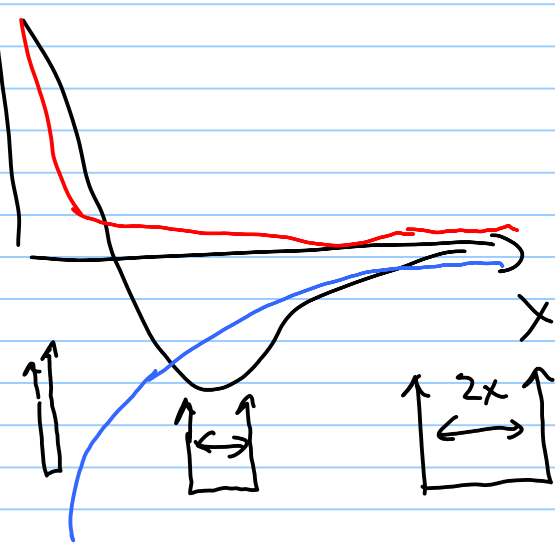
$$W = \frac{1}{2}\epsilon_0 \int E^2 \, d\tau$$

↑

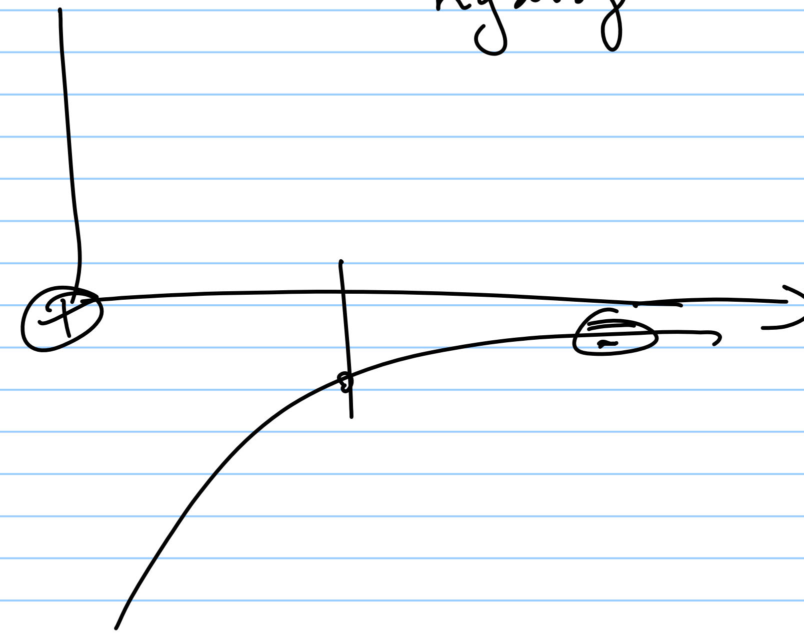
$\frac{\text{Joules}}{m^3}$



W = Total Energy = KE + PE

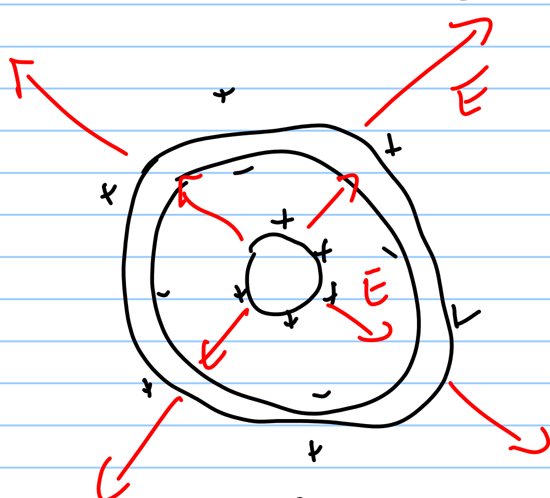


hydrogen

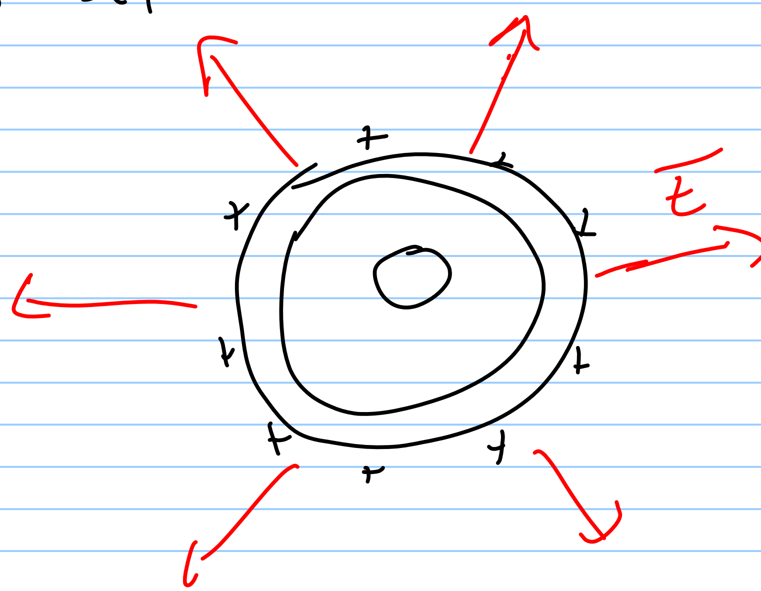


Van De Graaf

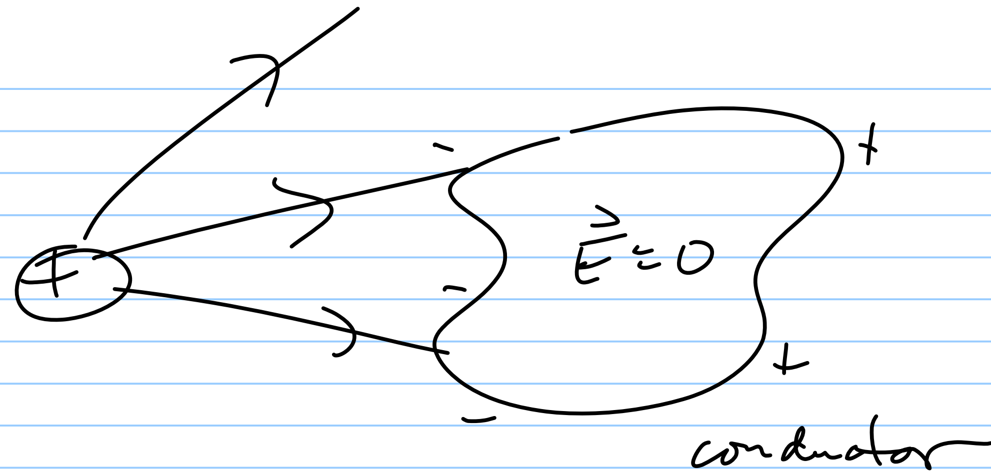
$$W = \int \frac{1}{2}\epsilon_0 E^2 \, d\tau$$



before



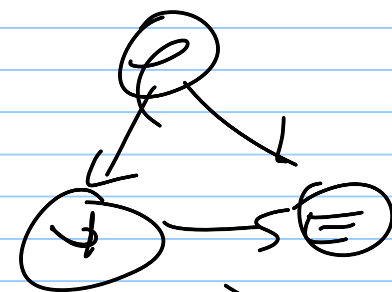
Ch 3



$E \perp$ to surface
cond. in electro statics

V is const on conductor

$$\vec{\nabla} \cdot \vec{E} = \rho/\epsilon_0$$



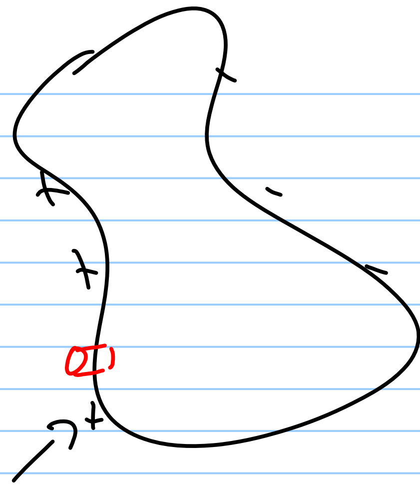
$$\boxed{\nabla^2 V = -\rho/\epsilon_0}$$ Poison's Eqn

$$\vec{E} = -\vec{\nabla} V$$

Between the conductor & charge

$$\nabla^2 V = 0 \quad \text{since } \rho = 0$$

Laplaces Eqn $\Rightarrow$ gives V in free space



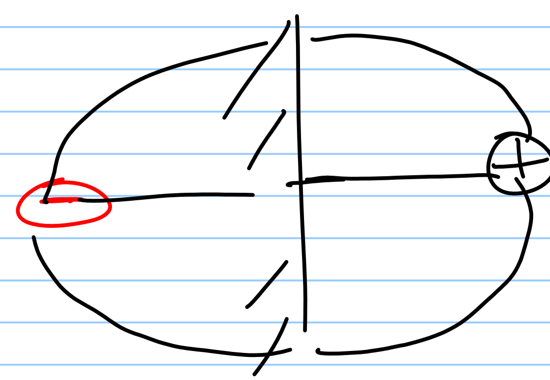
know V in free space near conductor $\Rightarrow \vec{E} = -\vec{\nabla} V$

So I know $\vec{E}$ " " "

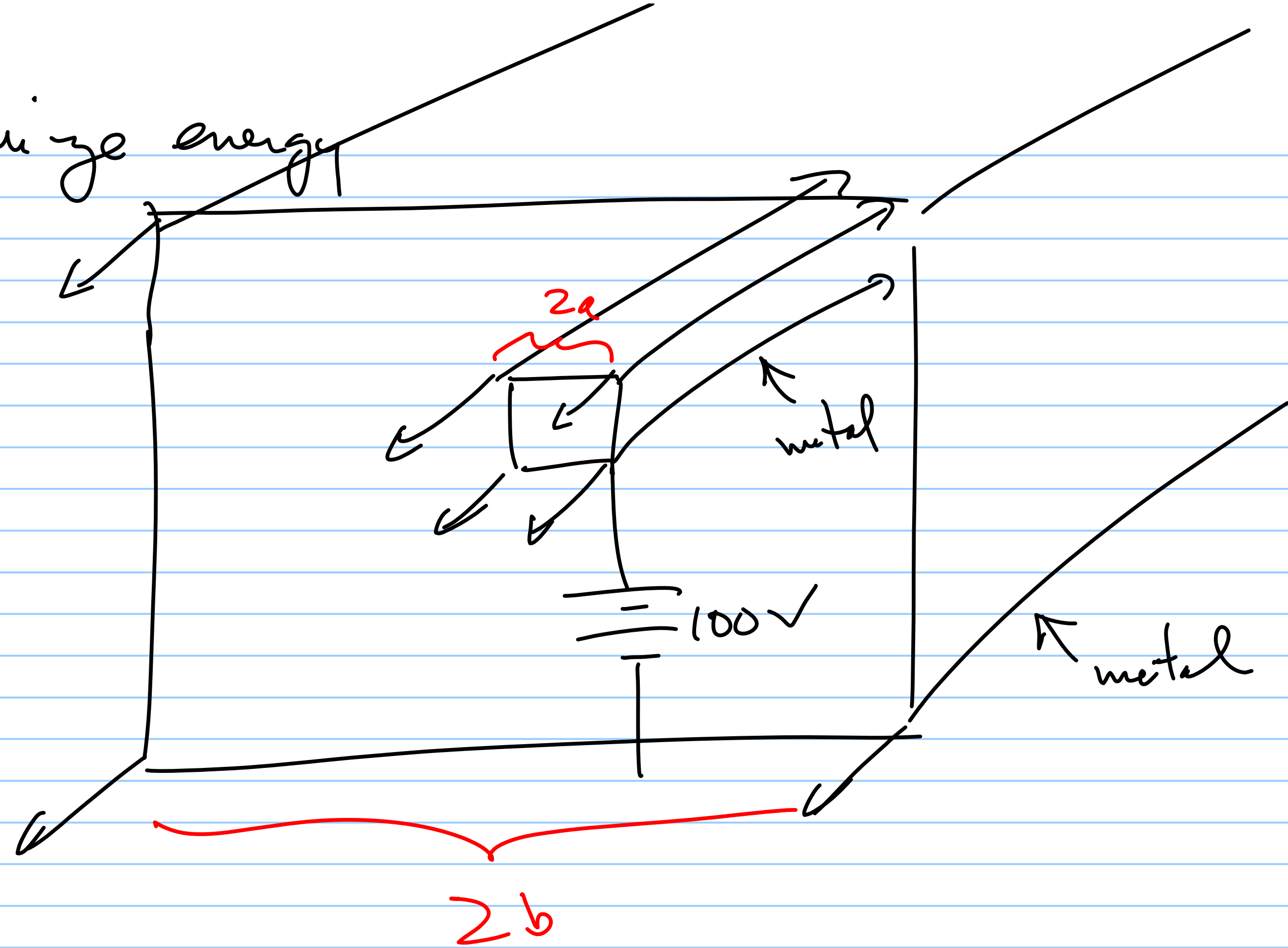
Then use Gauss's law in integral form near surface to get σ

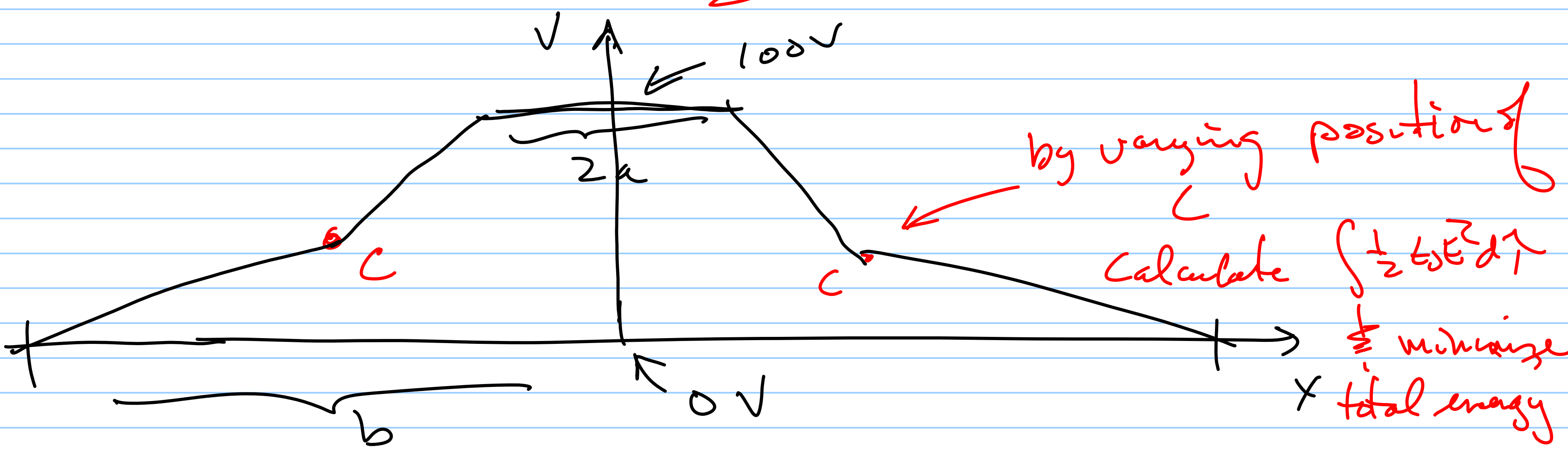
Methods of Soln

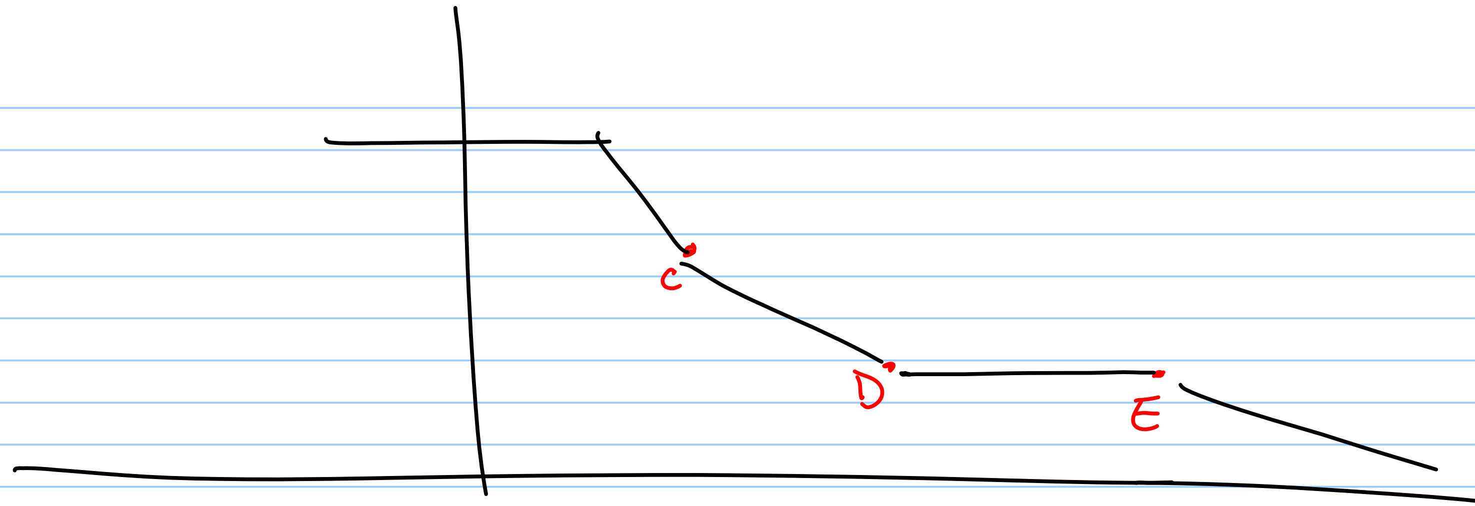
1.) Guess $\Rightarrow$ method of images



2.) Minimize energy

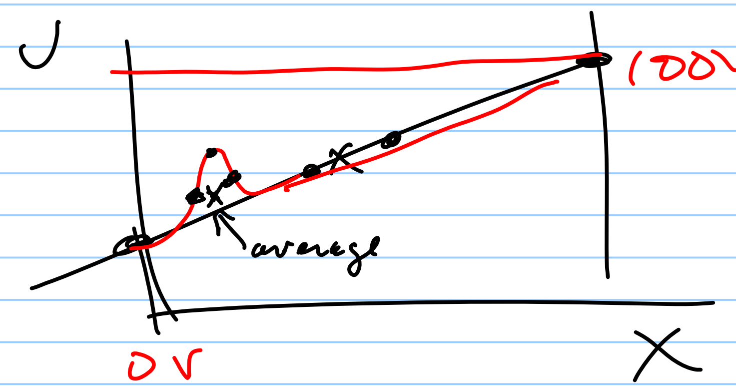






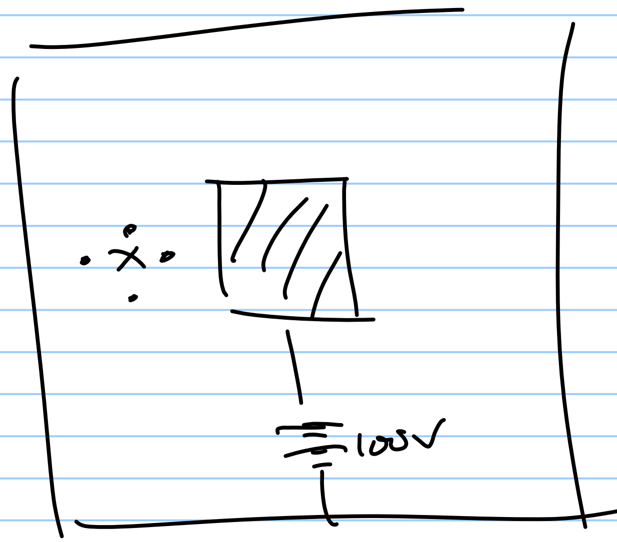
- $\nabla^2 V = 0 = \frac{d^2V}{dx^2} + \frac{d^2V}{dy^2} + \frac{d^2V}{dz^2} = 0$

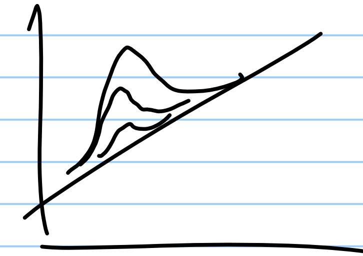
1-D $\qquad \frac{d^2V}{dx^2} = 0$



$\Rightarrow$ Average value of V near a point is V at that point

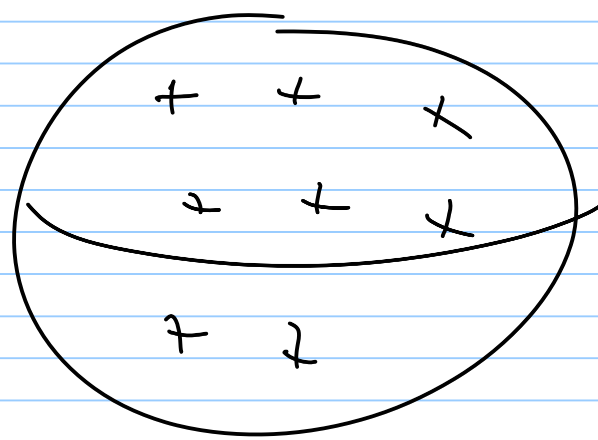
$\Rightarrow$ V has no local min or maxima



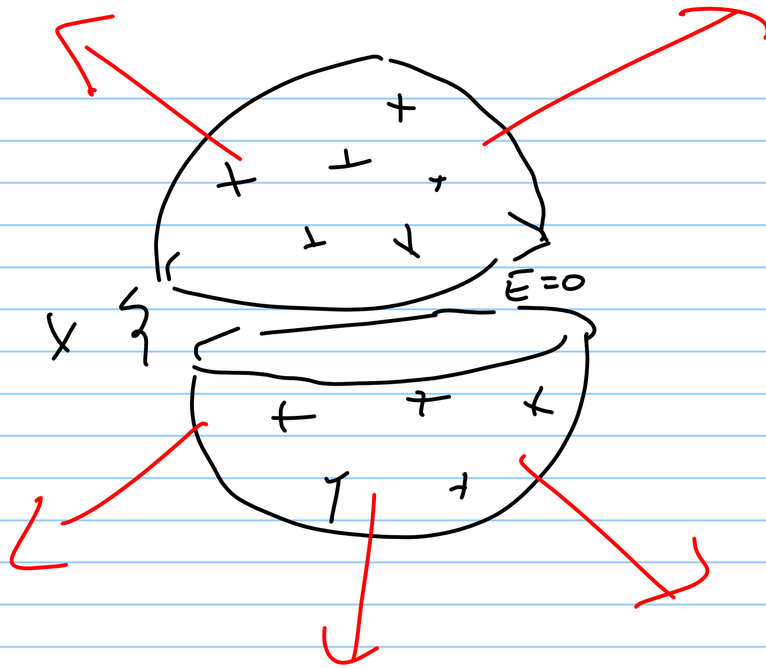


look down z axis

Homework



force on northern hemis. due to southern?

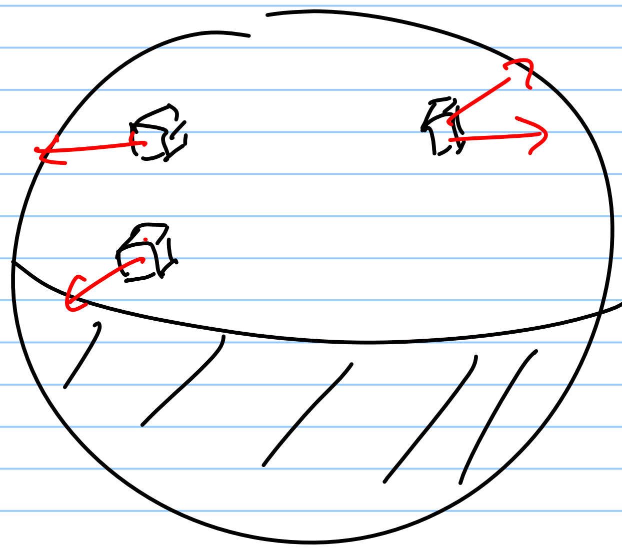


$$\int \frac{1}{2}\epsilon_0 E^2 d\tau = W$$

$$W = \int \vec{F}\cdot d\vec{\ell}$$

$$\vec{\nabla} W \cdot d\vec{\ell}$$

$$\frac{\partial W}{\partial x} d_x = dW$$



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

↑ $\frac{\text{force}}{\text{vol}}$

↑ ?

$$\iiint_{\text{Southern hem}} \frac{k\,dq}{r^2}\hat{r}$$