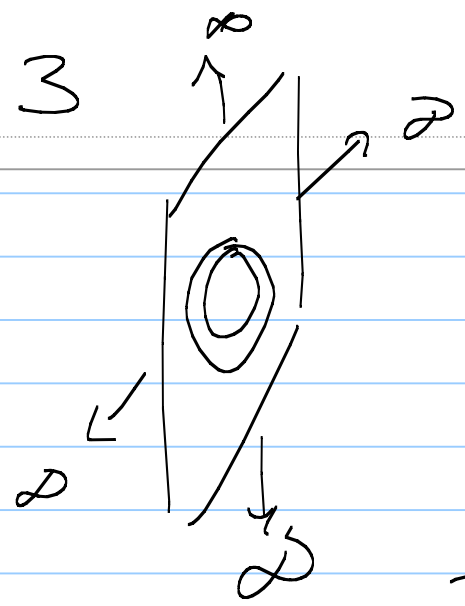
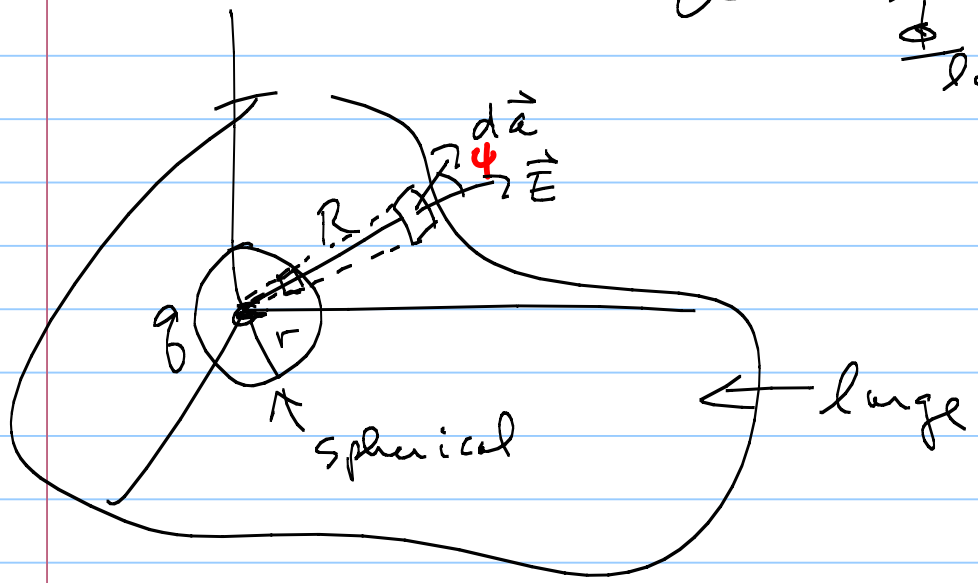
Lecture 3

Note Title 1/16/2006



$$\frac{q}{2\epsilon_0} = \Phi_E = \int \vec{E} \cdot d\vec{a}$$



$$\Phi_{large} = E_R \underbrace{\text{Area}}_{A_{perp}} \cos\psi$$

$$\Phi_{small} = E_r a \cos\theta$$

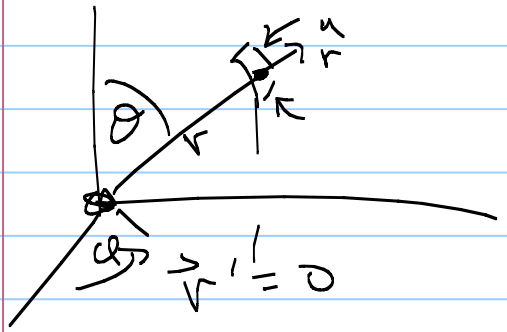
(a = area of small tile)

$E_r \propto \frac{1}{r^2}$ $\quad E_R \propto \frac{1}{R^2} = \frac{1}{r^2}\frac{r^2}{R^2} = E_r \frac{r^2}{R^2}$

$A_{perp} \propto R^2 = r^2 \frac{R^2}{r^2}$ $\quad A_{perp} \propto a \frac{R^2}{r^2}$

$\Phi_{large} = E_r \frac{r^2}{R^2} a \frac{R^2}{r^2} = E_r a = \Phi_r$

Pt charge $\quad \Phi_E = \oint \vec{E} \cdot d\vec{a} = \int_0^{2\pi}\int_0^{\pi} \frac{q}{4\pi\epsilon_0}\frac{\hat{r}}{r^2} \cdot \underbrace{r\sin\theta\, d\varphi \; r\, d\theta\, \hat{r}}_{da}$

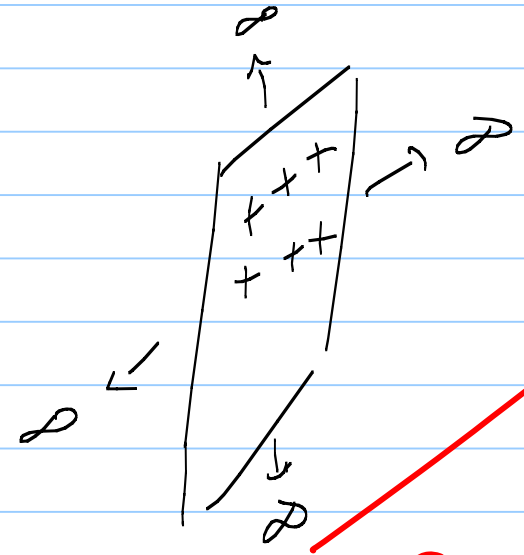


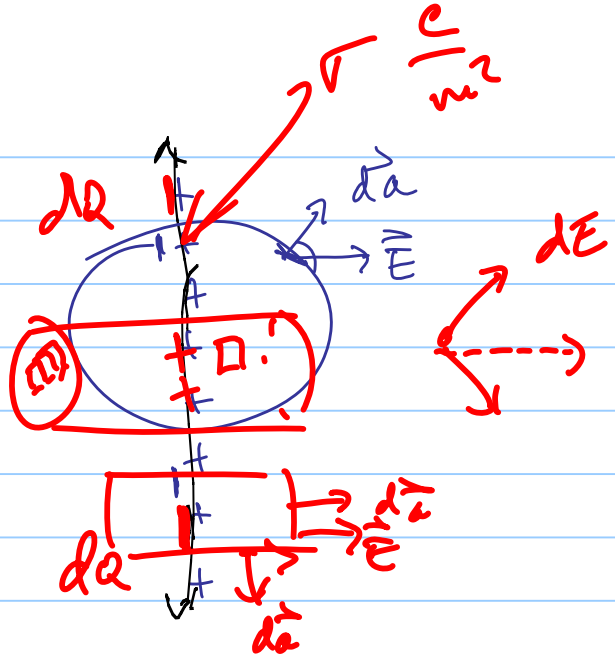
$\Phi = \frac{q}{\epsilon_0}$

Gauss's law

$$\oint \vec{E} \cdot d\vec{a} = \frac{Q_{enc}}{\epsilon_0}$$

ex:





$$\int \vec{E} \cdot d\vec{a} = \int_{cap_1} + \int_{cap_2} \vec{E} \cdot d\vec{a} + \int_{body} \vec{E} \cdot d\vec{a}$$

$|\vec{E}||d\vec{a}| \cos 90 = 0$

$|\vec{E}||d\vec{a}| \cos 0 = |\vec{E}|\, da$

$$\int_{cap\,2} = \int \vec{E}\, da = |\vec{E}| \underbrace{\int da}_{area\ end\ cap}$$

$$\underbrace{E_{area}}_{cap\,1} + \underbrace{E_{area}}_{cap\,2} = 2E_{area\,cap} = \frac{Q_{end}}{\epsilon_0}$$

$$2E_{area\,cap} = \frac{\sigma\, area_{cap}}{\epsilon_0}$$

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