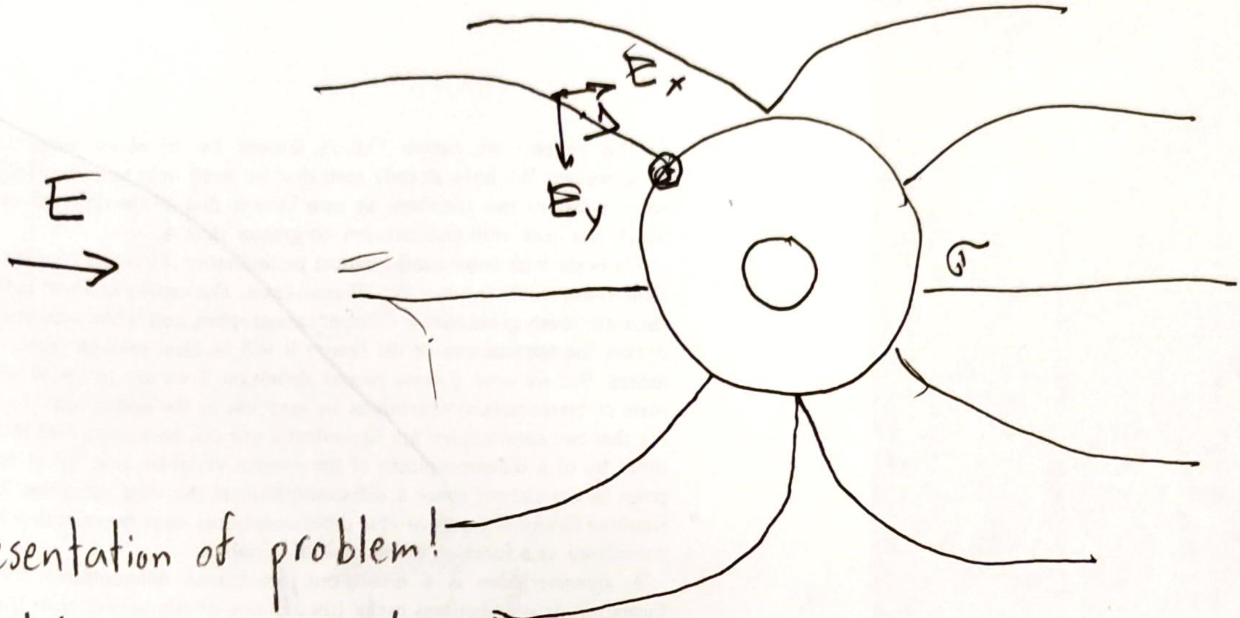
0-




Presentation of problem!

Sketch your arguments well.

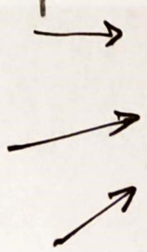
Stay logical.

$$E_t^{out} = E_t^{i} = 0$$

$$E_n^{out} - \underbrace{E_n^{i}}_{=0} = 4\pi\sigma$$

$$\sigma_{\cancel{\alpha}} = \sigma_0 \cos\alpha$$

Symmetry of problem w. E-field $\underline{dir^n}$



$$E(r) = E(\infty) - \frac{\cos\alpha}{r^{\cancel{2}}}$$

$$\vec{E}(\cancel{\infty})\Big|_{\infty} = \vec{E}_0$$

$E(r)$

$$\begin{cases} \operatorname{div} E = \cancel{4\pi\sigma}\ 0 \\ \operatorname{curl} E = 0 \end{cases}$$

1-

$\text{div}\,\vec{E} = 0$

$\text{curl}\,E = 0.$

$\hookrightarrow \quad \vec{E} = -\vec{\nabla}\phi$

$-\vec{\nabla}\cdot\vec{\nabla}\phi = 0 \rightarrow \nabla^2\phi = 0.$

$\phi = \underset{0}{\phi_0} + f_1(r)Y_1(\cos\theta) + Y_2(\cos\theta)\, f_2(r) \ldots$

$r\cos\theta$

$-\nabla\phi = E$

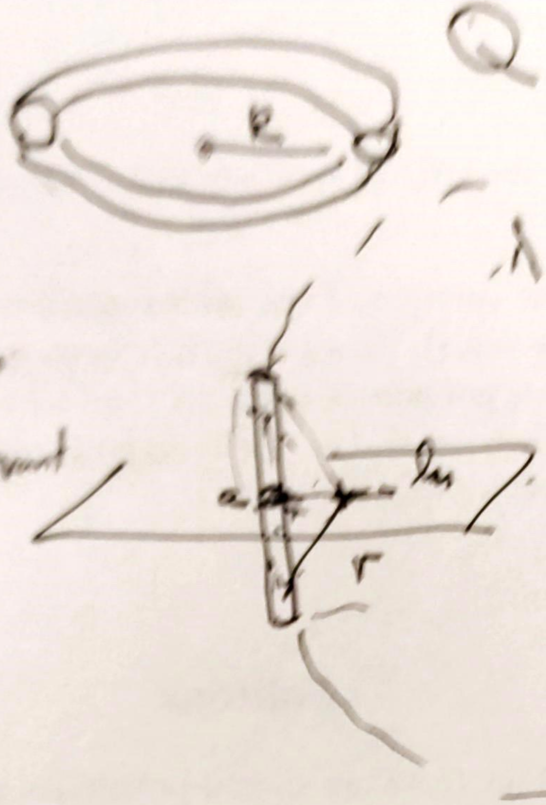
Another way, but same logic
same logical presentation

Stay neat. Then your thoughts will be neat.

2-

Scale of problem

→ Lets me take relevant approximations




$$\lambda = \frac{Q}{2\pi R}$$

$$C = \frac{\epsilon_0 R}{\ln\frac{R}{a}}$$

$$\lambda \ln\frac{R}{a}$$

$R \gg a$

$$\ln\frac{\alpha R}{a} = \underbrace{\ln\frac{R}{a}}_{\gg 0} + \ln\alpha$$

$$\int_0^L \frac{dx}{\sqrt{a^2+x^2}} = \int_0^a \frac{dx}{\sqrt{a^2+x^2}} + \int_a^L \frac{dx}{\sqrt{a^2+x^2}}$$

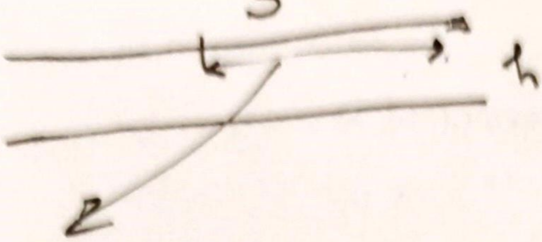
$$x = a\xi \rightarrow \int_0^1 \frac{\cancel{a}\,d\xi}{\cancel{a}\sqrt{1+\xi^2}}$$

$$\int_a^L \frac{dx}{\sqrt{a^2+x^2}} \simeq \int_a^L \frac{dx}{x} = \ln\frac{L}{a}$$

Logarithmic constants.

↳ come out due to scale

3-




$\sqrt{S}$

$$C = \frac{4\pi S}{h}$$

$$C = \frac{\epsilon_0 S}{h}\left(\frac{h}{\sqrt{S}}\right)$$

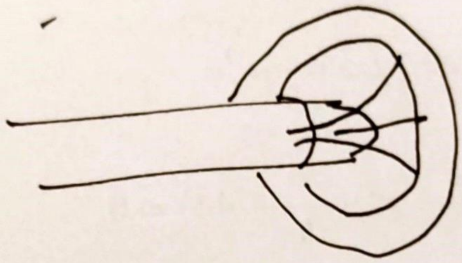
$$h^2 \ll S$$

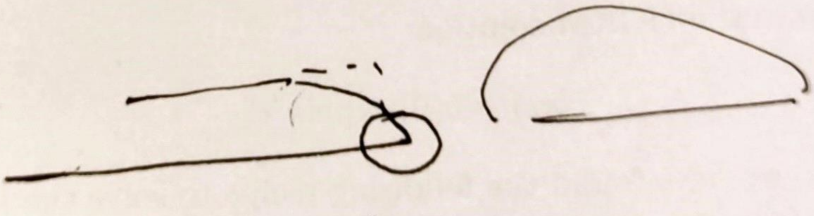
$$h \ll \sqrt{S}$$

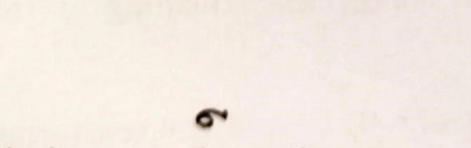
$$x = \frac{h}{\sqrt{S}} \ll 1$$

$$\frac{1}{x} \pm a + x + x^3$$

Expansion








understand problem

→ 2D approx.

→ log.

$$\tilde{E} \cdot \mathcal{L} = \phi$$

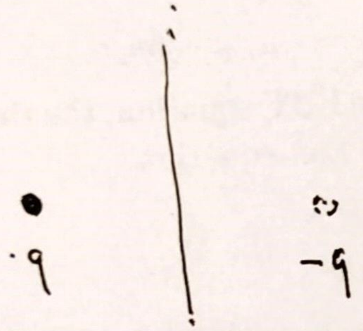
$$\phi = EL \propto \sigma L \quad \tilde{\sigma} \sim \tilde{E} \propto \frac{\phi}{\mathcal{L}} < \frac{\phi}{h} = E \sim \sigma$$

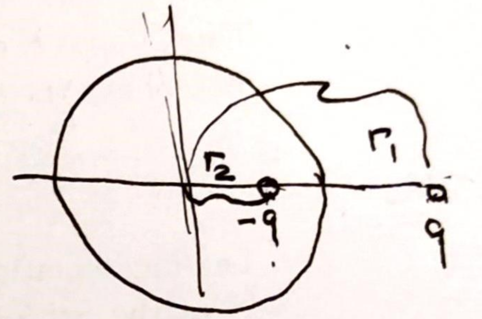
4 -

Harmonic

$\nabla^2\phi = 0$ $(x,y)$ $x+iy=z$

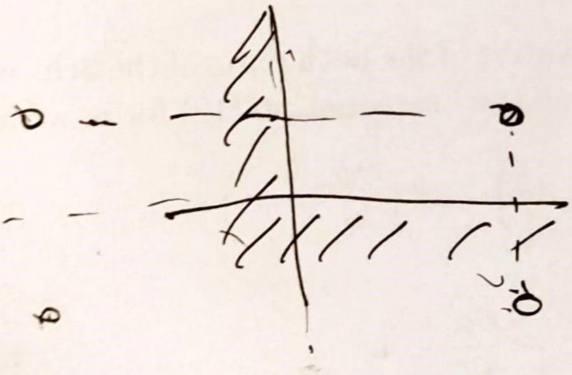
$f(x,y)$ $f(x,y) = f(x+iy) = \underline{u(x,y)} + i\underline{v(x,y)}$

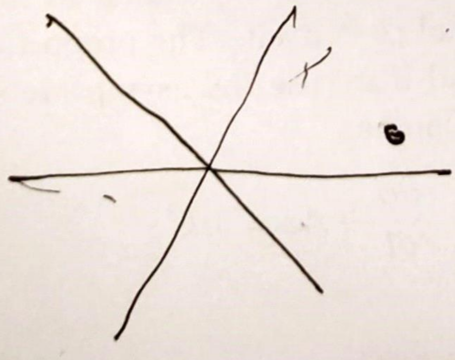


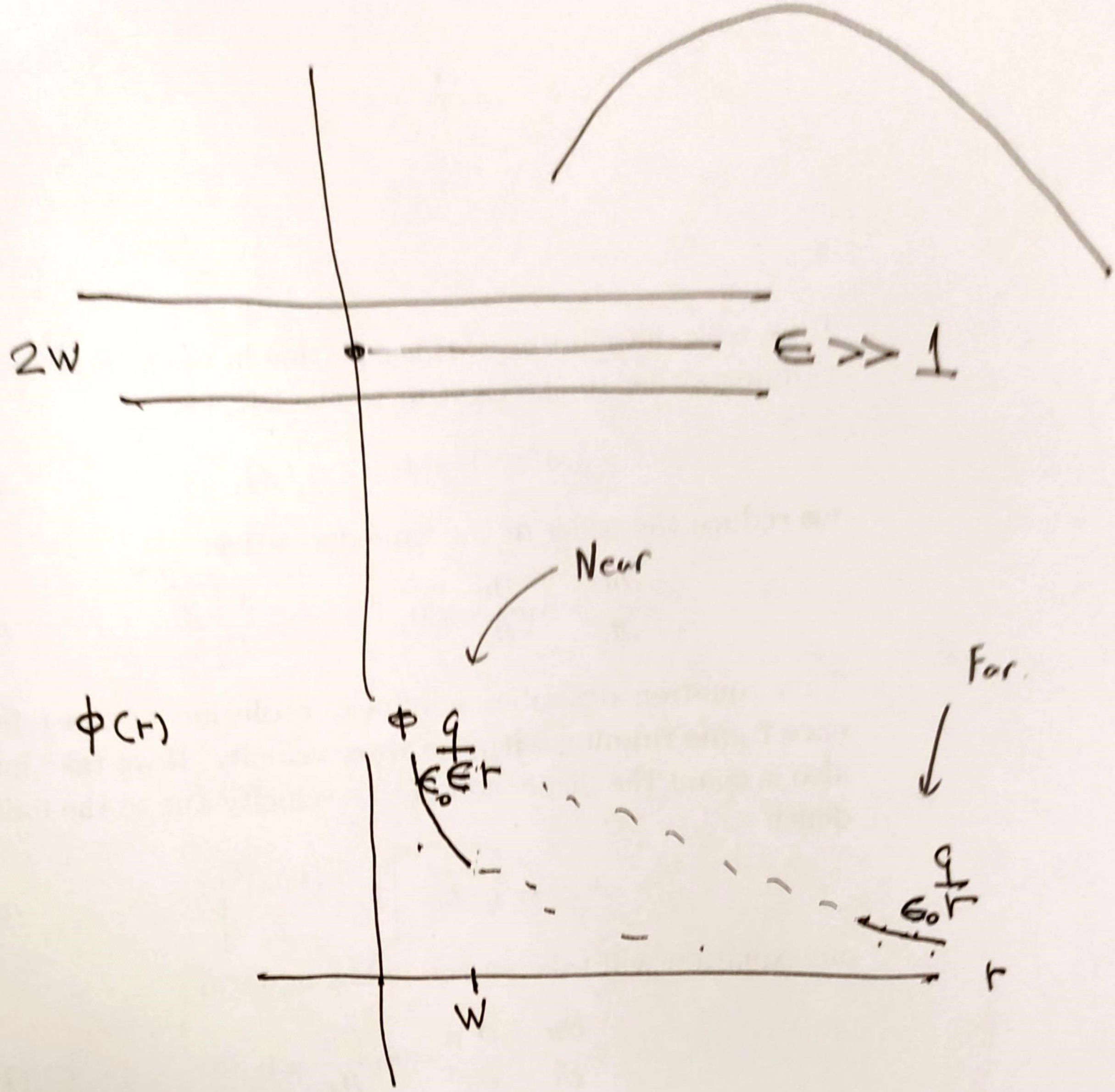

$$\underline{r_1 \cdot r_2 = R^2}$$

$$r_2 = \frac{R^2}{r_1}$$





5-




Intermediate: Has to approach near & far.