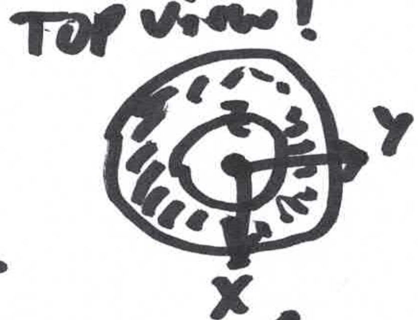
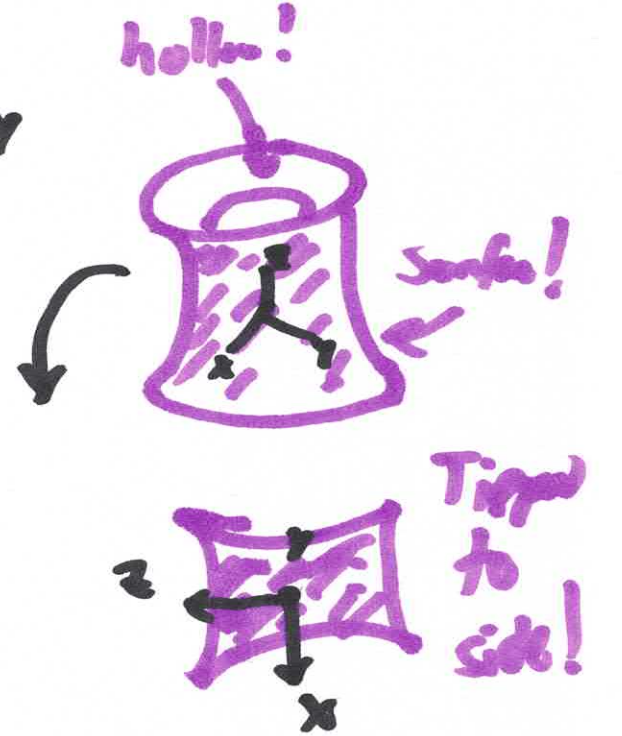
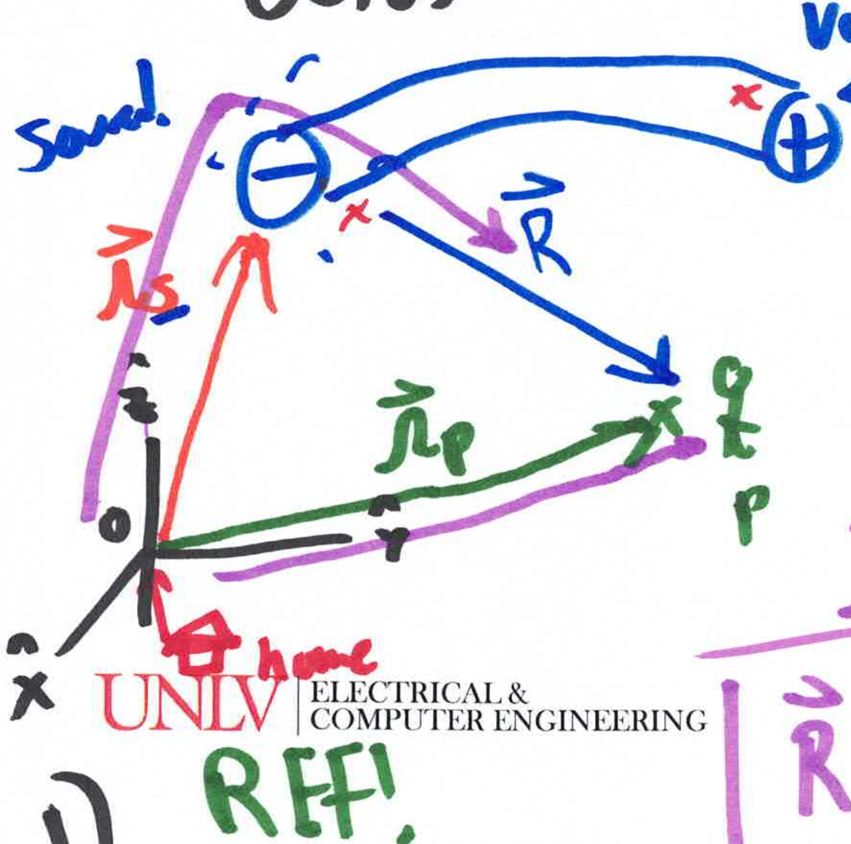
EE 330

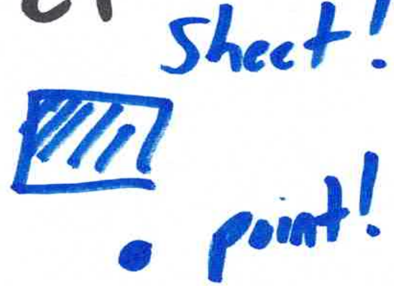
Review for Exam 1

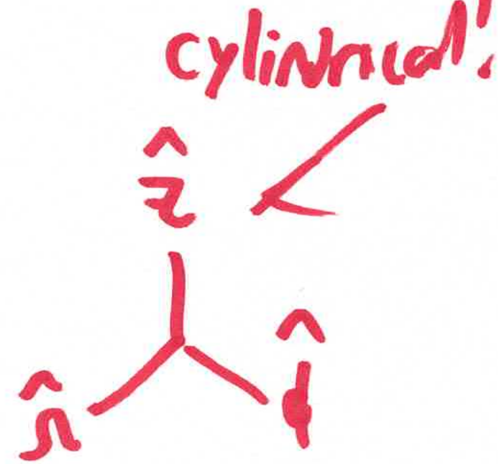
October 11th, 2021











$$\vec{r}_p = \vec{r}_s + \vec{R}$$

$$\boxed{\vec{R} = \vec{r}_p - \vec{r}_s} \quad b$$

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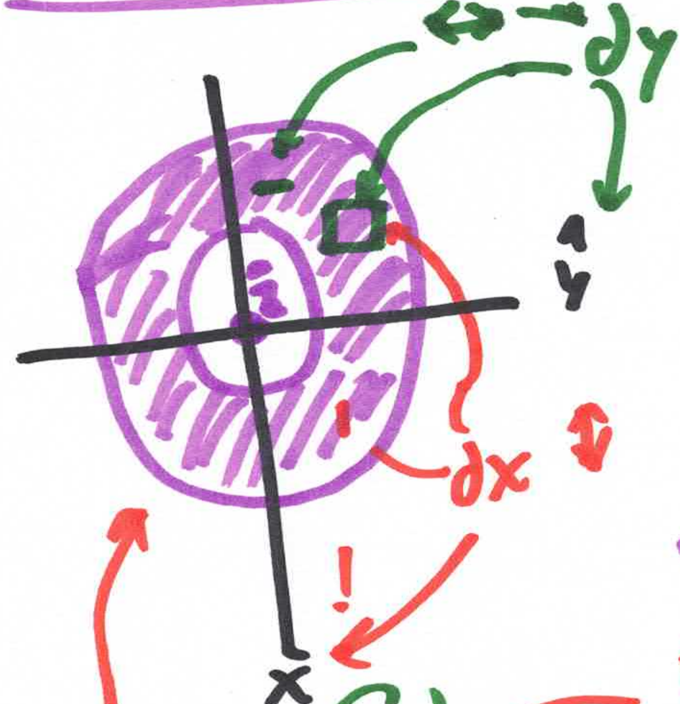
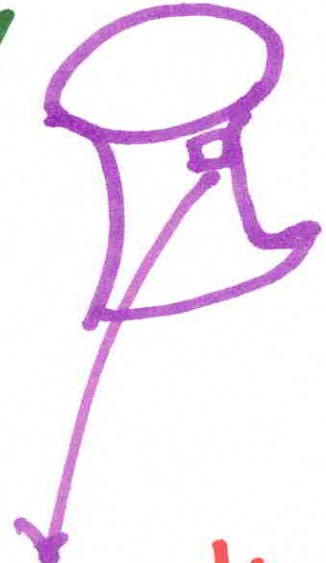
1)

David's hard mode

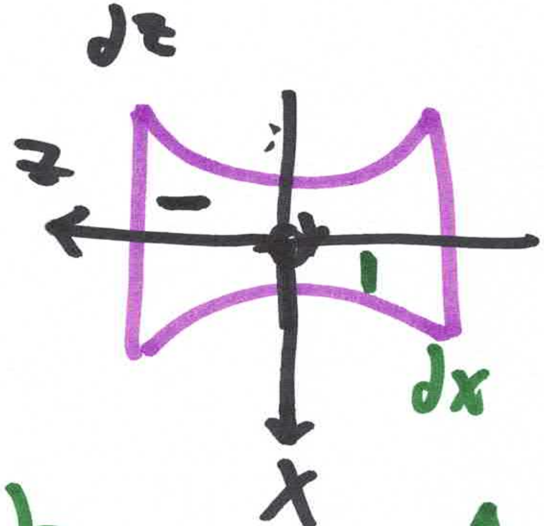




Projection method!

Surface!

$$\boxed{dS = dx\,dy}$$



$$ds = dz\,dx\;\hat{y}$$

Shadow!

Cross product method

Result in $\hat{}$!

$$ds = (\vec{x} \times \vec{y}) \cdot \hat{z}.$$

Electric Field!

function of any source!

$$d\vec{E}(\vec{r}_p) = \frac{dq(\vec{r}_s)\,\vec{R}}{4\pi\varepsilon_0\,|R|^3} \quad (1)$$

function of our position!

Bounded by shape!

$$\vec{R} = |R|\,\hat{R}$$

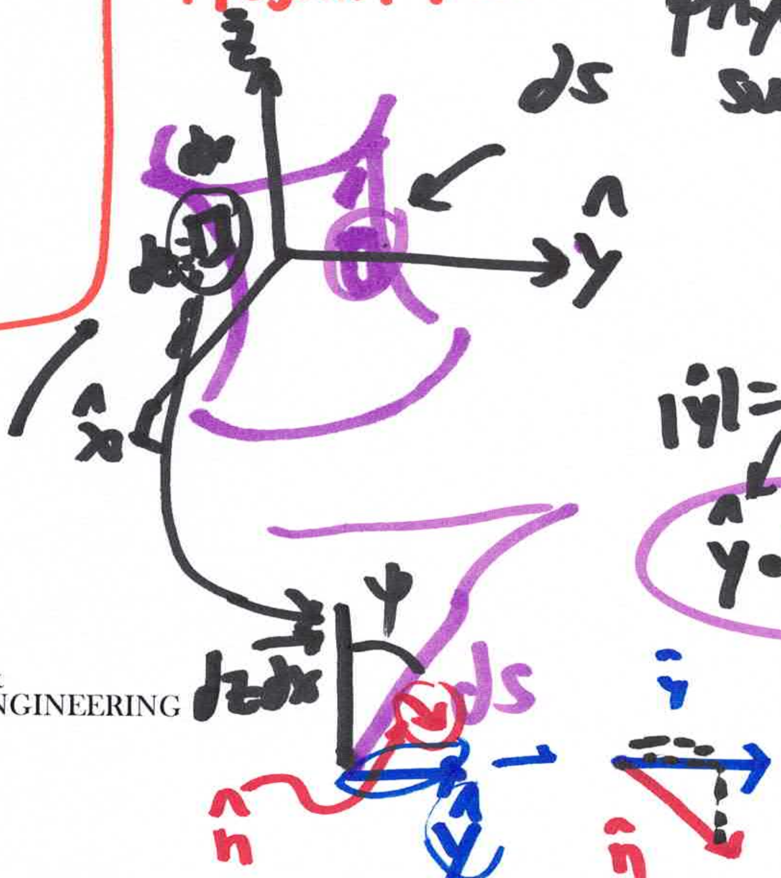
Vector   Mag   Direction

$$\frac{\hat{R}}{|R|^2}$$

Projection Method

Move wherever we want!

physical surface!



$$dz\,dx = ds\cos\psi$$

$$\boxed{ds = \frac{dx\,dz}{\cos\psi}}$$

$$|\hat{y}| = 1$$

$$\hat{y}\cdot\hat{n} = \cos\psi \rightarrow |\hat{y}\cdot\hat{n}|$$

Ref square!

dx dz

3) shadow!

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hyperboloid

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=1$$

$$\vec{A}=|A|\hat{A}$$

$$g(\vec{r})=\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}-1$$

Family of shapes!

$$\vec{\nabla} g(r)=\frac{2x}{a^2}\hat{x}+\frac{2y}{b^2}\hat{y}-\frac{2z}{c^2}\hat{z}$$

$$|\vec{\nabla} g(r)|=\left[\frac{4x^2}{a^4}+\frac{4y^2}{b^2}+\frac{4z^2}{c^2}\right]^{1/2}=2\left[\frac{2x^2}{a^4}+\frac{2y^2}{b^4}+\frac{2z^2}{c^4}\right]^{1/2}$$

$$\hat{A}\rightarrow \vec{\nabla} g(r)=\boxed{\hat{n}=\frac{\vec{\nabla} g(r)}{|\vec{\nabla} g(r)|}}$$

4)

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$$|\hat{n}\cdot\hat{y}| = \frac{y}{b^2\left[\frac{x^2}{a^4}+\frac{y^2}{b^4}+\frac{z^2}{c^4}\right]^{1/2}}$$

EE360

$$\int_{-\infty}^{\infty} x(t)\,\delta(0) = x(0)$$

Analogy!

Sifting!

Sift the $\hat{y}$ component!

$$\therefore\ dS = \frac{dz\,dx}{|\hat{n}\cdot\hat{y}|}$$

$$d\vec{E}(\vec{r}_p) = \int \frac{\rho_s\, dS\, \vec{R}}{4\pi\varepsilon_0 |R|^{3/2}} dz\,dx$$

Value = Magnitude!

$$dq = \rho_l\, d\vec{l} = \rho_s\, d\vec{s} = \rho_v\, d\vec{v}$$

$$\frac{x^2}{a^2} + \cancel{\frac{y^2}{b^2}} - \frac{z^2}{c^2} = 1$$

$$-a\sqrt{1-\frac{z^2}{c^2}} < x < +a\sqrt{1-\frac{z^2}{c^2}}$$

$$x = \pm a\sqrt{1-\frac{z^2}{c^2}}$$

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5)

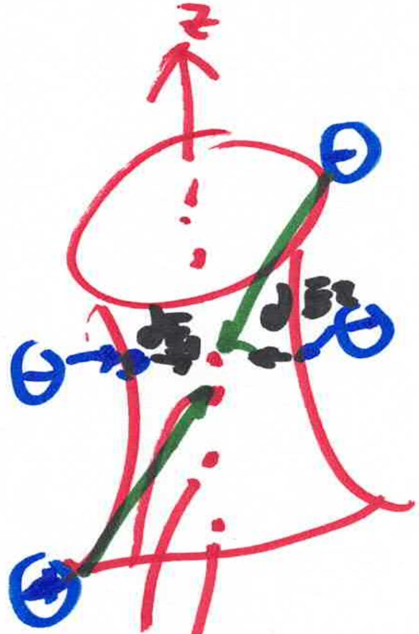
$$\vec{E}(\vec{r}_p) = \int d\vec{E}(\vec{r}) = 2\int_{-\beta}^{+\beta}\int \frac{\rho_s}{4\pi\varepsilon_0} \frac{\vec{R}}{(R)^{3/2}}$$

$z \to -\beta$ 0

x

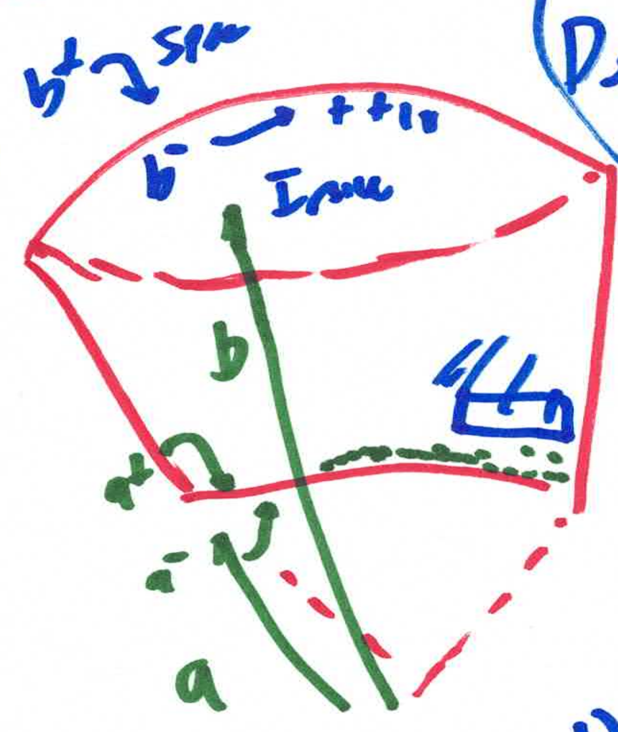
$\pm a\sqrt{1-\frac{z^2}{c}}$

5



$\vec{r}_p$

$$\vec{E} = \frac{\rho_s}{\varepsilon_0 r^2}$$



$D_{r_1}(r=b^+)$

$=-\rho_s(r=b)$

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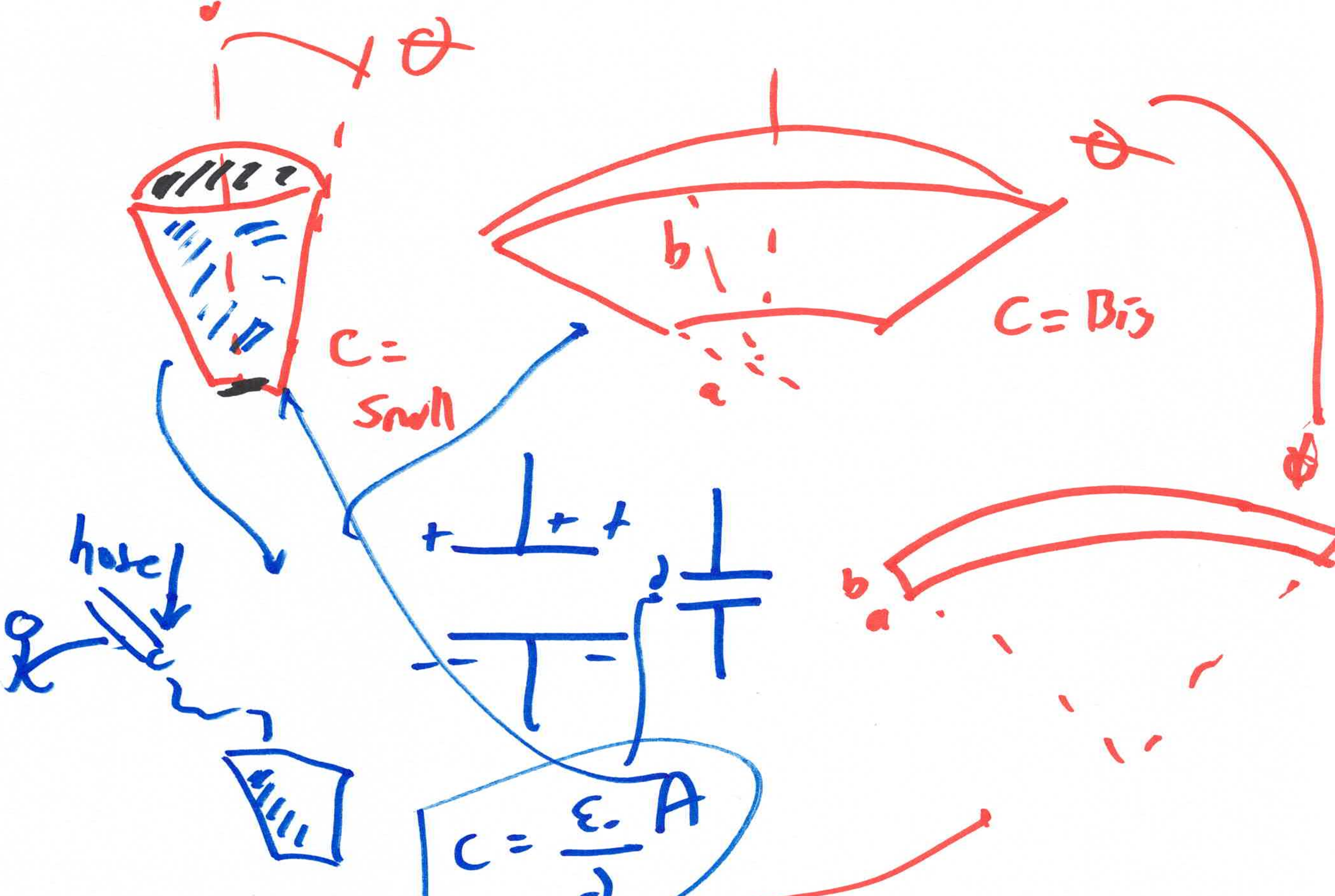
6)

$$\oint \vec{D}\cdot d\vec{s} = D_{r}(r=b^+) - D_r(r=b^-) = \rho_s(r=b)$$



$$C = \frac{\varepsilon_0 A}{d}$$

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7)