E&M Day 1 Feb 1st, 2021

I. Welcome!
II. Syllabus

Day 2 Feb 3rd, 2021

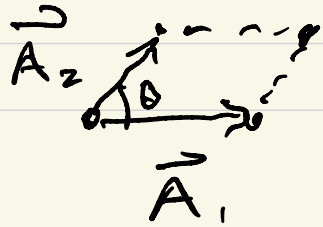
I. Questions?
II. Explore Electric Fields
III. Vector Algebra
IV. Young's Drill

II Def. of Electric field

$$\vec{E}(x,y,z) = \frac{\vec{F}_E}{q_{Test}}$$

This is not a velocity vector field!

III A flake of ~~table~~ salt



Done!

Vector algebra

We can get to any ion with

scalar mult. $\vec{A}_1 \to a\vec{A}_1$

$$= (aA_{1x}\hat{x} + aA_{1y}\hat{y})$$

We can go diagonally with

$$\vec{A}_1 + \vec{A}_2 = (A_{1x} + A_{2x})\hat{x} + (A_{1y} + A_{2y})\hat{y}$$

Dot product

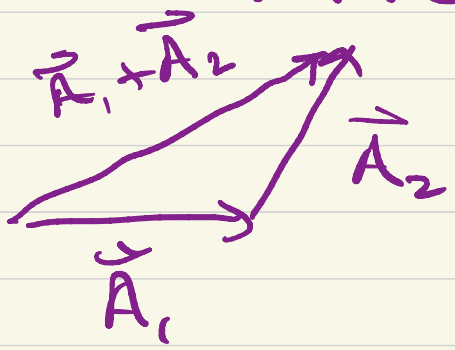
$$\vec{A}_1 \cdot \vec{A}_2 = \vec{A}_2 \cdot \vec{A}_1 = A_1 A_2 \cos\theta$$

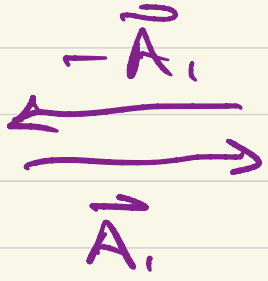
Cross product

$$\vec{A}_1 \times \vec{A}_2 = -\vec{A}_2 \times \vec{A}_1 = A_1 A_2 \sin\theta \hat{z}$$

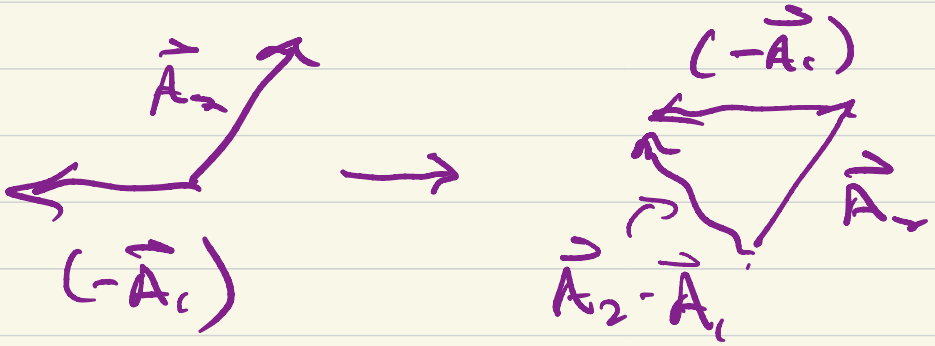
$$= \det \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ A_{1x} & A_{1y} & A_{1z} \\ A_{2x} & A_{2y} & A_{2z} \end{vmatrix}$$

Vector difference

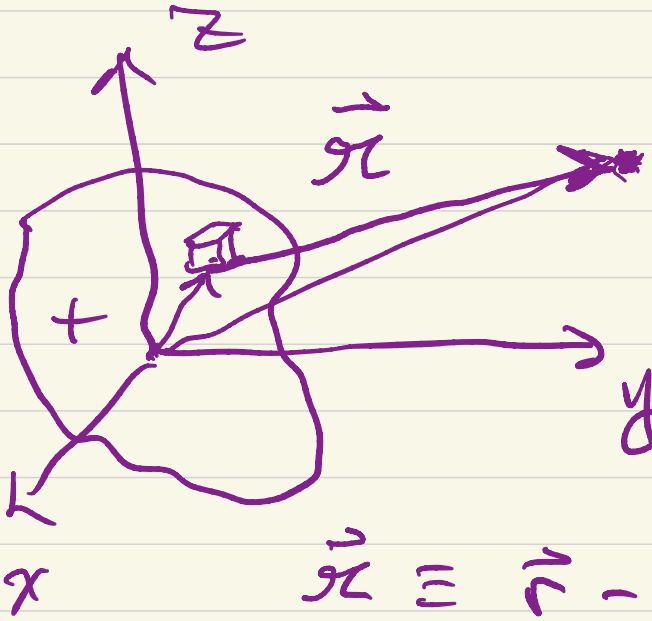




$$\vec{A}_2 - \vec{A}_1 = \vec{A}_2 + (-\vec{A}_1)$$



"Tip minus tail mnemonic"



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

$$= (x, y, z)$$

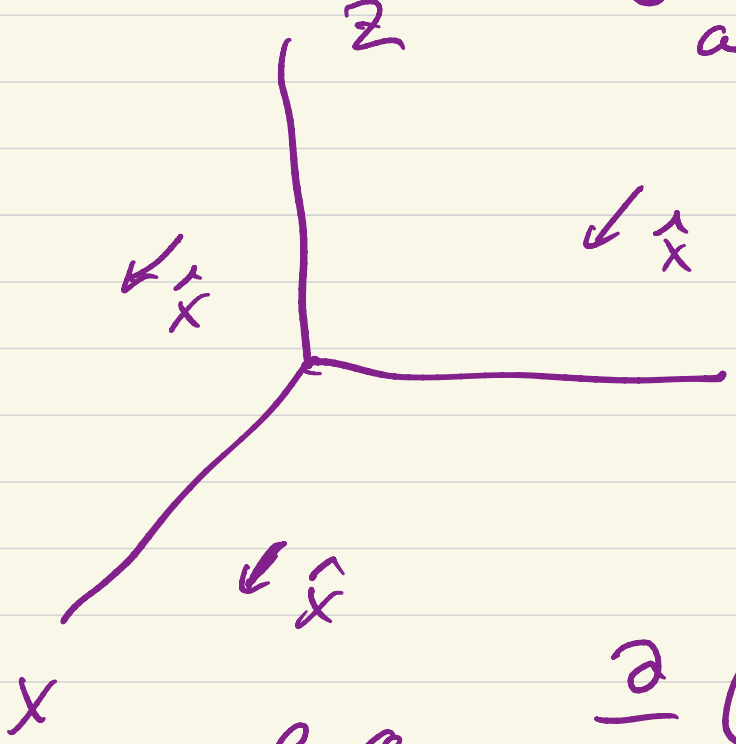
$$\vec{r}' = x'\hat{x} + y'\hat{y} + z'\hat{z}$$

$$= (x', y', z')$$

$$\vec{\mathcal{R}} \equiv \vec{r} - \vec{r}'$$

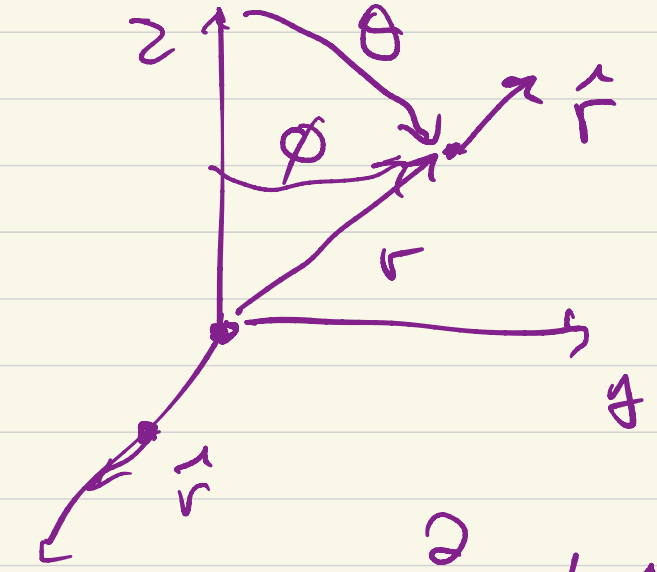
$$= (x - x')\hat{x} + (y - y')\hat{y} + (z - z')\hat{z} = (x - x', y - y', z - z')$$

Different coord. systems have advantages and disadvantages.



e.g. $\frac{\partial}{\partial x}(\hat{x}) = 0$

$\vec{E} = E_x \hat{x} + E_y \hat{y}$



$= E_r \hat{r} + E_\theta \hat{\theta} + E_\phi \hat{\phi}$

e.g. $\frac{\partial}{\partial \theta}(\hat{r}) \neq 0.$