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AGENDA

1) Gauss Law Introduction
2) Gauss Law W/S
3) Review Answers
4) Comment Cards

Electric Flux

$$\Phi_{(flux)} = \oint_S \vec{E} \cdot d\vec{A}$$

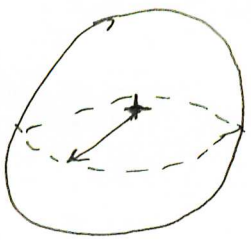
$\hat{n}$ is $\perp$ to surface pointing outward

Example

Find Electric Flux Φ_E due to point charge

- radius r
- charge q

→ $\vec{E}$ @ r is constant
→ $\vec{E}$ points radially away // to $\hat{n}$



$$\Phi_E = \oint_S d\vec{A} \cdot \vec{E}$$

$$\vec{E} = \frac{kq}{r^2}\hat{r}$$

$$\Phi_E = kq \oint \frac{1}{r^2} \hat{r} \cdot d\vec{A} \quad \rightarrow \quad \hat{n} \cdot \hat{r} = 1$$

SArea of sphere $= 4\pi r^2$

$$\Phi_E = \frac{kq}{r^2} \oint_S dA$$

$$\Phi_E = \frac{kq}{r^2} 4\pi r^2 \quad \therefore \quad \boxed{\Phi_E = \frac{q}{\varepsilon_0}}$$

We define Gauss Law: $\Phi_E = \oint_S \vec{E} \cdot d\vec{A} = \frac{Q_{in}}{\varepsilon_0}$

1st of Maxwell Equations

Always valid, but better when there's a symmetry