

Gauss' Law

\vec{A} = Area Vector, always \perp to face

$$I_E = \vec{E} \cdot \vec{A} = EA \cos \theta$$

$$I_E = \int \vec{E} \cdot d\vec{A}$$

$$I_E = \frac{q_{\text{enc}}}{\epsilon_0}$$

$$\lambda = \frac{q}{l}$$

$$I_E = \frac{\lambda l}{\epsilon_0}$$

$$E_{\text{gaussian cylinder}} = \frac{q}{2\pi\epsilon_0 rl} = \frac{\lambda}{2\pi r\epsilon_0}, \text{ from } A = 2\pi rl, \text{ sides of cylinder}$$

$$k = \frac{1}{4\pi\epsilon_0}$$

$$\epsilon_0 = 8.854 \times 10^{-12} \frac{\text{C}^2}{\text{Nm}^2}$$

σ = area charge density

$$\sigma = \frac{q}{A} = \frac{q_{\text{enc}}}{dA}, \text{ units: } \frac{\text{C}}{\text{m}^2}$$

Inside gaussian sphere: $E = \frac{kqr}{R^3}$, little r inside