

Calculating \vec{E} from Gauss' Law: Charged Plane Sheet



- Consider a uniformly charged plane sheet.
- Charge per unit area on sheet: σ (here assumed positive).
- Use Gaussian cylinder with cross-sectional area A placed as shown.

- Electric flux through Gaussian surface: $\Phi_E = \oint \vec{E} \cdot d\vec{A} = 2EA$.

Net charge inside Gaussian surface: $Q_{in} = \sigma A$.

- Gauss' law $\oint \vec{E} \cdot d\vec{A} = \frac{Q_{in}}{\epsilon_0}$ becomes $2EA = \frac{\sigma A}{\epsilon_0}$.

- Electric field at both ends of cylinder: $E = \frac{\sigma}{2\epsilon_0}$
(pointing away from sheet).

- Note that E does not depend on the distance from the sheet.

