Calculating $\vec{E}$ from Gauss's Law: Charged Wire

- Consider a uniformly charged wire of infinite length.
- Charge per unit length on wire: λ (here assumed positive).
- Use a coaxial Gaussian cylinder of radius R and length L.
- Electric flux through Gaussian surface: $\Phi_E = \oint \vec{E} \cdot d\vec{A} = E(2\pi RL)$.
- Net charge charge inside Gaussian surface: $Q_{in} = \lambda L$.
- Gauss's law $\oint \vec{E} \cdot d\vec{A} = \dfrac{Q_{in}}{\epsilon_0}$ becomes $E(2\pi RL) = \dfrac{\lambda L}{\epsilon_0}$.
- Electric field at radius R: $E = \dfrac{1}{2\pi\epsilon_0}\dfrac{\lambda}{R}$.