

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



- Consider a uniformly charged slab.
- Charge per unit volume on slab:  $\rho$ .
- Use Gaussian cylinder as shown.
- Total electric flux:  $\Phi_E = 2|E_z|A$ .

- Net charge inside:  $Q_{in} = \begin{cases} 2\rho A|z| & (|z| \leq a) \\ 2\rho Aa & (|z| \geq a) \end{cases}$

- Gauss's law:  $2|E_z|A = \begin{cases} \frac{2\rho A|z|}{\epsilon_0} & (|z| \leq a) \\ \frac{2\rho Aa}{\epsilon_0} & (|z| \geq a) \end{cases}$

- Electric field:  $E_z = \begin{cases} -\frac{\rho a}{\epsilon_0} & (z \leq -a) \\ \frac{\rho z}{\epsilon_0} & (-a \leq z \leq a) \\ \frac{\rho a}{\epsilon_0} & (z \geq a) \end{cases}$

