Can the electric field be parallel to a surface jump?

\[ E_{||,a} - E_{||,b} = 0 \]

(Electric field on both sides must be the same)

\[
\int \vec{E} \cdot d\vec{l} = \int E_{||,b} \cdot dx - \int E_{||,a} \cdot dx
\]

\[ 0 = \int dx(E_{||,b} - E_{||,a}) \]

\[ E_{||,a} = E_{||,b} \]

\[ E_{\perp,a} - E_{\perp,b} = \frac{\sigma}{\epsilon_0} \]

Use Gauss’s Law:

\[
\int_S \vec{E} \cdot d\vec{a} = \frac{Q_{\text{enclosed}}}{\epsilon_0} = \frac{\sigma A}{\epsilon_0}
\]

\[ A \cdot E_{||,a} - A \cdot E_{||,b} = \frac{\sigma A}{\epsilon_0} \]
\[ \int_b^a = \int_{-\epsilon}^0 E_{b,\perp} \, dx + \int_0^\epsilon E_{a,\perp} \, dx \]
\[ = E_{b,\perp} \int_{-\epsilon}^0 \, dx + E_{a,\perp} \int_0^\epsilon \, dx \]
\[ = -E_{b,\perp} \int_{-\epsilon}^0 \, dx + E_{a,\perp} \int_0^\epsilon \, dx \]
\[ \Delta V = \epsilon (E_a - E_b) \to 0 \]

How do you get electric field discontinuities?

# of lines indicate strength (field lines begin & end on charges)

**Conductors**

Perfect conductors: charges move freely and instantaneously

\[ \vec{E} = 0 \quad \text{inside} \]
\[ \rho = 0 \quad \text{inside} \]

net charge is on surface (conductor is equipotential)

\( \vec{E} \) at surface?
perpendicular b/c we just showed that

\[ E_{\text{all}} - E_{\text{bll}} = 0 \], and \( E_{\text{bll}} = 0 \)

\[ \oint S \vec{E} \cdot d\vec{a} = \frac{q}{\varepsilon_0} \]

- Conductor will let you know that there’s a charge inside, but nothing else
- How a faraday cage works