Boundary Conditions on Electric Fields at Surfaces

We would like to examine how the components of an electric field change as it crosses a charged surface (with surface charge density σ). Use one of the integral forms of Maxwell's equations, either

$$\oint \vec{\boldsymbol{E}} \cdot d\vec{\boldsymbol{r}} = 0$$

around a "small" rectangular loop or

$$\int \vec{\boldsymbol{E}} \cdot d\vec{\boldsymbol{A}} = \frac{1}{\epsilon_0} Q_{\text{enc}}$$

over a "small" box to find the discontinuity in the component of the field assigned to your group. You will have to decide which law to use and how to orient your loop or box depending on the physics of the problem.

If you get done with the first example, go on to the second.

Odd numbered groups:

Find the discontinuity in $E_\perp$, the component of the electric field perpendicular to the surface.

Even numbered groups:

Find the discontinuity in $E_\parallel$, the component of the electric field parallel to the surface.

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