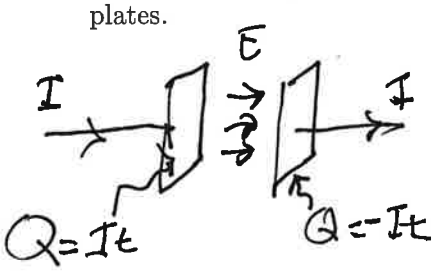
PHYS 334 Electromagnetic Theory II

In Class Exercise 2 — January 19, 2024 **Name:** Solutions

1. For charging parallel circular plates, with $Q(t) = \pm It$, find (a) the electric field in between the plates, and (b) find the integral of $\int \frac{\partial \mathbf{E}}{\partial t} \cdot d\mathrm{a}$ over a surface that sits in between the two plates.



$E_{plane} = \frac{\sigma}{2\varepsilon_0} = \frac{Q/A}{2\varepsilon_0}$ toward if $\sigma<0$ away if $\sigma>0$

In between both plates contribute an $\vec{E}$ to the right, so they combine to be

(a) $E = \frac{\sigma}{\varepsilon_0} = \frac{Q}{\varepsilon_0 A} = \frac{It}{\varepsilon_0 A} \rightarrow$

(b) $\int_S \frac{\partial \vec{E}}{\partial t} \cdot d\vec{a} = \int_S \frac{I}{\varepsilon_0 A} da = \frac{I}{\varepsilon_0}$

2. Given the definition $\mathbf{D} = \epsilon_0 \mathbf{E} + \mathbf{P}$, show that Gauss's law can be written as $\nabla \cdot \mathbf{D} = \rho_f$.

next class