Solid ball of charge, radius R, with volume charge density ρ = const. Find electric field everywhere.

Gauss' Law

$$\oint\!\!\oint_S \vec{E}\cdot d\vec{a} = \frac{Q_{enc}}{\epsilon_0}$$

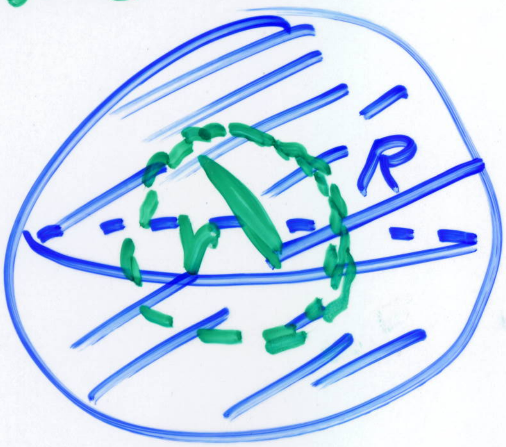
<u>outside $r>R$</u>

$$E(r)\,4\pi r^2 = \frac{\rho \frac{4}{3}\pi R^3}{\epsilon_0}$$

$$E(r) = \frac{\rho \frac{4}{3}\pi R^3}{4\pi\epsilon_0 \, r^2} \sim \frac{1}{r^2}$$

$$\vec{E}(r) = \frac{\rho R^3 \hat{e}_r}{3\epsilon_0 r^2}$$

inside $r<R$

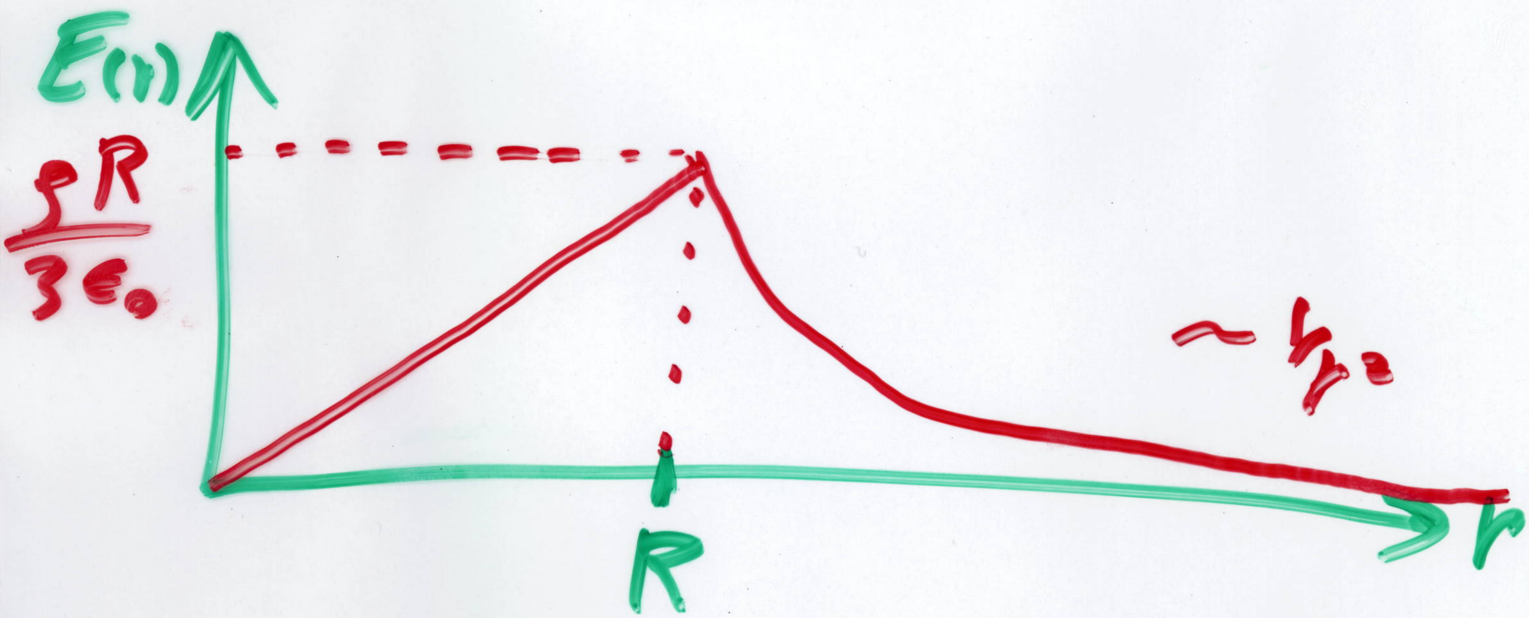


Gauss' Law

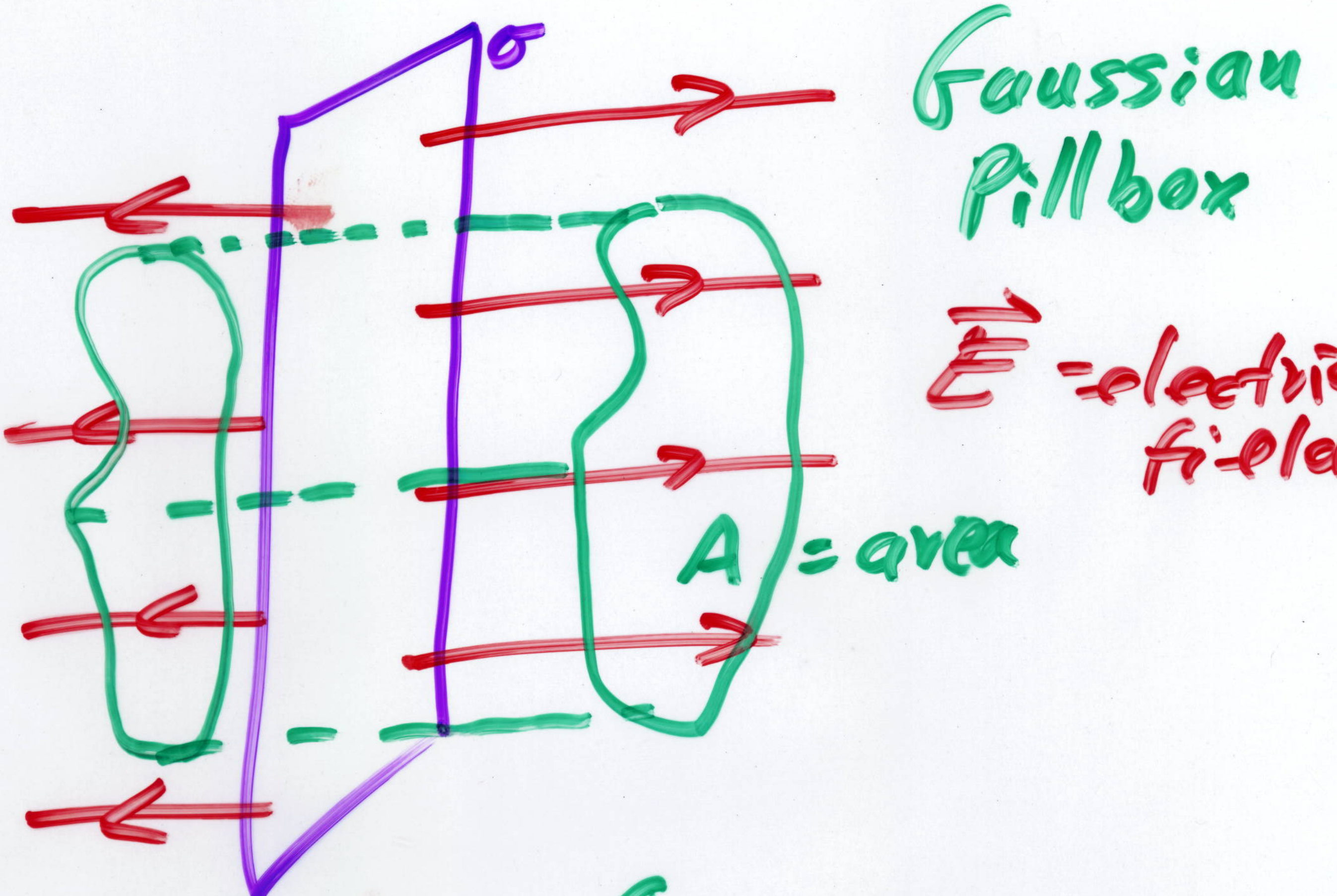
$$\oint_S \vec{E}\cdot d\vec{a} = \frac{Q_{enc}}{\epsilon_0}$$

$$E(r)\, 4\pi r^2 = \frac{\rho \frac{4}{3}\pi r^3}{\epsilon_0}$$

$$E(r) = \frac{\rho r}{3\epsilon_0} \sim r$$



Infinite plane with constant surface charge density σ.

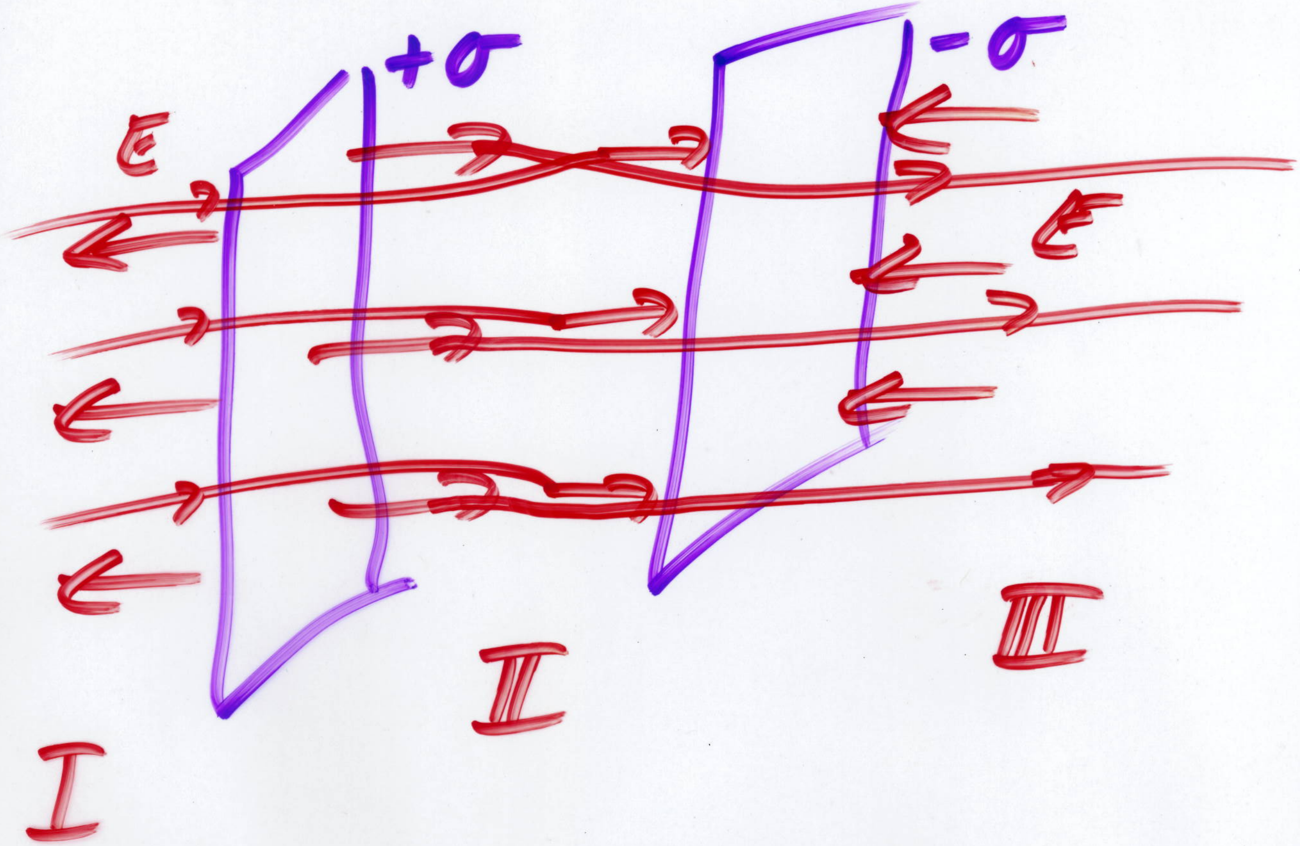


$$\oint\!\!\oint_S \vec{E}\cdot d\vec{a} = \frac{Q_{enc}}{\epsilon_0}$$

on endcaps $\vec{E}$ is parallel to $d\vec{a}$

on lateral area $\vec{E}$ is $\perp$ to $d\vec{a}$

$$2E\cancel{A} = \frac{\sigma \cancel{A}}{\epsilon_0} \Rightarrow E = \frac{\sigma}{2\epsilon_0}$$



$$E_I = 0 \qquad \vec{E}_{II} = 2\frac{\sigma}{2\epsilon_0} \quad \& \quad E_{III} = 0$$

$$= \frac{\sigma}{\epsilon_0} \text{ to the right}$$