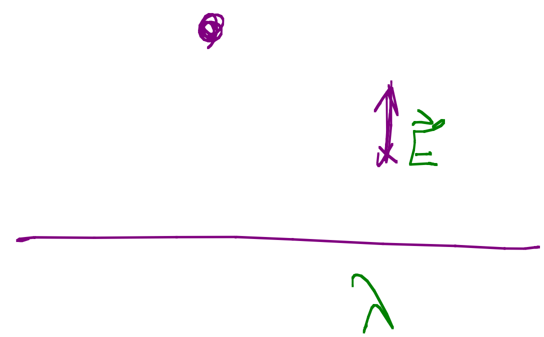
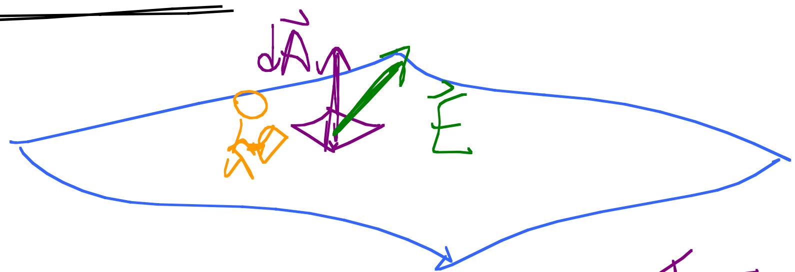
Note Title 9/7/2012

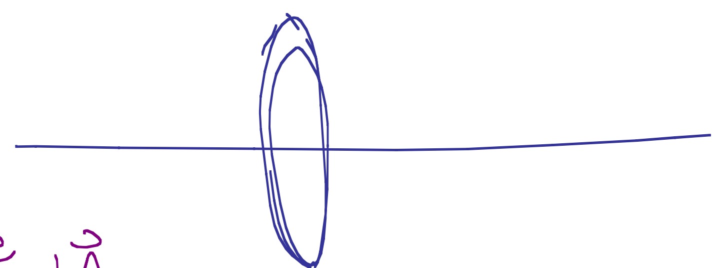
Phys 2120-4 9/7/12

$\vec{E}$ $\qquad$ $\vec{F} = q\vec{E}$



Ch 21 Gauss's's's Law

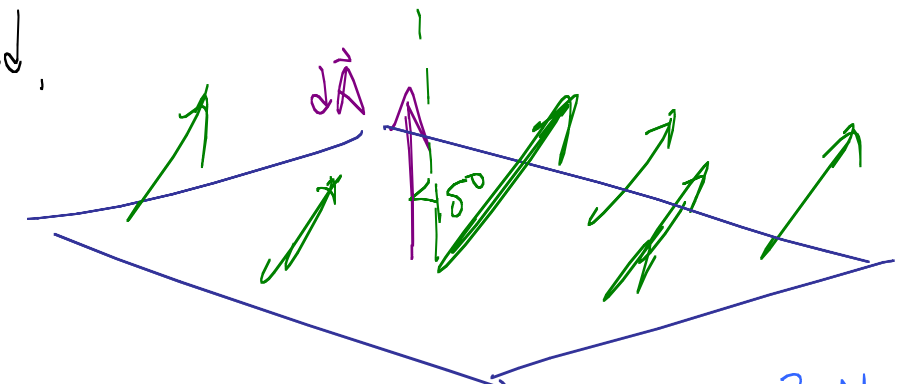




$$\Phi = \int \vec{E} \cdot d\vec{A}$$

21.20 Flat surface w/ area 2.0 m^2 in a uniform 850 N/C E-field. Find elec. flux thru surface when it's

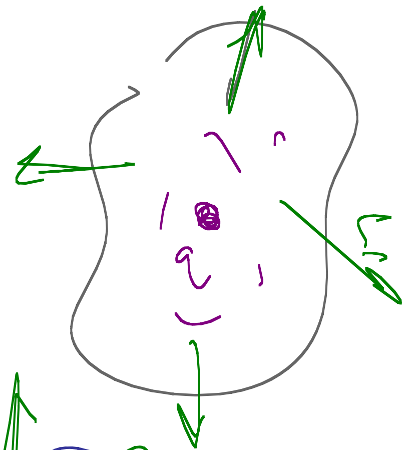
b) at 45° to the field.



$$\Phi = \int \vec{E} \cdot d\vec{A}$$

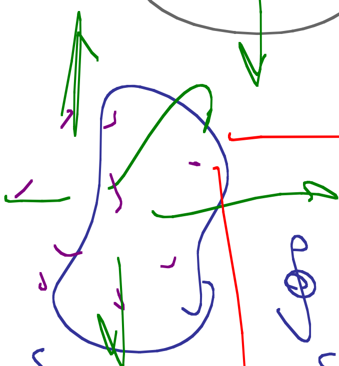
$$= EA \cos 45°$$

$$= \left(850 \tfrac{N}{C}\right)\left(2.0\,m^2\right)\tfrac{1}{\sqrt{2}} = 1.2 \times 10^3 \tfrac{N}{C} m^2$$



$$\oint \vec{E} \cdot d\vec{A}$$

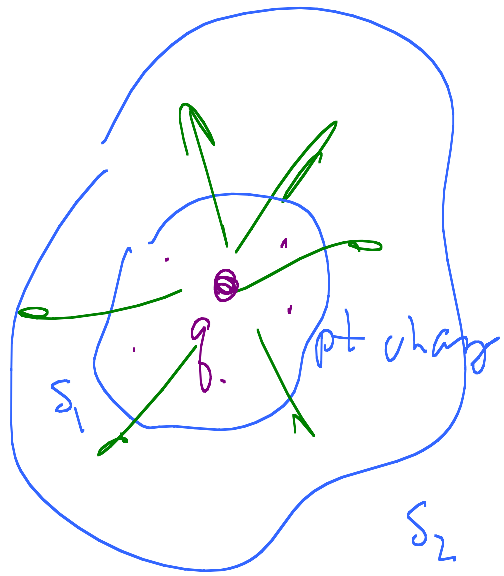
closed surface



Gauss's

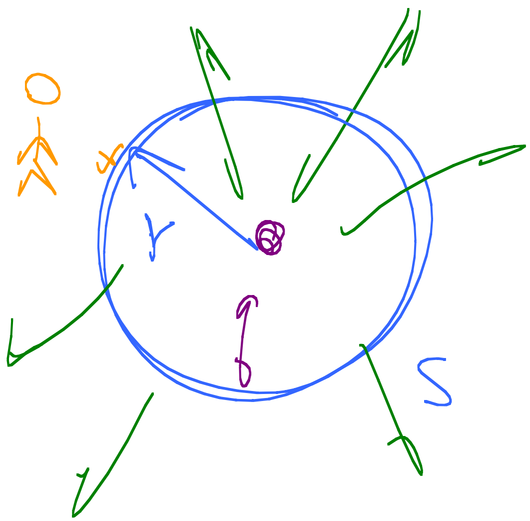
$$\boxed{\oint_S \vec{E} \cdot d\vec{A} = \frac{q_{encl}}{\epsilon_0}}$$

$$k = \frac{1}{4\pi\epsilon_0}$$



$$\int_S \vec{E} \cdot dA = q/\epsilon_0$$

S encl's q



$$\int \vec{E} \cdot d\vec{A} = q/\epsilon_0$$

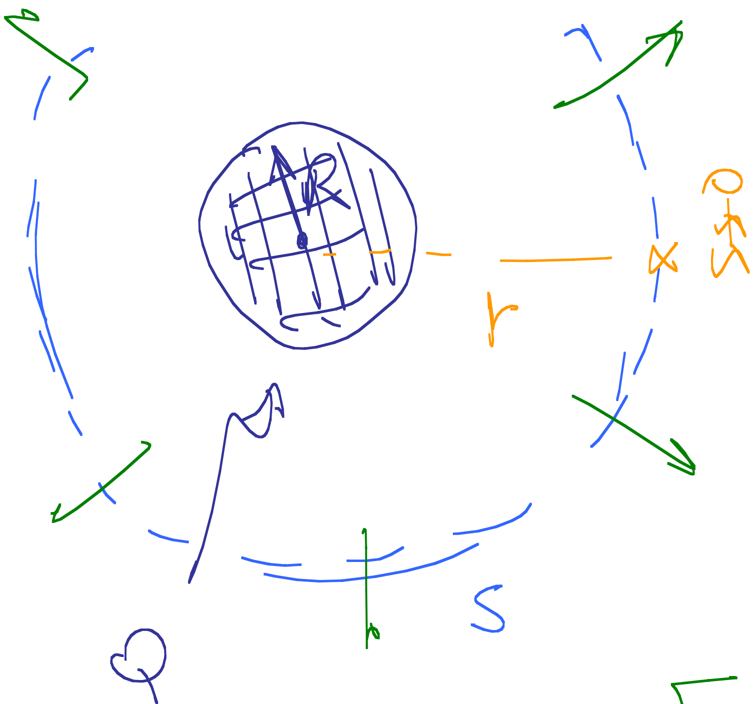
$$\underbrace{E_r A}_{\text{symmetry}} = q/\epsilon_0$$

$$E_r 4\pi r^2 = q/\epsilon_0$$

$$E_r = \frac{q}{4\pi\epsilon_0 r^2}$$

$$= k\, q/r^2$$

$$k = \frac{1}{4\pi\epsilon_0} \qquad \epsilon_0 = \frac{1}{4\pi k}$$



Solid ball of charge R, Q

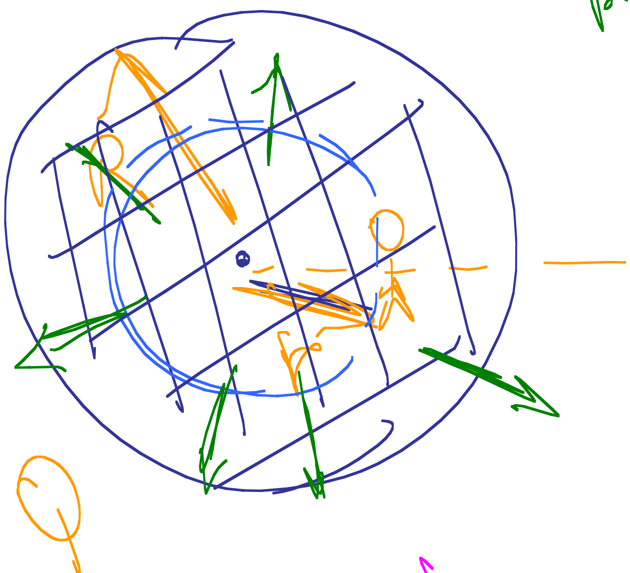
$$\rho = \frac{Q}{\frac{4}{3}\pi R^3}$$

$$\int \vec{E} \cdot d\vec{A} = E_r 4\pi r^2 = Q/\epsilon_0$$

$$E_r = \frac{Q}{4\pi\epsilon_0 r^2} = k\, Q/r^2$$

same as for point charge

p 357 - 358



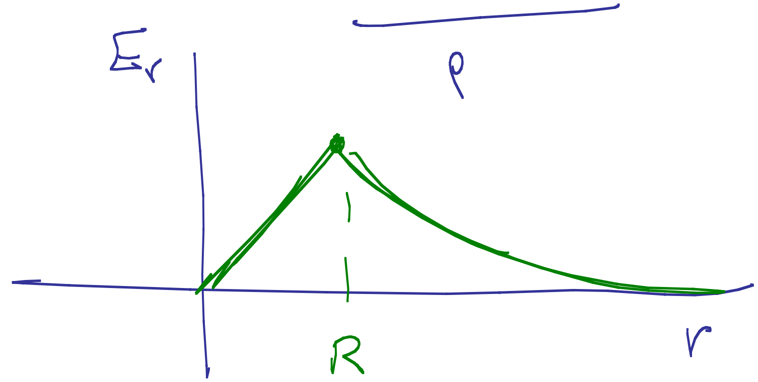
$$\int \vec{E}\cdot d\vec{A} = E_r 4\pi r^2$$

$$= q_{enc}/\epsilon_0 = \frac{1}{\epsilon_0}\frac{Q}{\cancel{\tfrac{4}{3}\pi} R^3}\cdot \cancel{\tfrac{4}{3}\pi} r^3$$

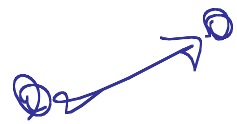
$$E_r 4\pi \cancel{r^2} = \frac{Q\,\cancel{r^3}}{\epsilon_0 R^3}$$

$$E_r = \frac{Q r}{4\pi\epsilon_0 R^3}$$

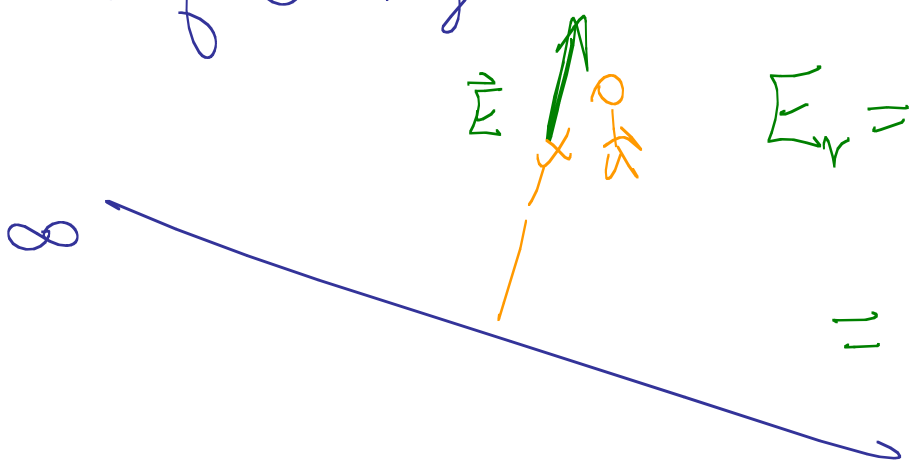
ρ



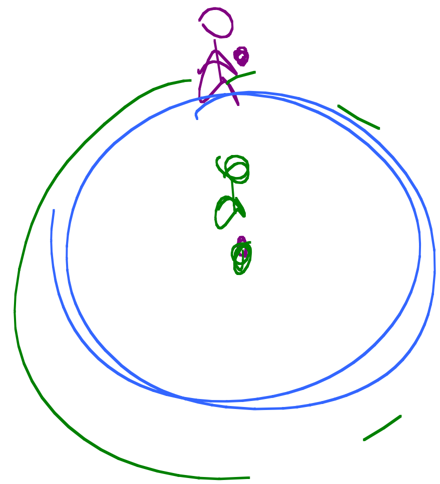
$$F = G\frac{m_1 m_2}{r^2}$$



Line of charge



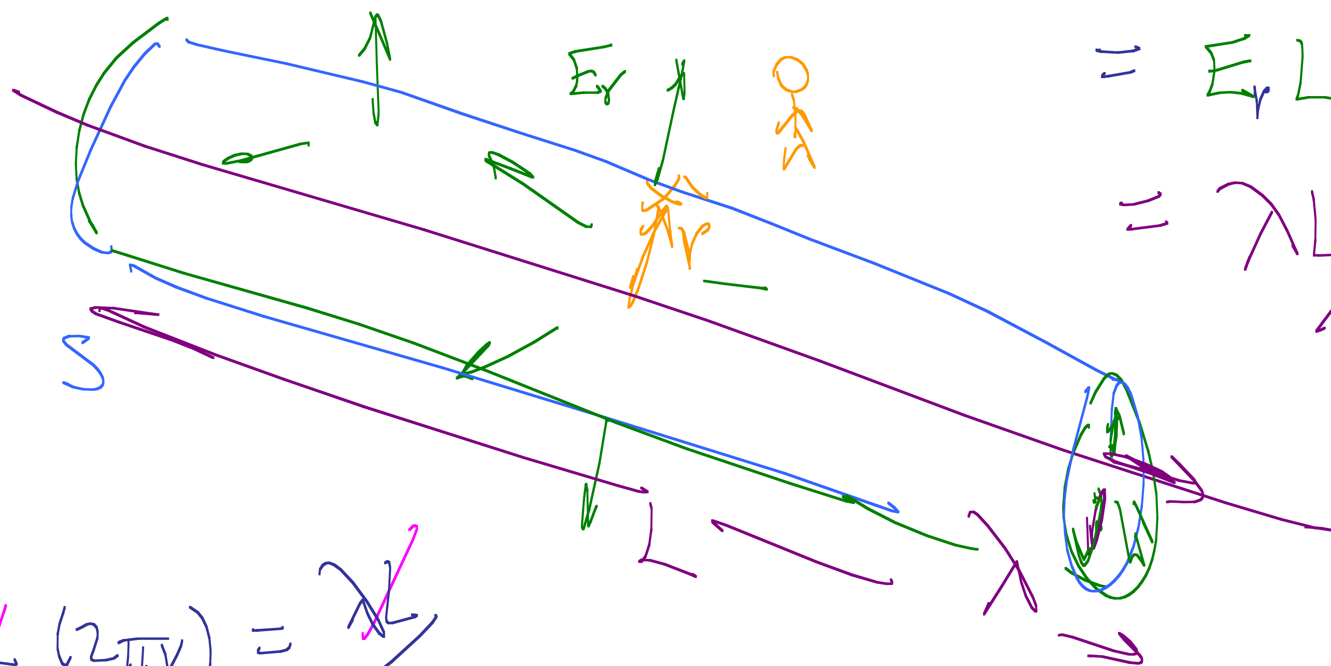
$$E_r = \frac{2k\lambda}{r} = \frac{\lambda}{2\pi\epsilon_0 r}$$



p. 342

Gauss's Law:

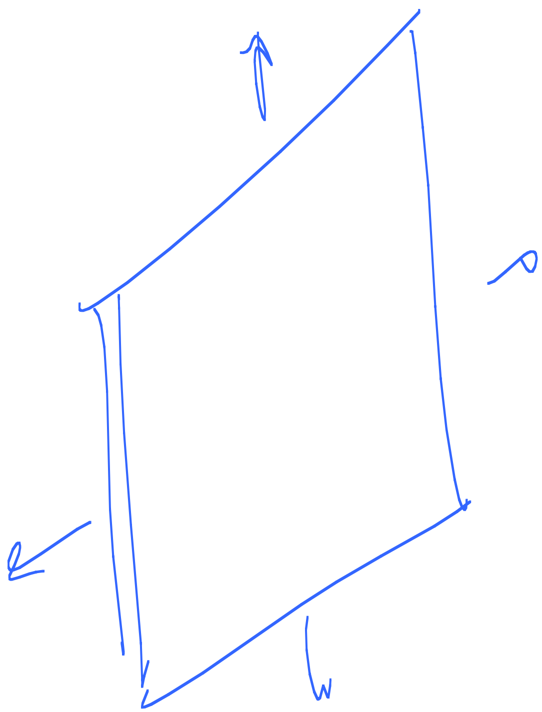
$$\oint \vec{E}\cdot d\vec{A} = E_r L(2\pi r) = \lambda L/\epsilon_0 = q_{encl}/\epsilon_0$$



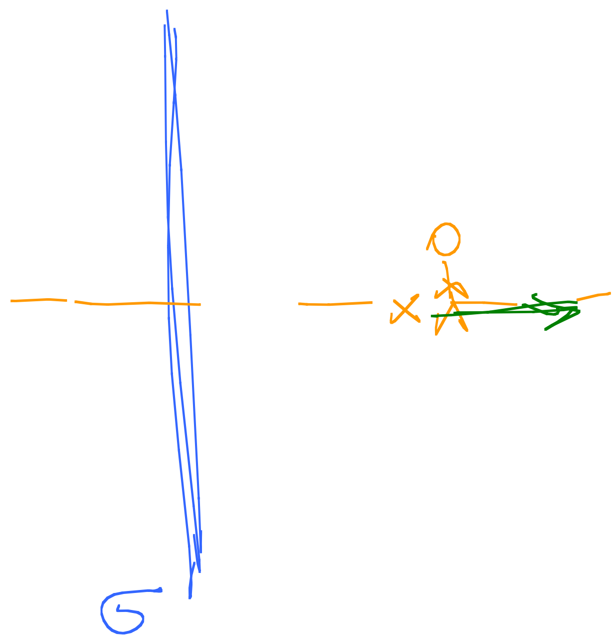
$$E_r \cancel{L}(2\pi r) = \lambda \cancel{L}/\epsilon_0$$

$$E_r = \frac{\lambda}{2\pi\epsilon_0 r}$$

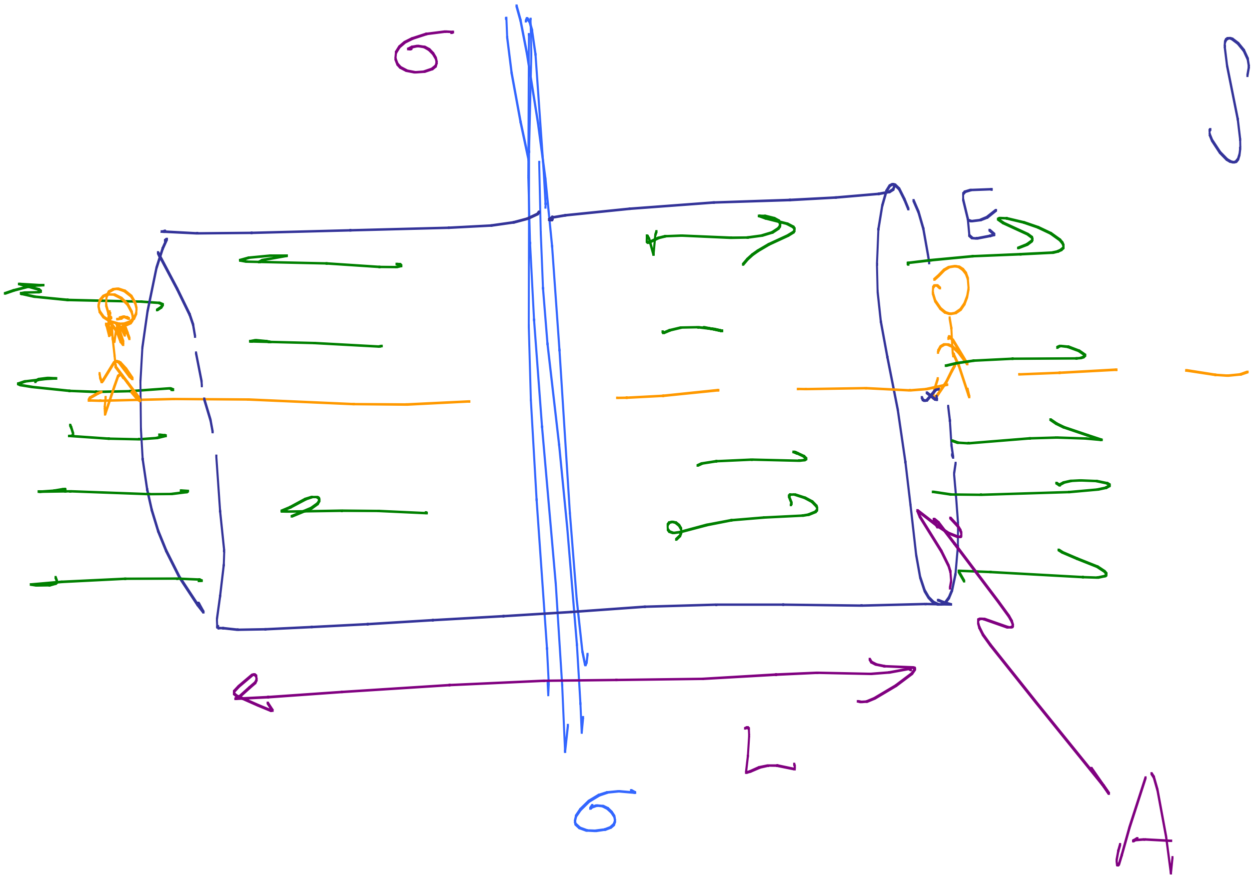
Sheet of charge, ∞



Charge density $= \sigma$ $\left(C/m^2\right)$



What is E field at your location

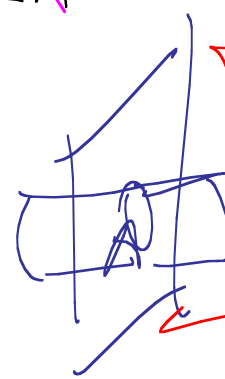


$\int \vec{E}\cdot d\vec{A} =$ on ends

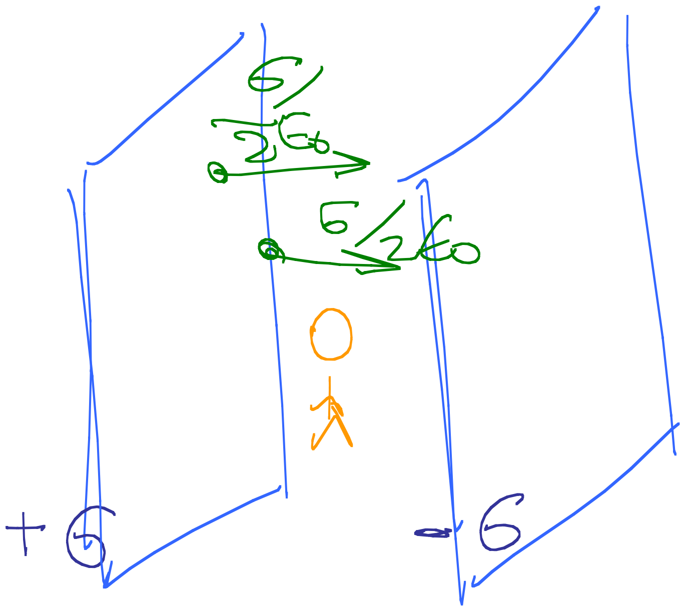
$= 2EA$

$= q_{encl}/\epsilon_0 = \sigma A/\epsilon_0$

$2E\cancel{A} = \sigma\cancel{A}/\epsilon_0$



$$\boxed{E_{sheet} = \frac{\sigma}{2\epsilon_0}}$$



Field measured by man

$$= \boxed{E = \sigma/\epsilon_0}$$