

Phys 2120-4 9/7/12

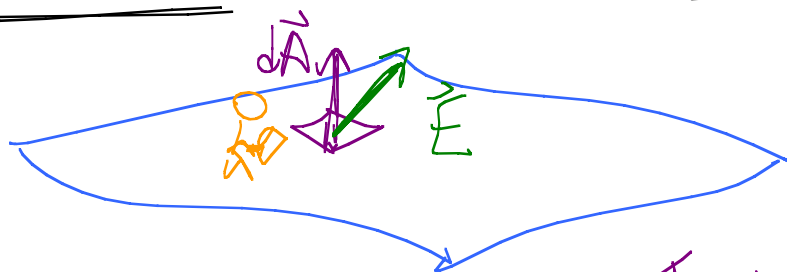
Note Title

9/7/2012

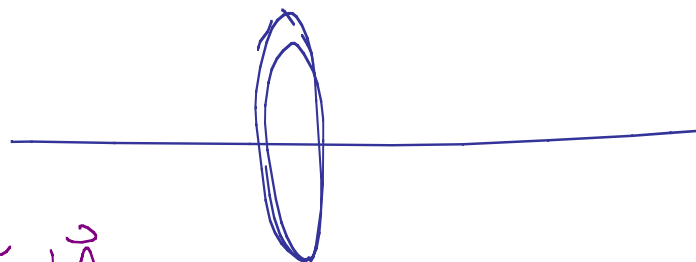
$$\vec{E} \quad \vec{F} = q\vec{E}$$



Ch 21 Gauss's's's Law



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



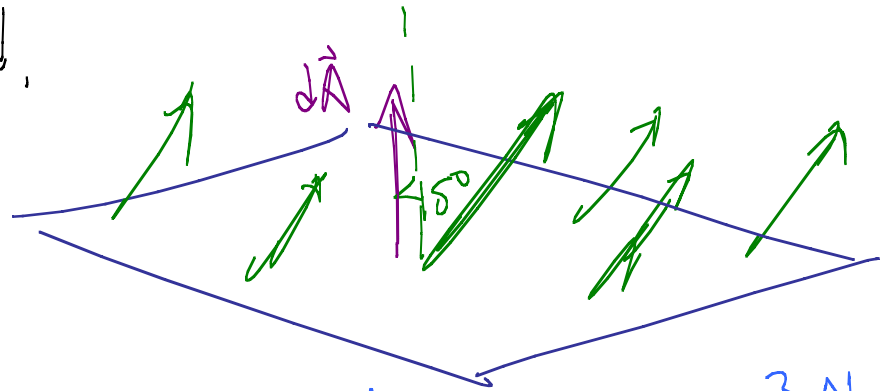
21.20 Flat surface w/ area 2.0 m^2 in a uniform 850 N/C E-field. Find elec. flux thru surface when it's

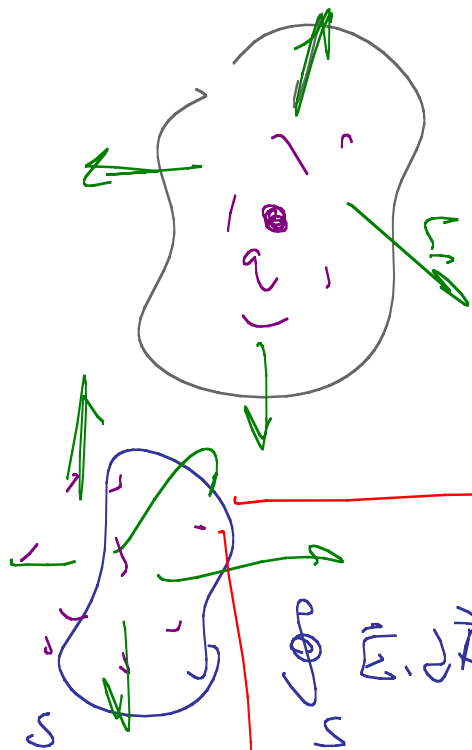
b) at 45° to the field.

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

$$= EA \cos 45^\circ$$

$$= (850 \text{ N/C})(2.0 \text{ m}^2) \frac{1}{\sqrt{2}} = 1.2 \times 10^3 \text{ N/C m}^2$$

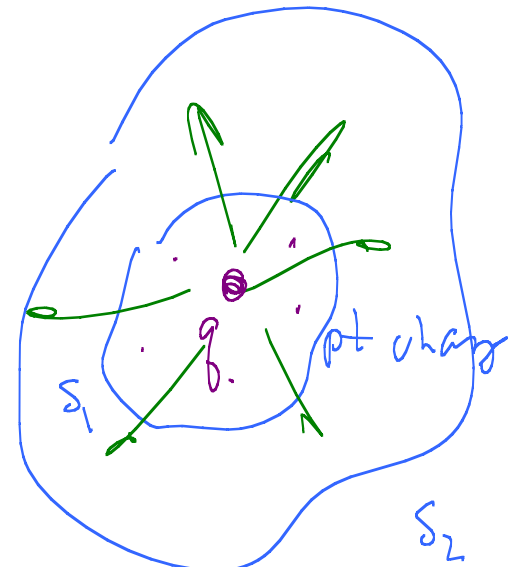




$$k = \frac{1}{4\pi\epsilon_0}$$

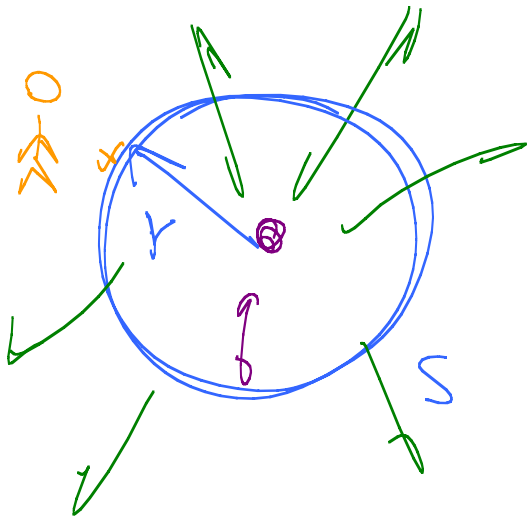
$\oint \vec{E} \cdot d\vec{A}$
closed
surface

Gauss's's's's



$$\int_S \vec{E} \cdot d\vec{A} = \frac{q}{\epsilon_0}$$

S encloses
 q



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

$$\underline{\underline{E_r A = q/\epsilon_0}}$$

Symmetry

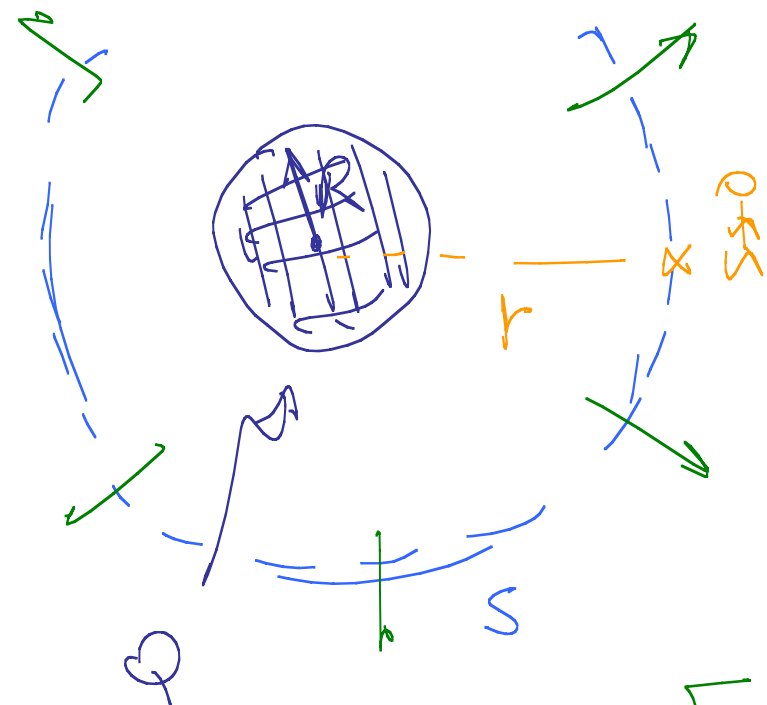
$$E_r 4\pi r^2 = q/\epsilon_0$$

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

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

$$G_0 = \frac{1}{4\pi k}$$

$$= k \frac{q}{r^2}$$



Solid ball of charge R, Q

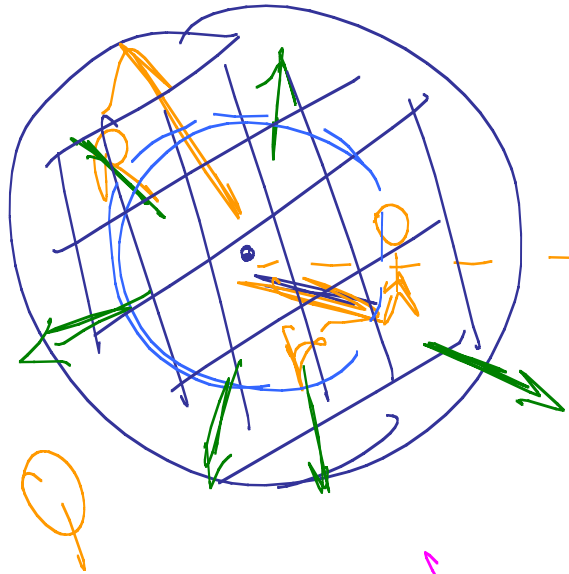
$$\rho = \frac{Q}{\frac{4}{3}\pi R^3}$$

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

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

same as for
point charge

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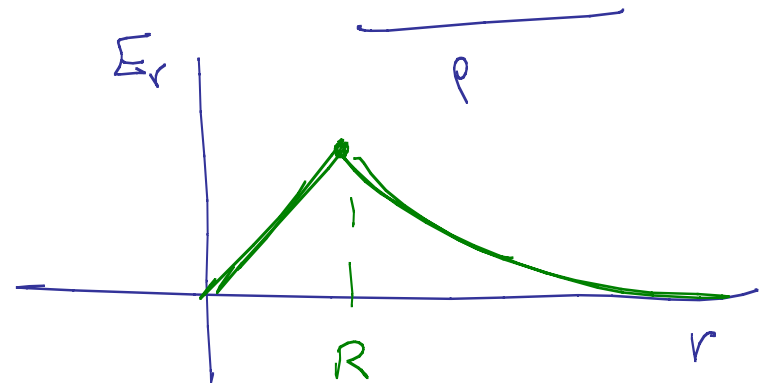


$$\int \vec{E} \cdot d\vec{A} = E_r 4\pi r^2$$

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

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

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



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

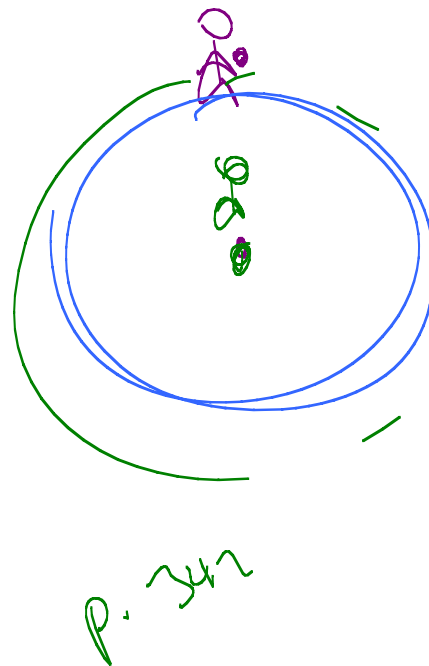


Line of charge



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

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

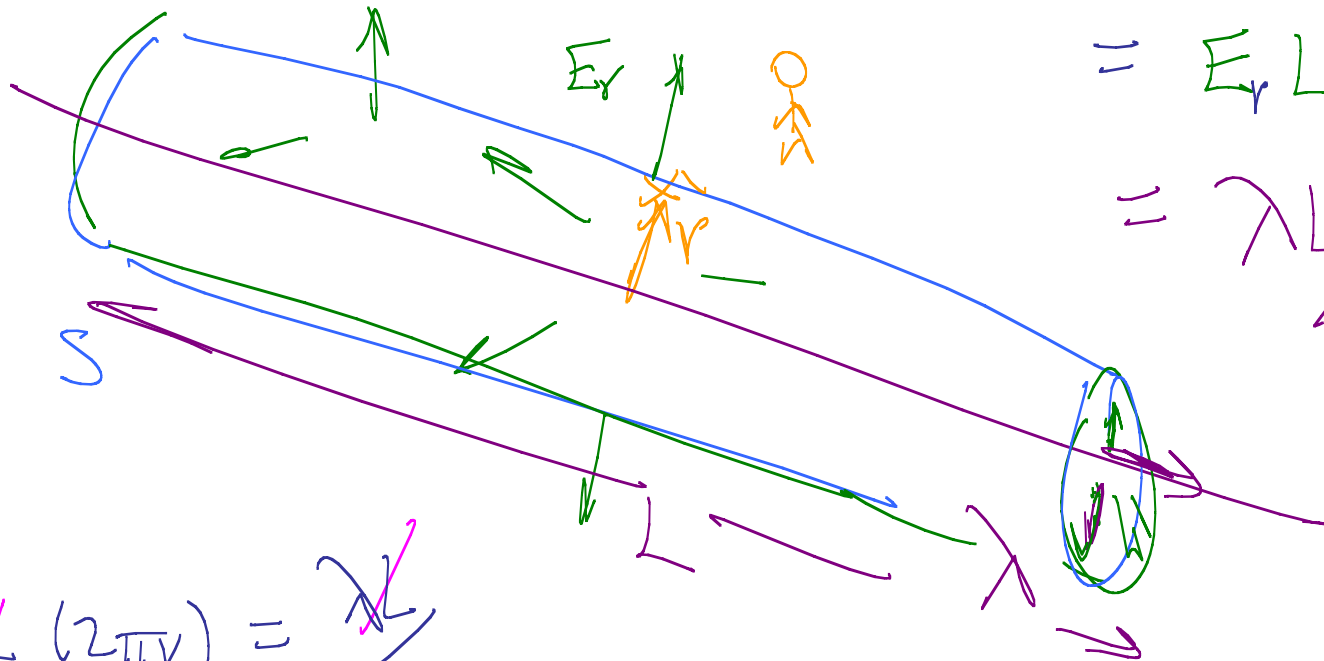


Gauss's Law:

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

$$= E_r L (2\pi r)$$

$$= \lambda L / \epsilon_0 = \text{Encl} / \epsilon_0$$

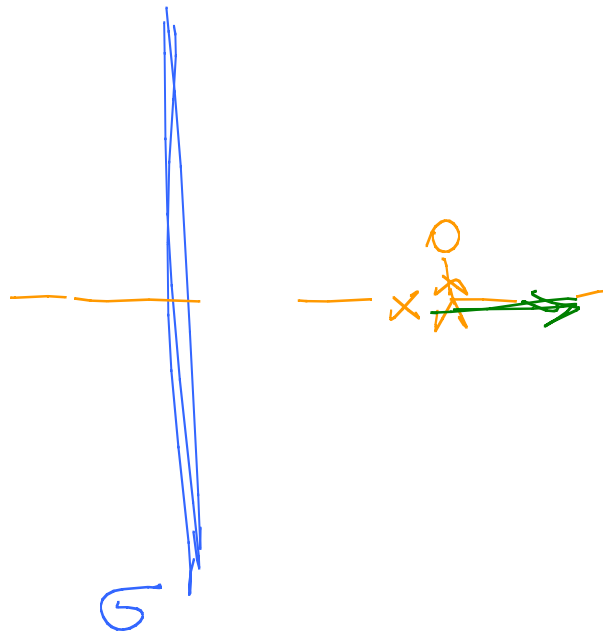
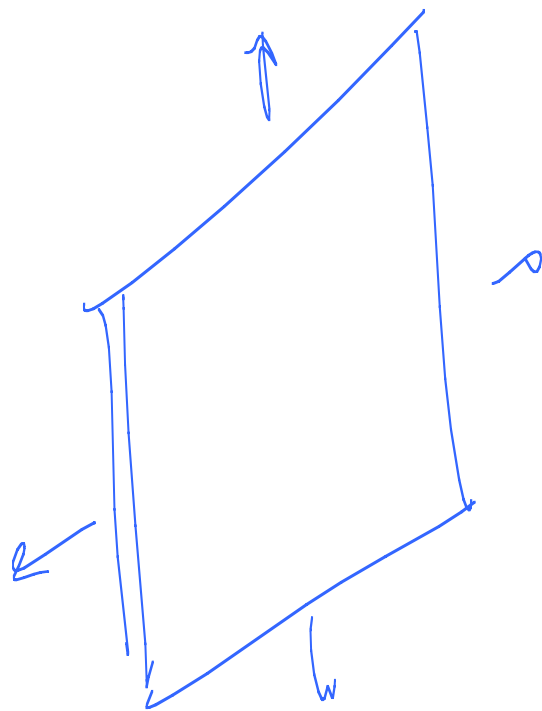


$$E_r L (2\pi r) = \lambda L / \epsilon_0$$

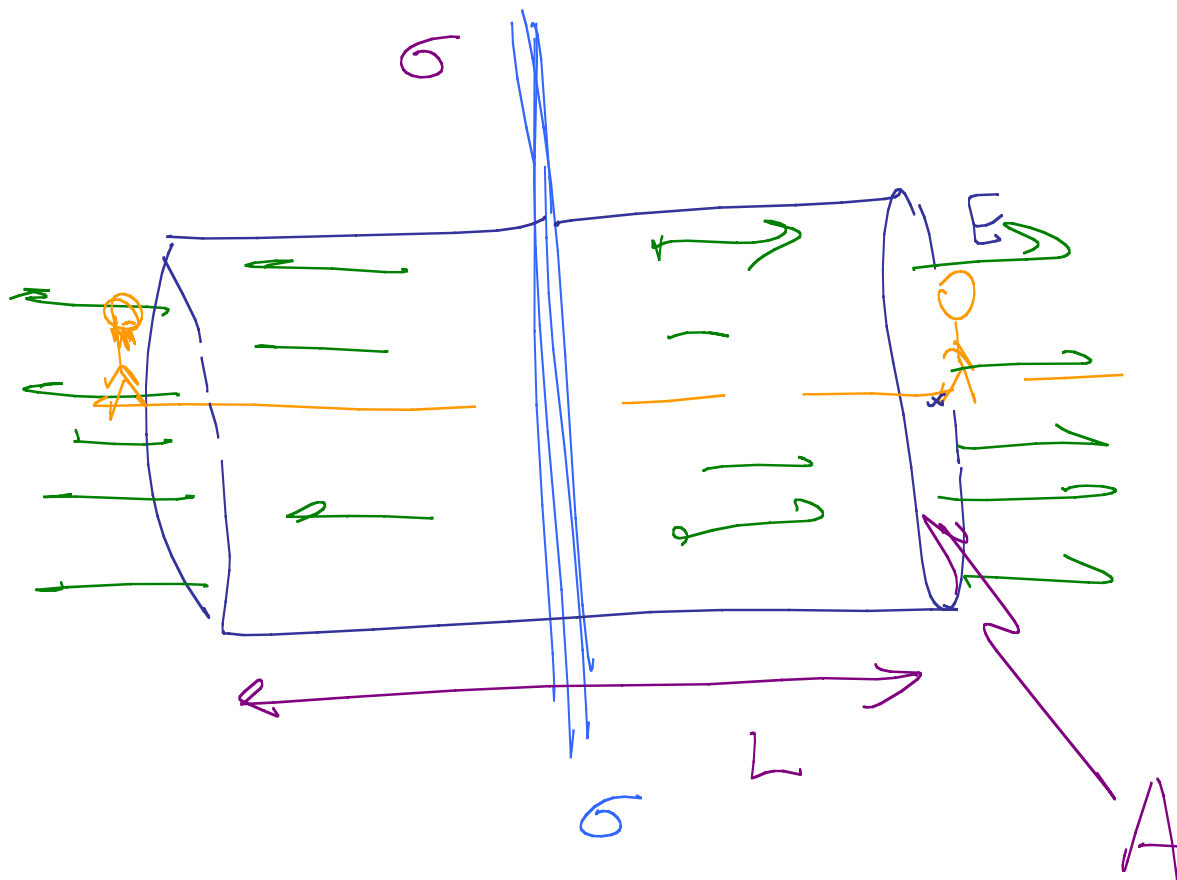
$$E_r = \frac{\lambda}{2\pi \epsilon_0 r}$$

Sheet of charge, ∞

Charge density = σ (C/m^2)



What is E field
at your
location



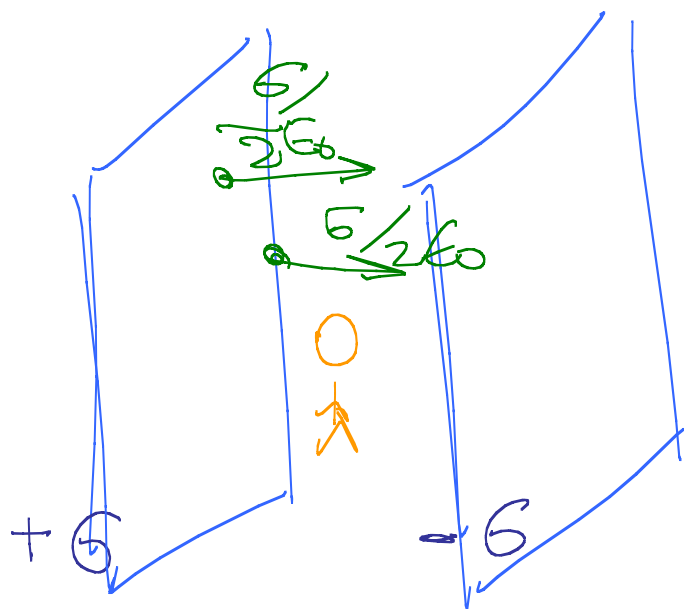
$$\int \vec{E} \cdot d\vec{A} = \text{on ends}$$

$$= 2EA$$

$$= q_{\text{enc}} / \epsilon_0 = \sigma A / \epsilon_0$$

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

A small diagram shows a portion of the cylindrical Gaussian surface, with a cross-section labeled 'A'. To its right, a red-bordered box contains the equation $E = \frac{\sigma}{2\epsilon_0}$, with the word 'show' written in red below the fraction.



Field measured by man

$$E = \frac{\sigma}{\epsilon_0}$$