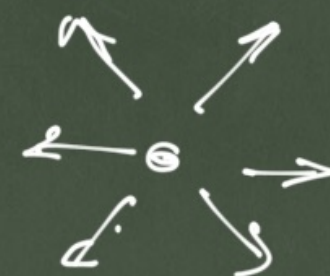
$$q \longleftrightarrow Q \qquad \vec{F} = k_e \frac{Qq}{r^2}$$

$$\vec{E} = \frac{\vec{F}}{q} = k_e \frac{Q}{r^2}$$



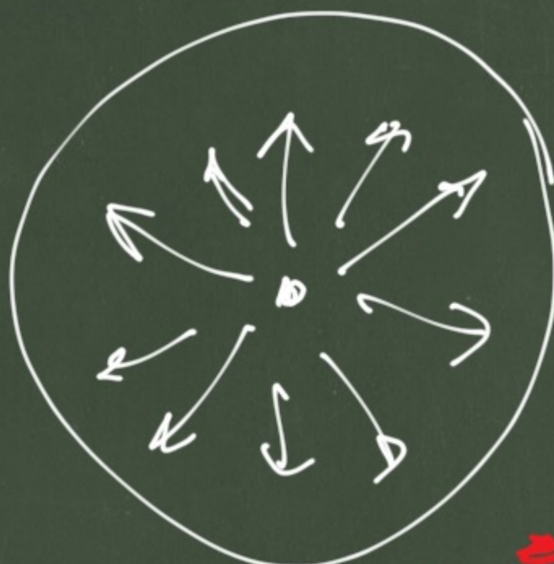
$$dq \longrightarrow d\vec{E}$$

$$\Sigma \longrightarrow \vec{E}_{TOT}$$

SOVRAPPOSIZIONE

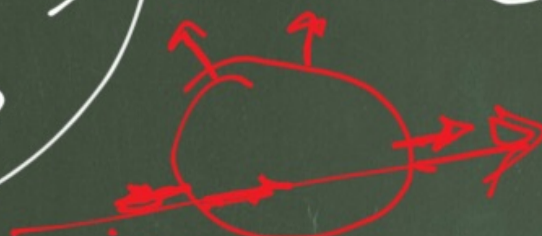
LEGGE DI GAUSS

I eq. Maxwell



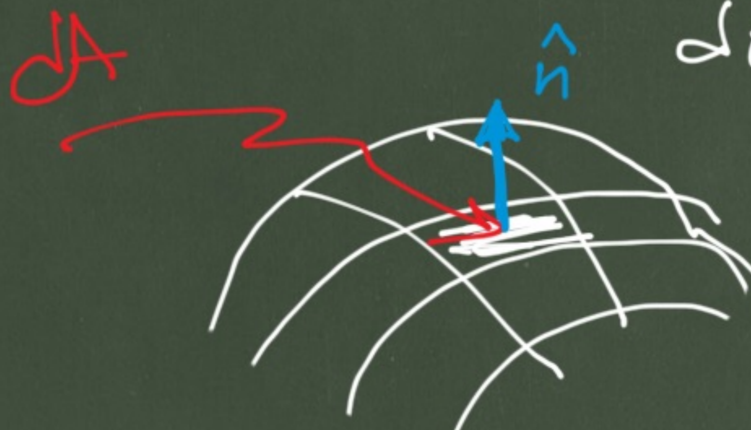
1. sup. chiusa
2. $\propto$ int.

sorgente



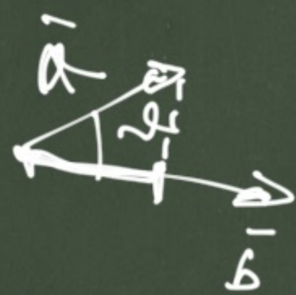
$$\oint_{S} E \cdot d\vec{A} = \frac{Q_V}{\varepsilon_0}$$

$$d\vec{A} = \hat{n}\, dA$$



S gaussiana

$$\bar{E}\cdot d\bar{A} = \bar{E}\cdot\hat{n}\,dA$$



$$\bar{a}\cdot\bar{b} = a_x b_x + a_y b_y + a_z b_z$$

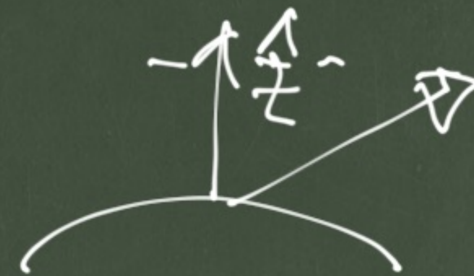
$$\stackrel{!}{=} |a||b| \cos\vartheta$$

$\bar{E}\cdot\hat{n} > 0$

$\bar{E}\cdot\hat{n} = 0$

$\bar{E}\cdot\hat{n} < 0$

$$\hat{n} = (n_x, n_y, n_z) = \hat{z}$$

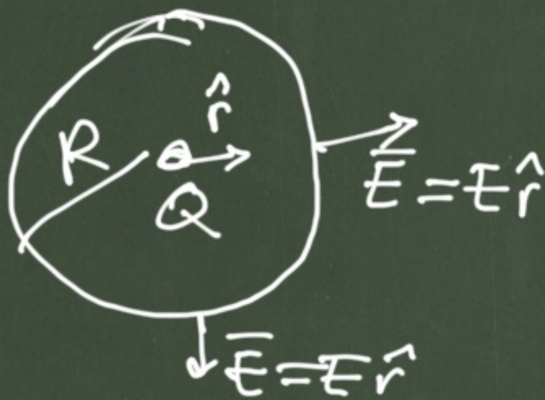


$$n_x^2 + n_y^2 + n_z^2 = 1$$

$$\vec{E}\cdot d\vec{A} = dA\,(E_x, E_y, E_z)\cdot(0, 0, 1)$$

$$= E_z\, dA$$

$$\oint_S \vec{E}\cdot d\vec{A} = \oint_S E_z\, dA = \oint_S E_z\, dx\, dy$$



$$\bar{E} = E\hat{r}$$

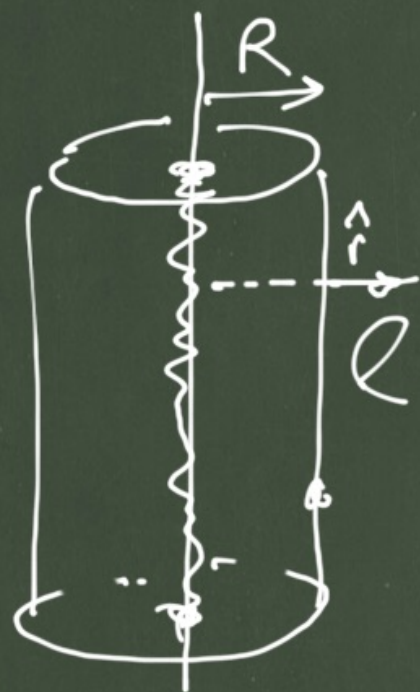
$$\oint_S \bar{E}\cdot d\bar{A} = \oint_S E\hat{r}\cdot\hat{r}\, dA = \oint_S E\, dA = E\underbrace{\oint_S dA}_{4\pi R^2}$$

$$\frac{Q}{\varepsilon_0}$$

$$E\,4\pi R^2 = \frac{Q}{\varepsilon_0}$$

$$\bar{E} = \hat{r}\frac{Q}{4\pi\varepsilon_0 R^2} = \hat{r}\frac{k_e Q}{r^2}$$

CARICA PUNT



$$\frac{Q}{\varepsilon_0} = \frac{\lambda \ell}{\varepsilon_0}$$

$$\vec{E} = E\,\hat{r}$$

$$\oint_S \vec{E}\cdot d\vec{A} = \oint_S E\,\hat{r}\cdot\hat{r}\,dA = \oint E\,dA$$

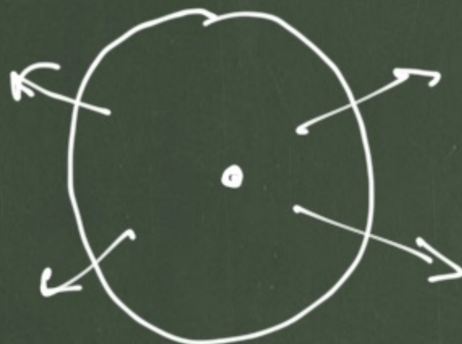
$$E\oint dA = E\,2\pi R \ell$$

$$= \frac{\lambda \cancel{\ell}}{\varepsilon_0}$$

FILO

$$E \, 2\pi R l = \frac{\lambda l}{\varepsilon_0}$$

$$\bar{E} = \hat{r} \, \frac{\lambda \cancel{l}}{2\pi R \cancel{l} \varepsilon_0} = \hat{r} \, \frac{2k_e \lambda}{r}$$



$$E\, 2\pi r = \frac{Q}{\varepsilon_0}$$

$$E = \frac{Q}{2\pi \varepsilon_0 r} = \frac{2 k_e Q}{r}$$

Cerca in 2D

~ filo ---

SFERA
PIENA

$$E\,4\pi r^2 = \frac{1}{\varepsilon_0}\oint_V \rho\, dV$$

$$= \frac{\rho_0}{\varepsilon_0}\oint_V dV$$

$\rho = \rho_0$

* $E\,4\pi r^2 = \frac{Q}{\varepsilon_0} \rightarrow E = \frac{k_e Q}{r^2}$

* $E\,4\pi r^2 = \frac{\rho_0}{\varepsilon_0}\oint_V dV = \frac{\rho_0}{\varepsilon_0}\frac{4\pi r^3}{3}$

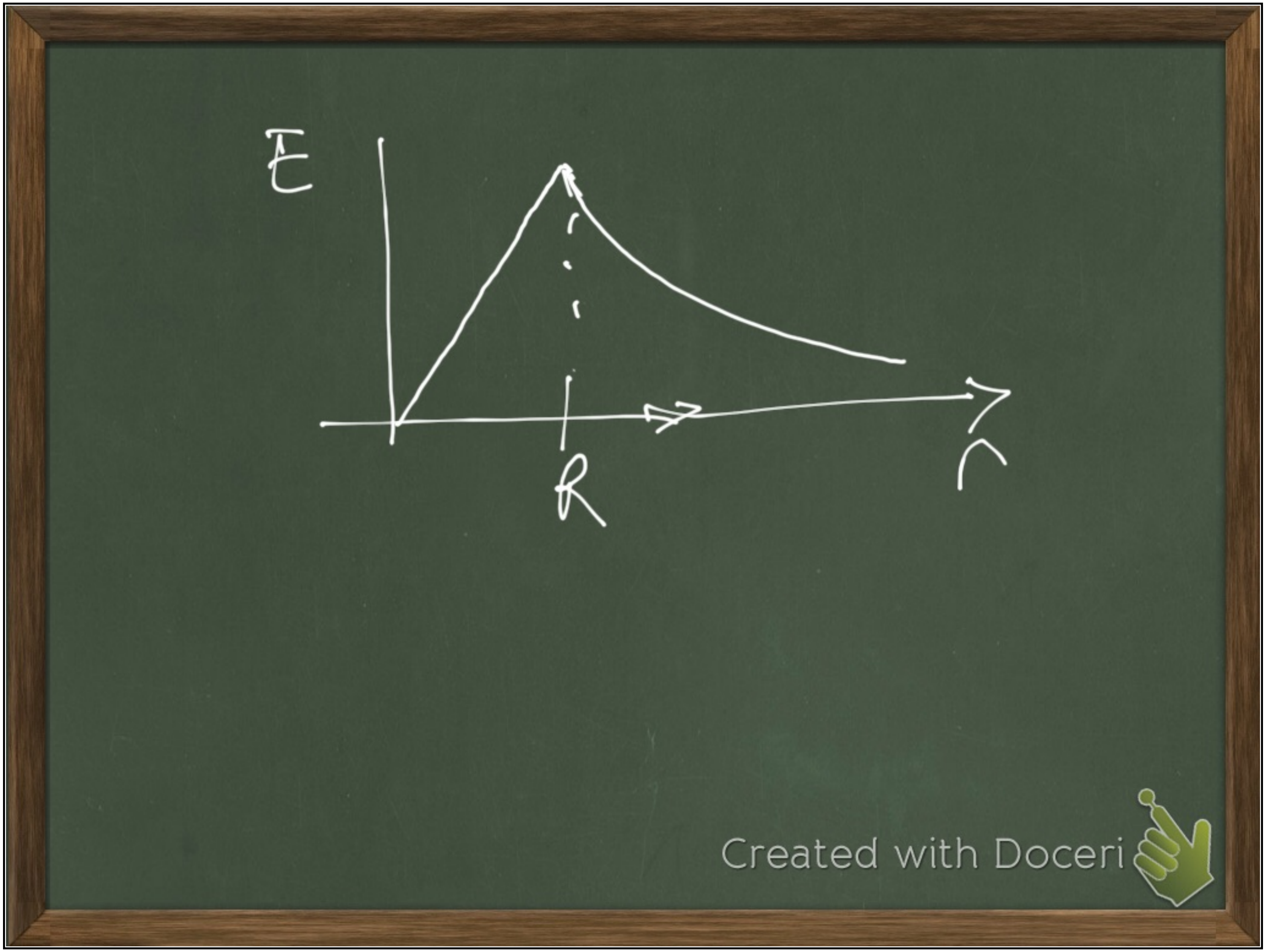
ε_0

$$\ast.\quad E\,4\pi r^2 = \frac{\rho_0}{\varepsilon_0}\oint_V dV = \frac{\rho_0}{\varepsilon_0}\,\frac{4\pi r^3}{3}$$

$$= \frac{\rho_0}{\varepsilon_0}\,\frac{4\pi R^3}{3}\,\frac{\cancel{3}}{4\pi R^3}\times\frac{4\pi r^3}{\cancel{3}}$$

$$= \frac{Q}{\varepsilon_0}\left(\frac{r}{R}\right)^3$$

$$E = \frac{Q\,r}{4\pi\varepsilon_0 R^3}$$


E
R
r
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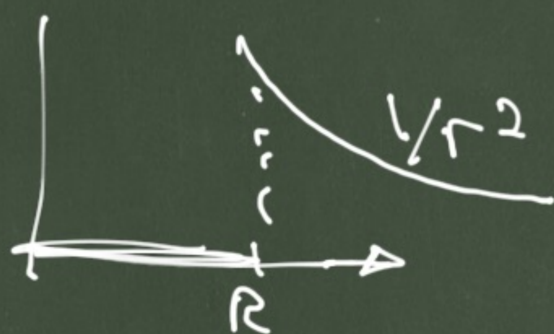
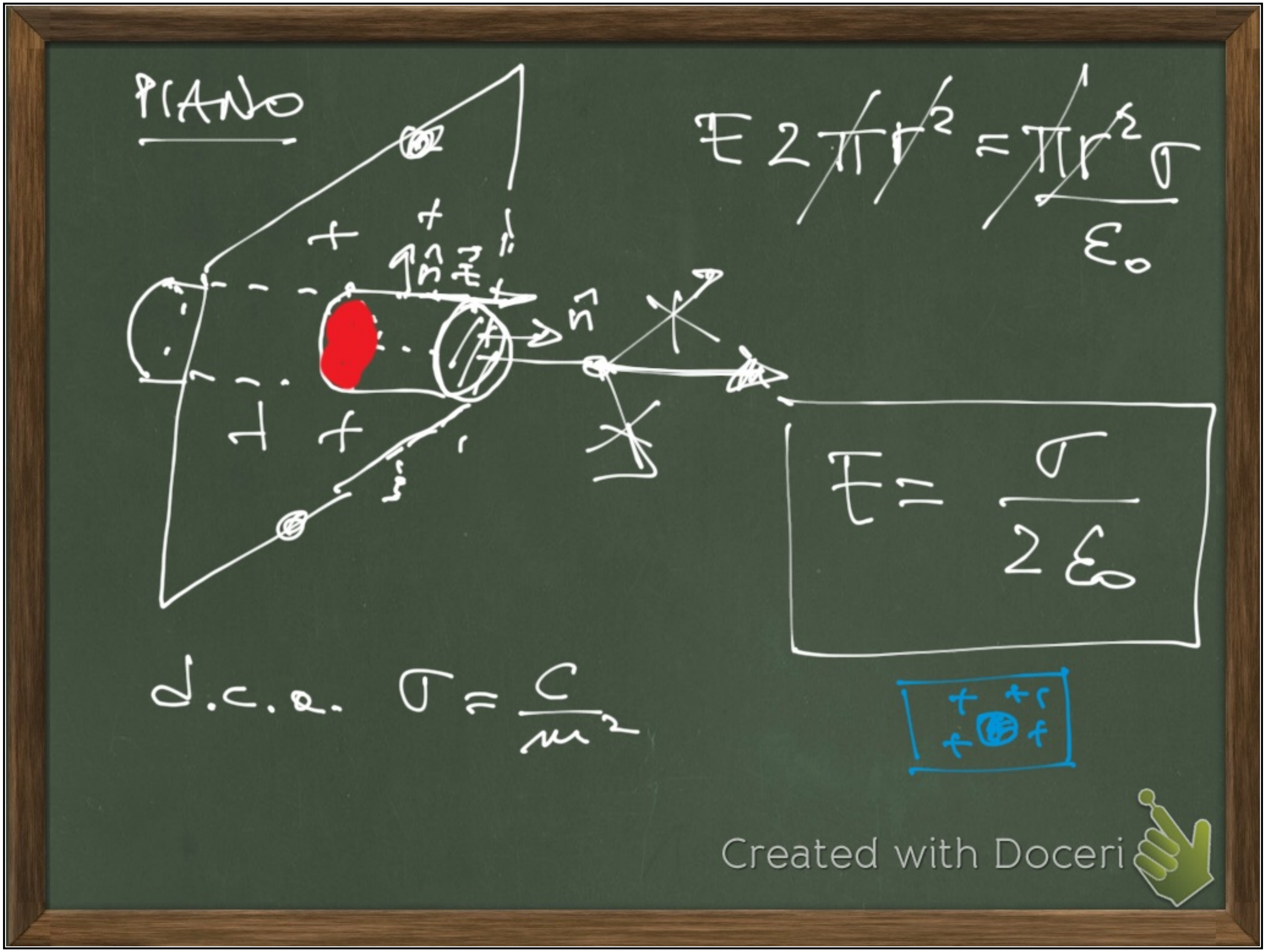
GUSCIO

fuori
$$\begin{cases} E\,4\pi r^2 = \dfrac{Q}{\varepsilon_0} \\ E = \dfrac{Q}{4\pi\varepsilon_0 r^2} \end{cases}$$

dentro
$$\begin{cases} E\,4\pi r^2 = \emptyset \\ E = 0 \end{cases}$$




PIANO
$\hat{n}$ $\vec{E}$
$\vec{n}$
$E\,2\cancel{\pi r^2} = \frac{\cancel{\pi r^2}\,\sigma}{\varepsilon_0}$
$\boxed{E = \frac{\sigma}{2\varepsilon_0}}$
d.c.e. $\sigma = \frac{C}{m^2}$
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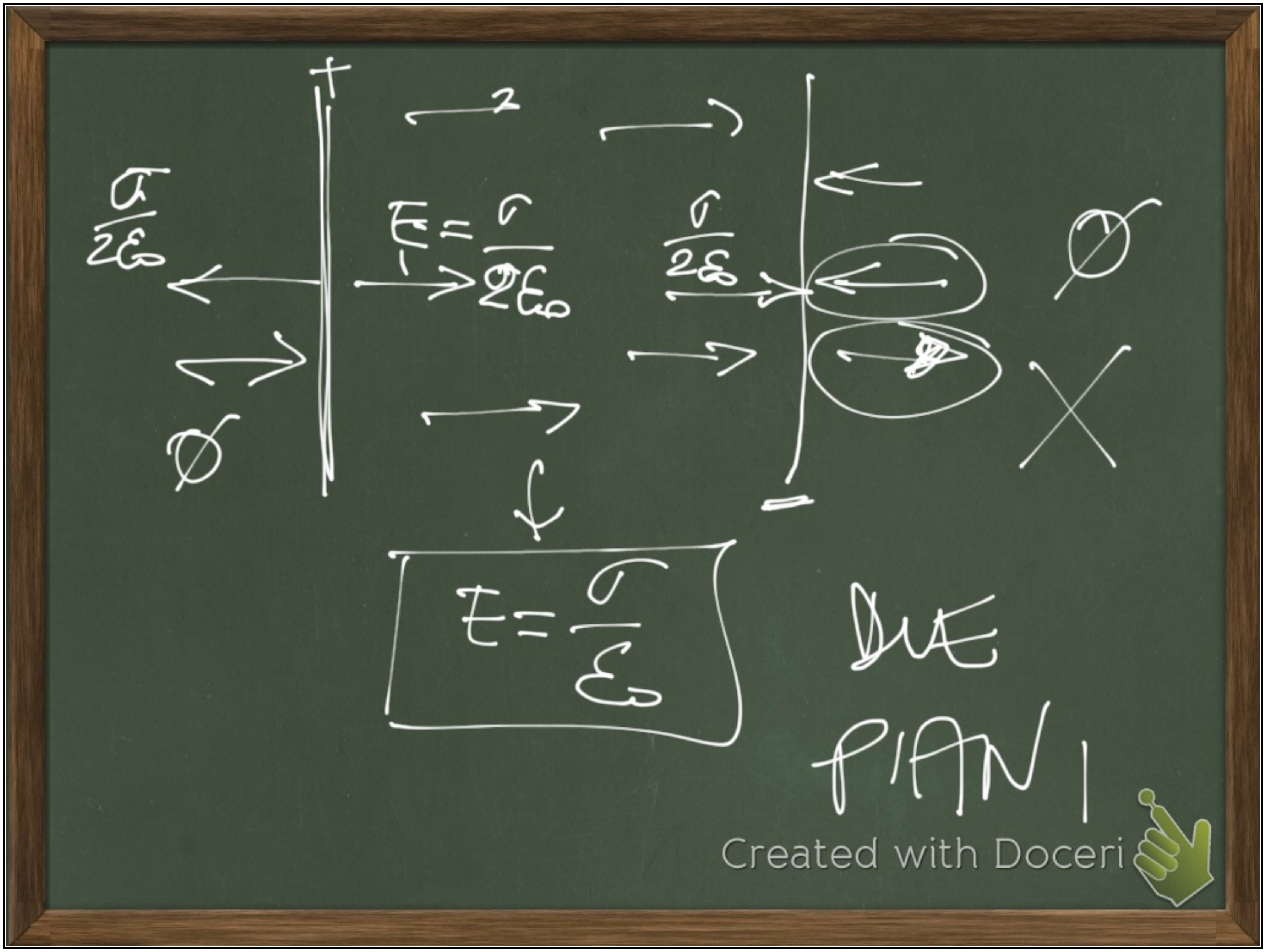
+
$\frac{\sigma}{2\varepsilon_0}$
$E = \frac{\sigma}{2\varepsilon_0}$
$\frac{\sigma}{2\varepsilon_0}$
Ø
Ø
−
$E = \frac{\sigma}{\varepsilon_0}$
DUE
PIANI
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