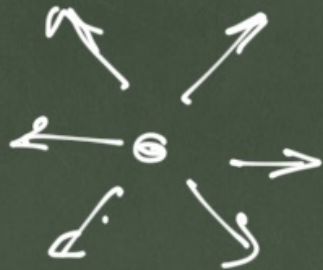



$q \leftrightarrow Q$ 
 $\vec{F} = k_e \frac{Qq}{r^2}$

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


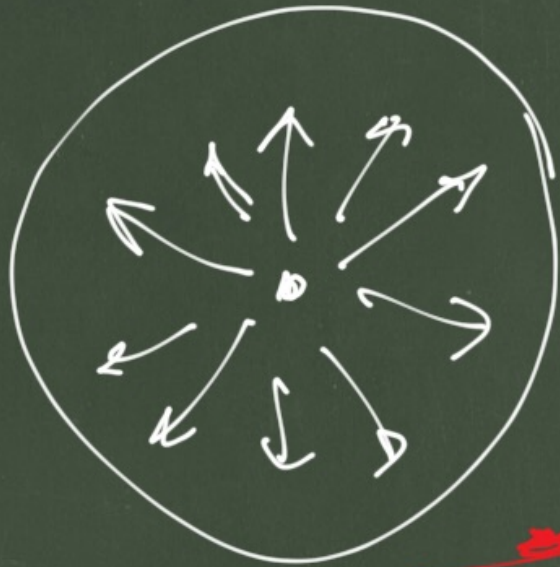
$q \rightarrow \sqrt{E}$   
 $\Sigma \rightarrow \vec{E}_{TOT}$

**SOPRAPPOLIZIONE**

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# LEGGE DI GAUSS

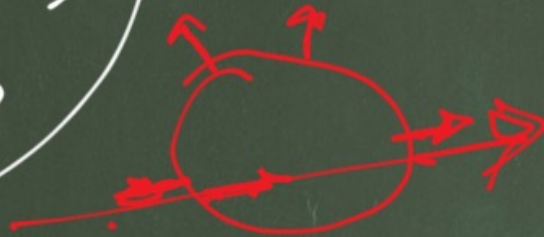
I eq. Maxwell



1. sup. chiusa

2.  $\propto$  int.

Sorgente

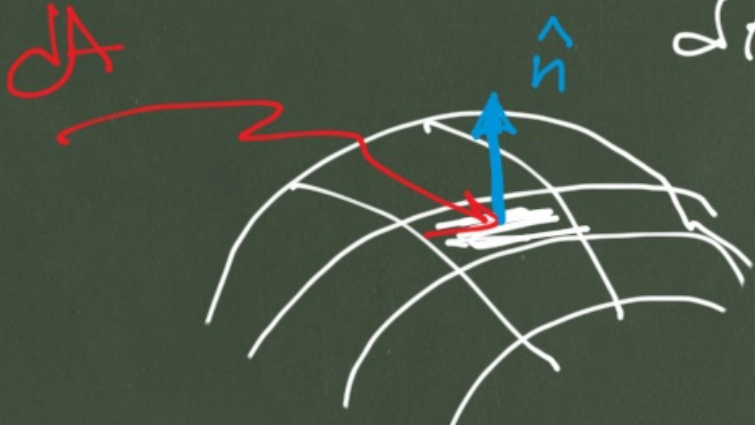


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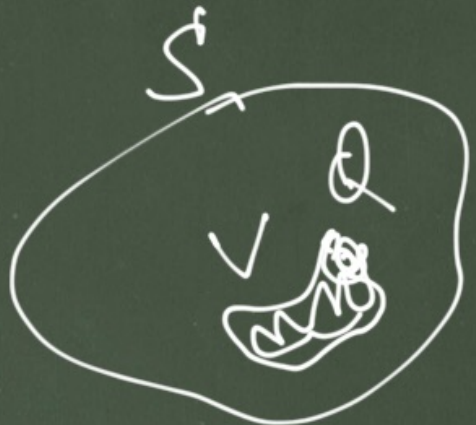


$$\oint_S \vec{E} \cdot d\vec{A} = \frac{Q_{enc}}{\epsilon_0}$$

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




The diagram shows a curved surface with a grid of lines. A red arrow labeled  $dA$  points to a small area element on the surface. A blue arrow labeled  $\hat{n}$  points upwards from the area element, representing the normal vector.

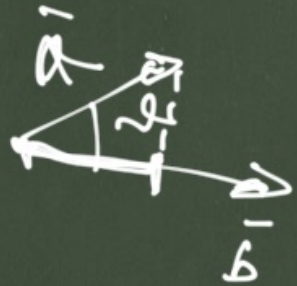


The diagram shows a closed surface labeled  $S$  containing a charge  $Q$ . A small area element  $dA$  is shown on the surface with a normal vector  $\hat{n}$  pointing outwards.

$\rightarrow$  gaussian

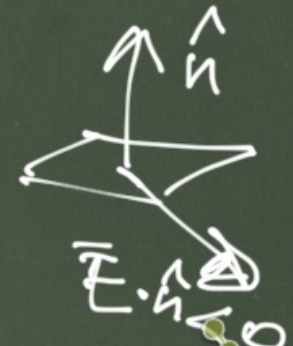
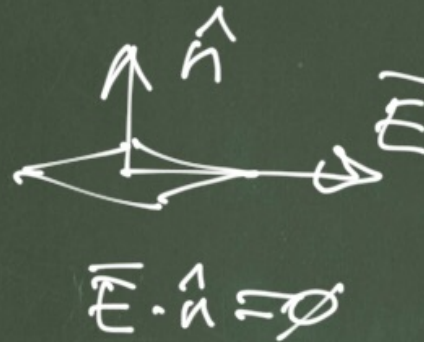
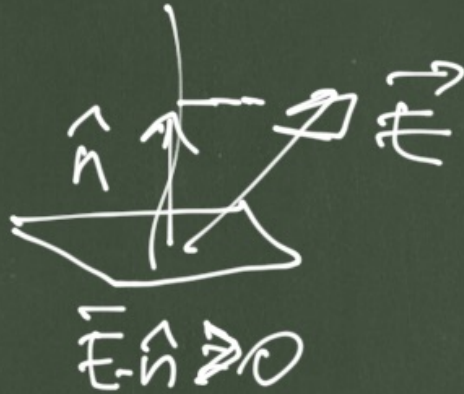
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$$\vec{E} \cdot \vec{J}A = \vec{E} \cdot \hat{n} dA$$



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

$$= |\vec{a}| |\vec{b}| \cos \phi$$



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

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



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

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

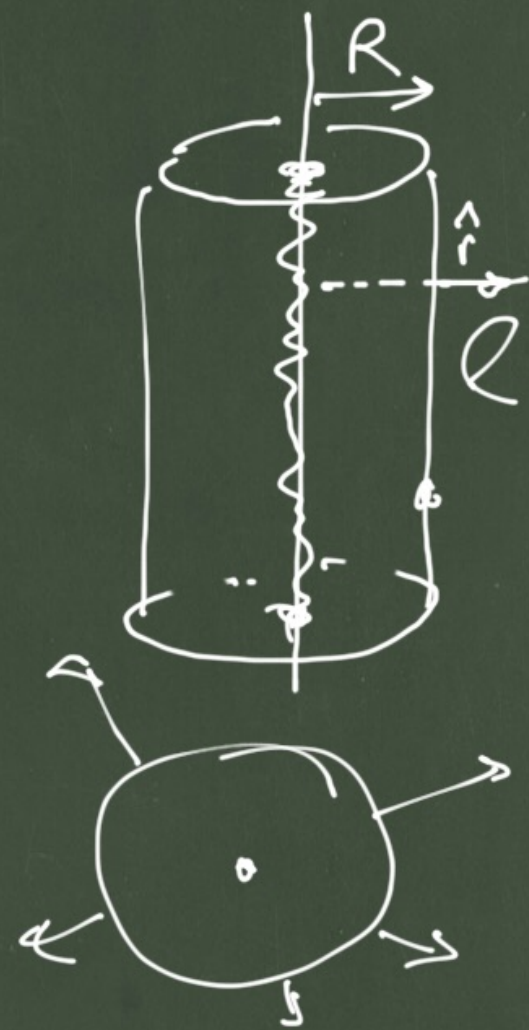
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$\vec{E} = E \hat{r}$   
 $\oint_S \vec{E} \cdot d\vec{A} = \oint_S E \hat{r} \cdot \hat{r} dA$   
 $= \oint_S E dA$   
 $= E \oint_S dA$   
 $= E 4\pi R^2$   
 $E 4\pi R^2 = \frac{Q}{\epsilon_0}$   
 $E = \frac{Q}{4\pi \epsilon_0 R^2} \hat{r}$   
 $= \hat{r} \frac{k_e Q}{r^2}$

**CARICA PUNTA**

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The diagram shows a vertical cylinder of radius  $R$  and length  $l$ . A dashed line represents the central axis. A Gaussian surface is drawn as a cylinder of the same length  $l$  and radius  $R$ , concentric with the outer cylinder. Arrows labeled  $\vec{E}$  point radially outward from the Gaussian surface. A top-down view of the Gaussian surface is shown below, with arrows indicating the outward radial direction.


$$\frac{Q}{\epsilon_0} = \frac{\lambda l}{\epsilon_0}$$

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

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

$$E \oint dA = E 2\pi R l$$

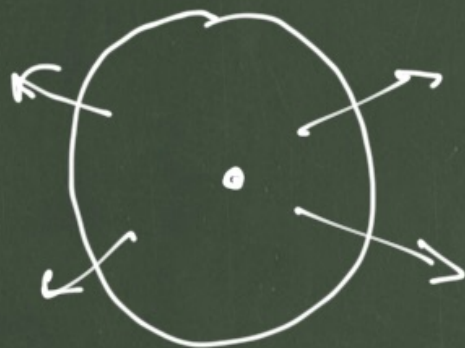
$$= \frac{\lambda l}{\epsilon_0}$$

**FILO**  
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$$E \cdot 2\pi R \lambda = \frac{\lambda \lambda}{\epsilon_0}$$
$$\vec{E} = \hat{r} \frac{\lambda \lambda}{2\pi R \lambda \epsilon_0} = \hat{r} \frac{2k_e \lambda}{r}$$

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$$E 2\pi r = \frac{Q}{\epsilon_0}$$


$$E = \frac{Q}{2\pi \epsilon_0 r^2} \cdot \frac{2\pi r Q}{r}$$

$\frac{Q}{2\pi \epsilon_0 r^2} \cdot \frac{2\pi r Q}{r}$   
 $\sim \frac{1}{r^2}$

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SPERA  
 PIENA




$\rho = \rho_0$

$$E 4\pi r^2 = \frac{1}{\epsilon_0} \int \rho dV$$

$$= \frac{\rho_0}{\epsilon_0} \int dV$$

\*  $E 4\pi r^2 = \frac{Q}{\epsilon_0} \rightarrow E = \frac{k_e Q}{r^2}$

\*  $E 4\pi r^2 = \frac{\rho_0}{\epsilon_0} \int dV = \frac{\rho_0}{\epsilon_0} \frac{4\pi r^3}{3}$


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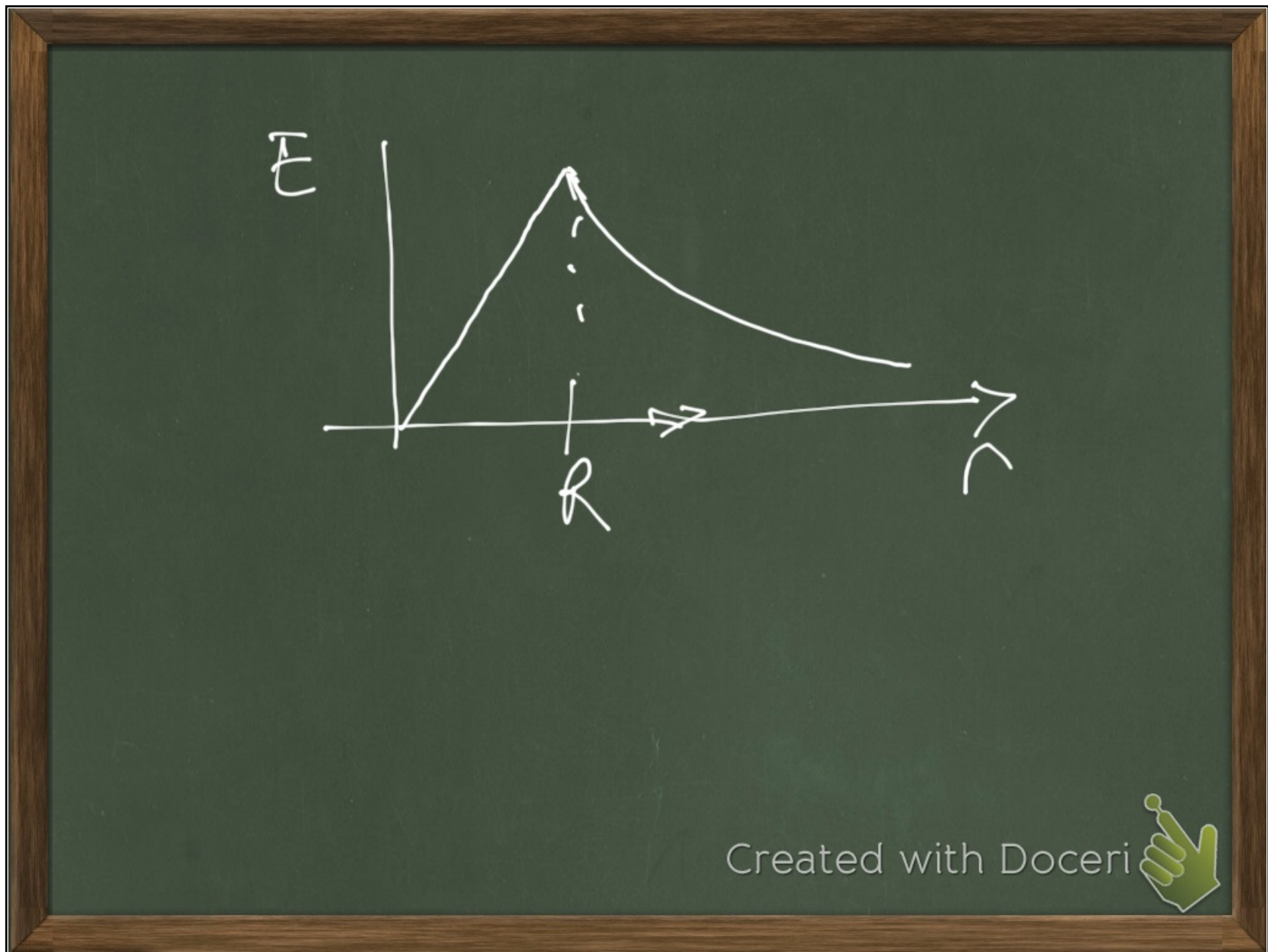
$$* \epsilon 4\pi r^2 = \frac{\rho_0}{\epsilon_0} \int dV = \frac{\rho_0}{\epsilon_0} \frac{4\pi r^3}{3}$$

$$= \frac{Q}{\epsilon_0} \left(\frac{r}{R}\right)^3 = \frac{\rho_0}{\epsilon_0} \frac{4\pi R^3}{3} \frac{r^3}{4\pi R^3}$$

$$\propto \frac{4\pi r^3}{3}$$

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

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The diagram illustrates the electric field of a charged sphere. It features a central sphere with a dashed inner boundary and a solid outer boundary. A dashed circle of radius  $r$  is drawn around the sphere, with the word "fuori" (outside) written next to it. The electric field equations for this region are:

$$\begin{cases} E 4\pi r^2 = \frac{Q}{\epsilon_0} \\ E = \frac{Q}{4\pi \epsilon_0 r^2} \end{cases}$$

Below the sphere, a dashed circle of radius  $R$  is drawn, with the word "dentro" (inside) written next to it. The electric field equations for this region are:

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

At the bottom left, a graph shows the electric field strength  $E$  versus distance  $r$ . The curve follows a  $1/r^2$  relationship for  $r > R$  and is zero for  $r < R$ . The radius  $R$  is marked on the horizontal axis.

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PIANO

$E 2\pi r^2 = \frac{\pi r^2 \sigma}{\epsilon_0}$

$E = \frac{\sigma}{2\epsilon_0}$

d.c.e.  $\sigma = \frac{C}{m^2}$

+ +  
+ ⊕ +

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