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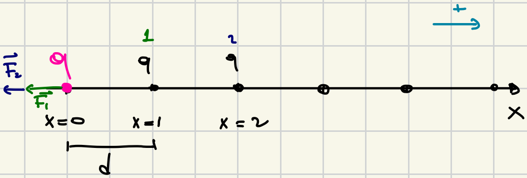


d = 1 cm

q = 1 nC

e ce ne sono infinite tutte uguali

Potrebbe essere utile
$$\boxed{\sum_{n=1}^{\infty}\frac{1}{n^2} = \frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\dots = \frac{\pi^2}{6}}$$

▷ Calcola la forza totale sulla carica in $x=0$

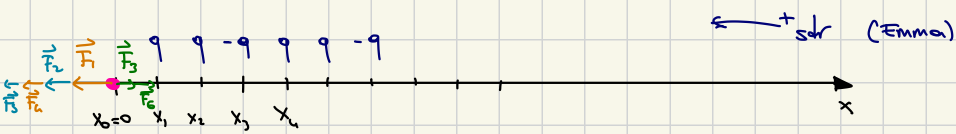
La forza totale è la somma di tutte le forze fatte dalle cariche sulla prima

$$\vec{F}_{TOT,0} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \dots$$

$$F_{TOT} = F_1 + F_2 + F_3 + F_4 + \dots$$

$$= k_0\frac{|q||q|}{d^2} + k_0\frac{|q||q|}{(2d)^2} + k_0\frac{|q||q|}{(3d)^2} + \dots$$

$$= k_0\frac{q^2}{d^2}\overbrace{\left(1+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\dots\right)}^{\pi^2/6} = k_0\frac{q^2\pi^2}{6d^2} \approx 1{,}5\cdot 10^4\ \mathrm{N}$$



Nelle posizioni $x_3, x_6, x_9, \dots$ si mette $-q$ invece che q.
Quanto vale adesso F_{TOT}?

Adesso alcune cariche attraggono e altre respingono. Vediamo che succede.

$$\vec{F}_{TOT} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \vec{F}_4 + \vec{F}_5 + \vec{F}_6 + \dots$$

$$F_{TOT} = F_1 + F_2 - F_3 + F_4 + F_5 - F_6 + \ldots$$

$$= k_0 \frac{|q||q|}{d^2} + k_0 \frac{|q||q|}{(2d)^2} - k_0 \frac{|q||-q|}{(3d)^2} + k_0 \frac{|q||q|}{(4d)^2} + \ldots$$

$$= k_0 \frac{q^2}{d^2} \left(1 + \frac{1}{2^2} - \underbrace{\frac{1}{3^2}} + \frac{1}{4^2} + \frac{1}{5^2} - \underbrace{\frac{1}{6^2}} + \ldots \right)$$

$$= k_0 \frac{q^2}{d^2} \left(1 + \frac{1}{2^2} + \frac{1}{4^2} + \frac{1}{5^2} + \ldots - \left(\frac{1}{3^2} + \frac{1}{6^2} + \frac{1}{9^2} + \ldots \right) \right)$$

$$= k_0 \frac{q^2}{d^2} \left(1 + \frac{1}{2^2} + \frac{1}{4^2} + \frac{1}{5^2} + \ldots - \frac{1}{3^2} \underbrace{\left(1 + \frac{1}{2^2} + \frac{1}{3^2} + \ldots \right)}_{\pi^2/6} \right)$$

$$= k_0 \frac{q^2}{d^2} \left(\underbrace{1 + \frac{1}{2^2} + \frac{1}{4^2} + \frac{1}{5^2} + \ldots}_{\text{aggiungo e tolgo}} - \frac{\pi^2}{3^3 \cdot 2} \right)$$

$$= k_0 \frac{q^2}{d^2} \left(\underbrace{1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \frac{1}{5^2} + \frac{1}{6^2} + \ldots}_{\frac{\pi^2}{6}} - \underbrace{\left(\frac{1}{3^2} + \frac{1}{6^2} + \frac{1}{9^2} + \ldots \right)}_{\frac{\pi^2}{3^3 \cdot 2}} - \frac{\pi^2}{3^3 \cdot 2} \right)$$

$$= k_0 \frac{q^2}{d^2} \left(\frac{\pi^2}{6} - \frac{\pi^2}{3^3 \cdot 2} - \frac{\pi^2}{3^3 \cdot 2} \right) = k_0 \frac{q^2}{d^2} \frac{\pi^2}{6} \left(1 - \frac{1}{9} - \frac{1}{9} \right)$$

$$= k_0 \frac{q^2 \pi^2}{6 d^2} \cdot \frac{7}{9}$$