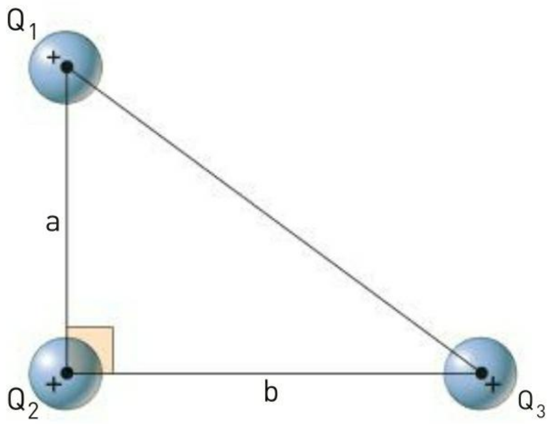
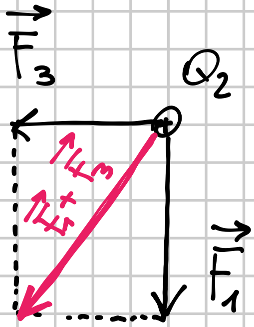
19/9/2019

33 ★★★ Tre cariche puntiformi $Q_1 = 4{,}0 \times 10^{-10}$ C, $Q_2 = 5{,}0 \times 10^{-10}$ C e $Q_3 = 3{,}0 \times 10^{-10}$ C sono disposte ai vertici di un triangolo rettangolo di cateti a = 3,0 cm e b = 4,0 cm. La carica Q_2 è posta nel vertice dell'angolo retto.



- Calcola l'intensità della forza totale subita dalla carica Q_2.
- Calcola l'intensità della forza totale subita dalla carica Q_1.

[2,2 × 10⁻⁶ N; 2,3 × 10⁻⁶ N]



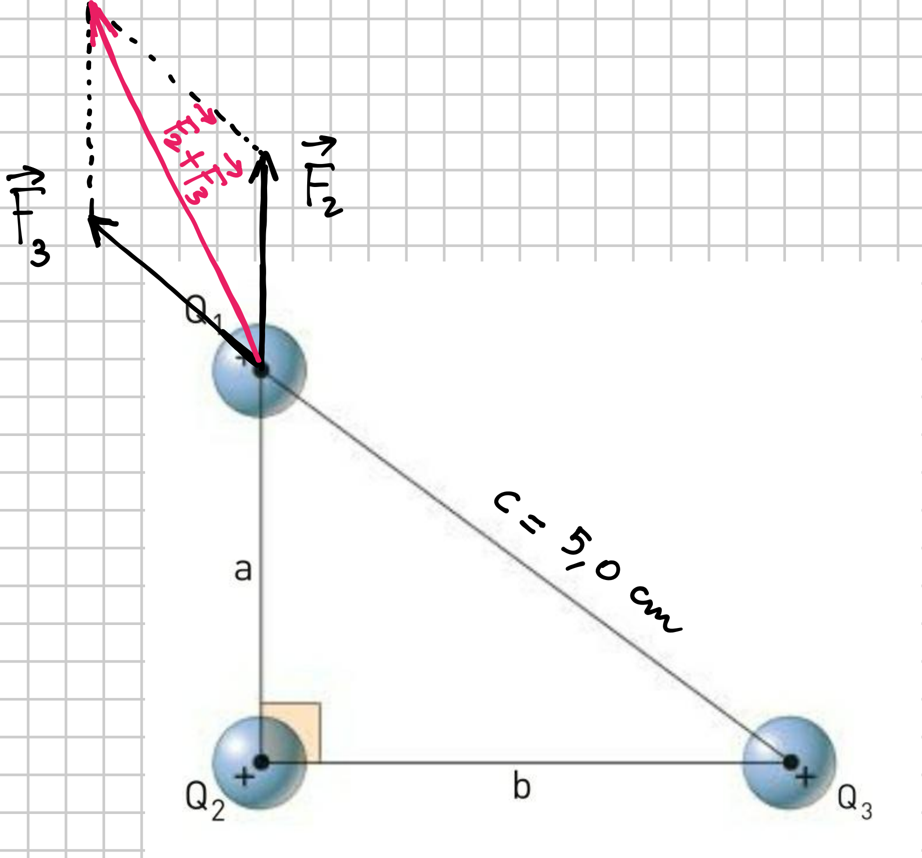
$$F_3 = K_0 \frac{Q_2 Q_3}{b^2} \qquad F_1 = K_0 \frac{Q_1 Q_2}{a^2}$$

$$F_{TOT} = |\vec{F}_1 + \vec{F}_3| = \sqrt{F_1^2 + F_3^2} = \sqrt{K_0^2 \frac{Q_2^2 Q_1^2}{a^4} + K_0^2 \frac{Q_2^2 Q_3^2}{b^4}} =$$

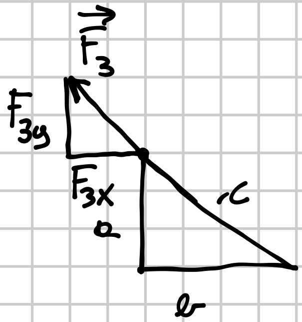
$$= K_0 Q_2 \sqrt{\frac{Q_1^2}{a^4} + \frac{Q_3^2}{b^4}} = (8{,}988 \times 10^9)(5{,}0 \times 10^{-10}) \sqrt{\frac{(4{,}0)^2 \times 10^{-20}}{(3{,}0)^4 \times 10^{-8}} + \frac{(3{,}0)^2 \times 10^{-20}}{(4{,}0)^4 \times 10^{-8}}}\ N$$

$$= (8{,}988 \times 10^9)(5{,}0 \times 10^{-10}) \times 10^{-6} \sqrt{\frac{16}{81} + \frac{9}{256}}\ N =$$

$$= 21{,}678\ldots \times 10^{-7}\ N \simeq \boxed{2{,}2 \times 10^{-6}\ N}$$



$$F_2 = K_0 \frac{Q_1 Q_2}{a^2} \qquad \vec{F}_2 = (0, F_2)$$



$$F_3 = K_0 \frac{Q_1 Q_3}{c^2}$$

$$F_3 : c = F_{3y} : a \qquad F_3 : c = |F_{3x}| : b$$

$$\Downarrow \qquad\qquad \Downarrow$$

$$F_{3y} = \frac{a}{c} F_3 = \frac{3}{5} F_3 \qquad F_{3x} = -\frac{4}{5} F_3$$

$$\vec{F}_3 = \left(-\frac{4}{5} F_3 , \frac{3}{5} F_3\right) = \left(-\frac{4}{5}, \frac{3}{5}\right) F_3$$

$$\vec{F}_2 + \vec{F}_3 = \left(0 - \frac{4}{5} F_3 , F_2 + \frac{3}{5} F_3\right) = \left(-\frac{4}{5} F_3 , F_2 + \frac{3}{5} F_3\right) =$$

$$= \left(-\frac{4}{5} K_0 \frac{Q_1 Q_3}{c^2} , K_0 \frac{Q_1 Q_2}{a^2} + \frac{3}{5} K_0 \frac{Q_1 Q_3}{c^2}\right) =$$

$$= \left(-\frac{4}{5} K_0 \frac{Q_1 Q_3}{c^2} ,\ K_0 \frac{Q_1 Q_2}{a^2} + \frac{3}{5} K_0 \frac{Q_1 Q_3}{c^2} \right) =$$

$$= \left(-\frac{4}{5} \frac{Q_3}{c^2} ,\ \frac{Q_2}{a^2} + \frac{3}{5} \frac{Q_3}{c^2} \right) \cdot K_0 Q_1 =$$

$$= \left(-\frac{4}{5} \frac{3{,}0 \times 10^{-10}}{25 \times 10^{-4}} ,\ \frac{5{,}0 \times 10^{-10}}{9 \times 10^{-4}} + \frac{3}{5} \frac{3{,}0 \times 10^{-10}}{25 \times 10^{-4}} \right) \cdot \left(8{,}988 \times 10^{9}\right) \left(4{,}0 \times 10^{-10}\right) N$$

$$= \left(-0{,}096 ,\ 0{,}627555 \ldots \right) \times 10^{-6} \times 35{,}952 \times 10^{-1}\ N =$$

$$= \left(-0{,}096 ,\ 0{,}627555 \ldots \right) \cdot 35{,}952 \times 10^{-7}\ N$$

$$\left| \vec{F}_2 + \vec{F}_3 \right| = \sqrt{(-0{,}096)^2 + (0{,}62755\ldots)^2} \cdot 35{,}952 \times 10^{-7}\ N =$$

$$= 22{,}8241 \ldots \times 10^{-7}\ N \simeq \boxed{2{,}3 \times 10^{-6}\ N}$$