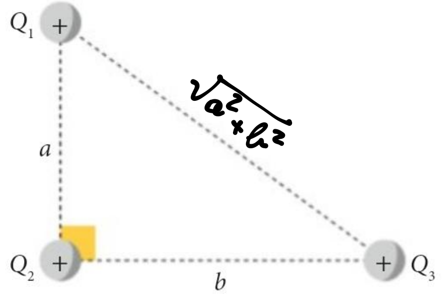
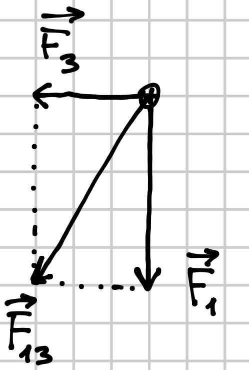
52 Tre cariche puntiformi, $Q_1 = 4{,}0 \times 10^{-10}$ C, $Q_2 = 5{,}0 \times 10^{-10}$ C e $Q_3 = 3{,}0 \times 10^{-10}$ C, sono disposte ai vertici di un triangolo rettangolo di cateti $a = 3{,}0$ cm e $b = 4{,}0$ cm. La carica Q_2 è posta nel vertice dell'angolo retto.



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

[$2{,}2 \times 10^{-6}$ N; $2{,}3 \times 10^{-6}$ N]

a)



$$\vec{F}_{13} = \vec{F}_1 + \vec{F}_3$$

$$F_{13} = \sqrt{F_1^2 + F_3^2}$$

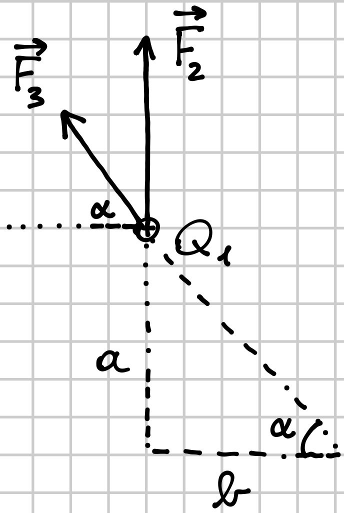
$$F_1 = k_0 \frac{Q_1 Q_2}{a^2} \qquad F_3 = k_0 \frac{Q_1 Q_3}{b^2}$$

$$F_{13} = \sqrt{k_0^2 \frac{Q_1^2 Q_2^2}{a^4} + k_0^2 \frac{Q_1^2 Q_3^2}{b^4}} = k_0 Q_1 \sqrt{\frac{Q_2^2}{a^4} + \frac{Q_3^2}{b^4}} =$$

$$= \left(8{,}99 \times 10^9 \frac{N \cdot m^2}{C^2}\right)\left(4{,}0 \times 10^{-10} C\right) \sqrt{\frac{(5{,}0\,C)^2}{(3{,}0\,m)^4} + \frac{(3{,}0\,C)^2}{(4{,}0\,m)^4}} \times \frac{10^{-10}}{10^{-4}} =$$

$$= 21{,}08\ldots \times 10^{-7}\,N \simeq \boxed{2{,}1 \times 10^{-6}\,N}$$

b)



$$F_2 = k_0 \frac{Q_1 Q_2}{a^2} \qquad F_3 = k_0 \frac{Q_1 Q_3}{a^2 + b^2}$$

$$\vec{F}_2 = (0, F_2) \qquad \vec{F}_3 = (-F_3 \cos\alpha, F_3 \sin\alpha)$$

$$\tan\alpha = \frac{a}{b} \qquad \alpha = \arctan\left(\frac{a}{b}\right) = \arctan\left(\frac{3}{4}\right) = 36{,}8698\ldots°$$

$$F_2 = (8{,}99 \times 10^9) \frac{(4{,}0 \times 10^{-10})(5{,}0 \times 10^{-10})}{(3{,}0 \times 10^{-2})^2}\,N = 19{,}9777\ldots \times 10^{-7}\,N$$

$$F_3 = (8{,}99 \times 10^9) \frac{(4{,}0 \times 10^{-10})(3{,}0 \times 10^{-10})}{(5{,}0 \times 10^{-2})^2}\,N = 4{,}3152 \times 10^{-7}\,N$$

$$\vec{F}_2 = (0, F_2) \qquad \vec{F}_3 = (-F_3 \cos\alpha, F_3 \sin\alpha)$$

$$\vec{F}_{23} = (-F_3 \cos\alpha \,,\, F_2 + F_3 \sin\alpha) =$$

$$= \left(-4,3152 \cdot \cos(36,8698...^\circ) \times 10^{-7}\,N \,,\, 19,977... \times 10^{-7}\,N + 4,3152 \cdot \sin(36,8698...^\circ) \times 10^{-7}\,N\right) =$$

$$= \left(-3,452164... \times 10^{-7}\,N \,,\, 22,566114... \times 10^{-7}\,N\right)$$

$$F_{23} = \sqrt{(-3,452164...)^2 + (22,566114...)^2} \times 10^{-7}\,N = 22,828... \times 10^{-7}\,N$$

$$\simeq \boxed{2,3 \times 10^{-6}\,N}$$