

Physics/Science
Equations editor
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A charge $Q_1 = 2nC$ is at the origin, $(0, 0)$, another charge $Q_2 = -5nC$ is on the x axis at $x = 2m$, and charge $Q_3 = +10nC$ is at a point $(x, y) = (4m, 4m)$. Calculate the magnitude and direction of the resultant force

$$F_{e,net \text{ on } Q_3} \cdot \begin{pmatrix} k = 9 \cdot 10^9 \\ q_1 = 2 \cdot 10^{-9} \\ q_2 = -5 \cdot 10^{-9} \\ q_3 = 10 \cdot 10^{-9} \end{pmatrix}, \begin{pmatrix} r_{13} = (4^2 + 4^2) \\ r_{23} = (2^2 + 4^2) \\ F_{13} = k \cdot \frac{q_1 \cdot q_3}{4^2 + 4^2} \end{pmatrix}$$

$$F_{13} = k \cdot \frac{q_1 \cdot q_3}{r_{13}^2} = 9 \cdot 10^9 \cdot \frac{2 \cdot 10^{-9} \cdot 10 \cdot 10^{-9}}{32} = 5.625 \cdot 10^{-9}$$

$$\theta_{13} = \text{arc tan} \left(\frac{4}{4} \right) = 45^\circ$$

$$F_{13,x} = F_{13} \cdot \cos \theta_{13} = 5.625 \cdot 10^{-9} \cdot 0.707 = 3.97 \cdot 10^{-9}$$

$$F_{13,y} = F_{13} \cdot \sin \theta_{13} = 5.625 \cdot 10^{-9} \cdot 0.707 = 3.97 \cdot 10^{-9}$$

$$F_{23} = k \cdot \frac{q_2 \cdot (q_3)}{2^2 + 4^2}$$

$$F_{23} = k \cdot \frac{q_2 \cdot q_3}{r_{23}^2} = 9 \cdot 10^9 \cdot \frac{(-5) \cdot 10^{-9} \cdot 10 \cdot 10^{-9}}{2^2 + 4^2} = -2.25 \cdot 10^{-8}$$

$$\beta_{23} = \text{arc tan} \left(\frac{2}{4} \right) = 26.56^\circ$$

$$\theta_{23} = 270 - \beta_{23} = 270^\circ - 26.56^\circ = 243.43^\circ$$

$$F_{23,x} = F_{23} \cdot \cos \theta_{23} = -2.25 \cdot 10^{-8} \cdot \cos (26.56) = -2.01 \cdot 10^{-8}$$

$$F_{23,y} = F_{23} \cdot \sin \theta_{23} = -2.25 \cdot 10^{-8} \cdot \sin (26.56) = -1.00 \cdot 10^{-8}$$

$$F_{R,x} = F_{13,x} + F_{23,x} = 3.97 \cdot 10^{-9} - 2.01 \cdot 10^{-8} = -1.613e-8$$

$$F_{R,y} = F_{13,y} + F_{23,y} = 3.97 \cdot 10^{-9} - 1.00 \cdot 10^{-8} = -6.03 \cdot 10^{-9}$$

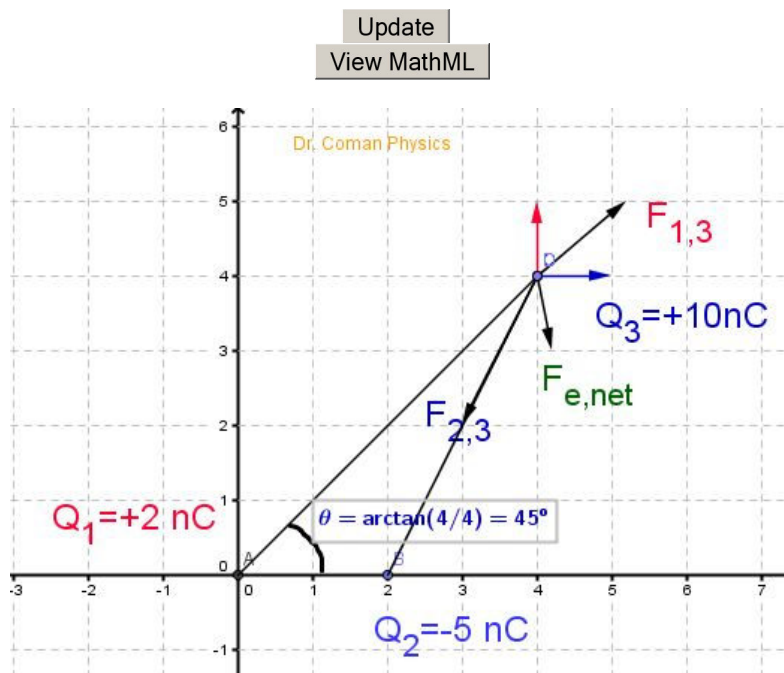
$$\theta_{F_R} = \text{arc tan} \left(\frac{F_{R,y}}{F_{R,x}} \right) = \text{arc tan} \left(\frac{-6.03 \cdot 10^{-9}}{-1.613e-8} \right) = 20.49^\circ$$

with respect to the +x axis measure clockwise \rightarrow

with respect to the +x axis measure counterclockwise

$$\theta_{F_R} = 360^\circ - 20.49^\circ$$

A charge $Q_1 = 2 \text{ nC}$ is at the origin, $(0,0)$, another charge $Q_2 = -5 \text{ nC}$ is on the x axis at $x = 2 \text{ m}$, and charge $Q_3 = +10 \text{ nC}$ is at a point $(x,y) = (4,4)$. Calculate the magnitude and direction of the resultant force $F_{e,n}$ on Q_3 .



Schimba

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