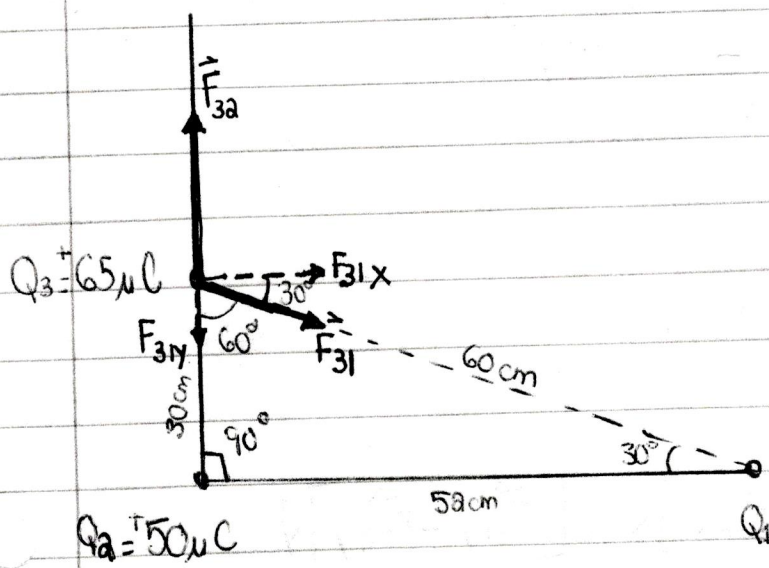
* Vector involved covers ~~charges of 3+~~ 3+ charges $(q_1, q_2, \dots q_3)$

Solving Problems Involving Coulomb's Law and Vectors

Example 2: Calculate the net electrostatic force on charge Q_3 from charges Q_1 and Q_2



$\mu = 10^{-6}$

$$F_{31} = K\left(\frac{Q_3 Q_1}{r_{31}^2}\right)$$

$$F_{31} = (9\times10^9\ Nm^2/C^2)\left(\frac{(65\times10^{-6}\ C)(-86\times10^{-6}\ C)}{(0.6\ m)^2}\right)$$

$$\boxed{F_{31} = -139.6\ N}$$

Step 1 Find Electric Forces F_{31} and F_{32}

$$F_{32} = K\left(\frac{Q_3 Q_2}{r_{32}^2}\right)$$

$$F_{32} = (9\times10^9\ Nm^2/C^2)\left[\frac{(65\times10^{-6}\ C)(50\times10^{-6}\ C)}{(0.3\ m)^2}\right]$$

$$\boxed{F_{32} = 324.57\ N}$$

continuation . . .

Step 2

Find vectors $\vec{F}_{31}$ and $\vec{F}_{32}$ in x and y component form each

$\theta_{3,} = 30^\circ$

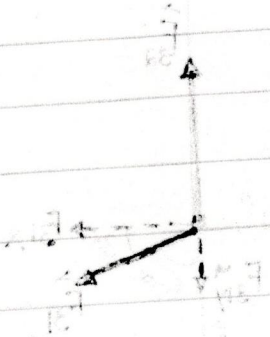
$\vec{F}_{31} = \vec{F}_{31x} + \vec{F}_{31y}$

$\vec{F}_{31} = (F_{31}\cos\theta_{31})\hat{x} + (F_{31}\sin\theta_{31})\hat{y}$

$\vec{F}_{31} = (139.6\text{N}\cos 30)\hat{x} + (139.6\text{N}\sin 30^\circ)\hat{y}$

$\vec{F}_{31} = (120.89\text{N})\hat{x} + (-69.78\text{N})\hat{y}$

(− : y direction)



$\vec{F}_{32} = \vec{F}_{32x} + \vec{F}_{32y}$

$\vec{F}_{32} = (0\text{N})\hat{x} + (324.57\text{N})\hat{y}$

Step 3

Find $\vec{F}_{3,\text{total}}$ and x-y components from vectors $\vec{F}_{31}$ and $\vec{F}_{32}$

$\vec{F}_{3\text{total}} = [\vec{F}_{31x} + \vec{F}_{32x}]\hat{x} + [\vec{F}_{31y} + \vec{F}_{32y}]\hat{y}$

$\vec{F}_{3\text{total}} = [120.86\text{N} + 0\text{N}]\hat{x} + [-69.78\text{N} + 324.57]\hat{y}$

$\vec{F}_{3\text{total}} = \{120.86\text{N}\}\hat{x} + \{254.79\text{N}\}\hat{y}$

* This is the net (total) electrostatic force on charge Q_3 from Q_2 and Q_1 in x and y component form.

Magnitude and direction

$|\vec{F}_{3\text{total}}| = \sqrt{(F_{3\text{total}x})^2 + (F_{3\text{total}y})^2}$

$F_{3_{\text{total}}} = \sqrt{(120.85\text{N})^2 + (254.79\text{N})^2}$

$F_{3\text{total}} = 282\text{N}$

* This is the net total electrostatic force on charge Q_3 from Q_2 and Q_1 in magnitude form

$\theta =$