PP|638

4.

$$F_q = \frac{kq_1q_2}{r^2}$$

$$F_q' = \frac{kq_1q_2}{(4r)^2}$$

$$F_q' = \frac{1}{16}\left(\frac{kq_1q_2}{r^2}\right) \leftarrow F_q$$

$$F_q' = \frac{1}{16}F_q$$

$$F_q' = \frac{1}{16}(8.0N)$$

$$F_q' = 0.5N$$

5.

old		new
$q_1 = +6.0mC$	total is +4.0mC; $\times \frac{1}{3}$	$q_1 = ?$ +2.0mC
$q_2 = -2.0mC$	$\times 1$	$q_2 = ?$ +2.0mC
$r = d$	$\times 2$	$r = 2d$
$F_q = 2.0N$		$F_q' = ?$

$$F_q = \frac{kq_1q_2}{d^2}$$

$$F_q' = \frac{k\left(\frac{q_1}{3}\right)q_2}{(2d)^2}$$

$$F_q' = \frac{\frac{1}{3}}{4}\frac{kq_1q_2}{d^2}$$

$$F_q' = \frac{1}{12}F_q$$

$$F_q' = \frac{1}{12}(2.0N)$$

$$F_q' = 0.17N$$

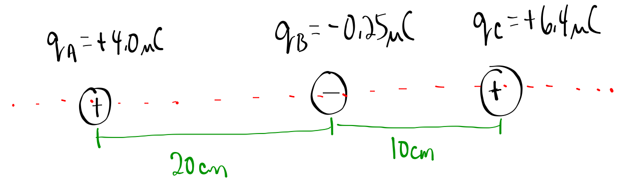
Coulomb's Law + Vectors

$$F_Q = \frac{kq_1q_2}{r^2}$$ ← magnitude only

- direction can only be determined if we know the relative position of the charged particles.

Example

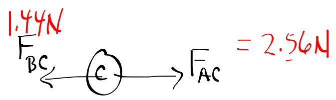
Consider 3 charges. A and B are in fixed positions. and charge C is in line with A and B. Find the net force on C.



We are only interested in the net force on C, so draw a FBD for C:

A-C (repulsive)

B-C (attractive)



$$F_{AC} = \frac{kq_Aq_C}{r_{AC}^2}$$

$$F_{AC} = \frac{\left(9.0\times10^9 \frac{N\cdot m^2}{C^2}\right)(4.0\times10^{-6}C)(6.4\times10^{-6}C)}{(0.30m)^2}$$

$$F_{AC} = 2.56N$$

$$\vec{F}_{AC} = 2.56N\ [right]$$

$$F_{BC} = \frac{\left(9.0\times10^9 \frac{N\cdot m^2}{C^2}\right)(0.25\times10^{-6}C)(6.4\times10^{-6}C)}{(0.10m)^2}$$

$$F_{BC} = 1.44\ N$$

$$\vec{F}_{BC} = 1.44N\ [left]$$

$$\vec{F}_{net} = \vec{F}_{AC} + \vec{F}_{BC}$$

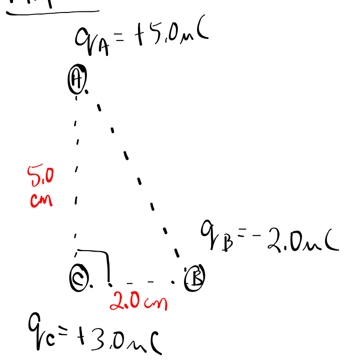
$= 2.56N\ [right] + 1.44N\ [left]$

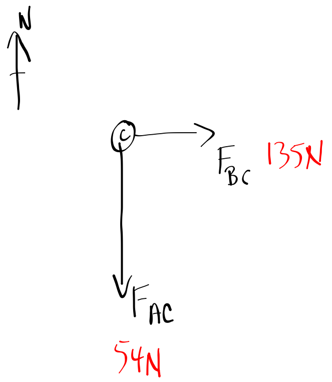
$= 2.56 - 1.44$

$= 1.1\ N\ [right]$

MP/639

What is the net force on C?





(repulsive)

$$F_{AC} = \frac{k q_A q_C}{r_{AC}^2}$$

$$F_{AC} = \frac{\left(9.0\times10^9 \frac{N\cdot m^2}{C^2}\right)(5.0\times10^{-6}C)(3.0\times10^{-6}C)}{(0.050m)^2}$$

$F_{AC} = 54\,N$

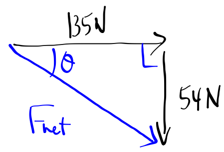
$\vec{F}_{AC} = 54\,N\,[S]$

(attractive)

$$F_{BC} = \frac{\left(9.0\times10^9 \frac{N\cdot m^2}{C}\right)(2.0\times10^{-6}C)(3.0\times10^{-6}C)}{(0.020m)^2}$$

$F_{BC} = 135N$

$\vec{F}_{BC} = 135N\,[E]$



$c^2 = a^2 + b^2$

$c^2 = 135^2 + 54^2$

$c = 145N$

$\tan\theta = \frac{54N}{135N}$

$\theta = 22^\circ$

$\vec{F}_{net}(\text{on } C) = 145N\,[E\,22^\circ S]$

TO DO

1. PP/638 (Coulomb's Law Basics)
2. PP/640-641 (Coulomb's Law + Vectors)
3. Assignment p684/18-25