Chapter 14 - Fields + Forces

Like charges → repel
Unlike charges → attract

} electrostatic force can be attractive/repulsive

gravitational force can only be attractive.

$F_Q \propto q_1$

$F_Q \propto q_2$

$F_Q \propto \frac{1}{r^2}$

} $F_Q \propto \frac{q_1 q_2}{r^2}$

$F_Q = \frac{k q_1 q_2}{r^2}$ ← COULOMB'S LAW

where F_Q is the electrostatic force of attraction/repulsion (N)

q_1, q_2 are the charges (C) ← Coulomb's

(DO NOT PUT SIGNS ON THE CHARGES!!)

r is the separation (m)

k is Coulomb's Constant

$9.0 \times 10^9 \frac{N \cdot m^2}{C^2}$

mp 637

$q_1 = -8.0\mu C$

$q_2 = \pm 5.0\mu C$??

$F_Q = 0.50N$ (attractive)

a) $q_2 = ?$ + or - ?? (attractive)

b) $r = ?$

b) $F_Q = \frac{kq_1q_2}{r^2}$

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

$r^2 = \frac{(9.0\times10^9 \frac{N\cdot m^2}{C^2})(8.0\times10^{-6}C)(5.0\times10^{-6}C)}{0.50N}$

$r \doteq 0.85m$

The Vector Nature of Coulomb's Law

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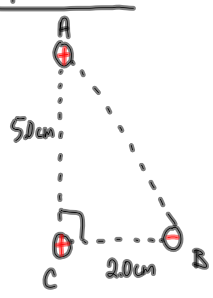
A (+5.0 μC)

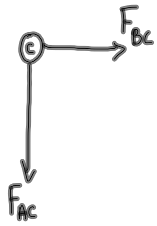
B (−2.0 μC)

C (+3.0 μC)

$F_{net(c)} = ??$



FBD for C



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

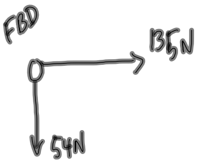
$$F_{AC} = \frac{\left(9.0\times10^9 \frac{N\cdot m^2}{C^2}\right)(5.0\times10^{-6}C)(3.0\times10^{-6}C)}{(0.050m)^2}$$

$$F_{AC} = 54N$$

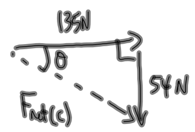
$$F_{BC} = \frac{\left(9.0\times10^9 \frac{Nm^2}{C^2}\right)(2.0\times10^{-6}C)(3.0\times10^{-6}C)}{(0.020m)^2}$$

$$F_{BC} = 135N$$

FBD



vector addition



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

$C = 145N$

The net force on C is

145N [22° CW from the line b/w B+C]

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

$\theta = 22°$

TO DO

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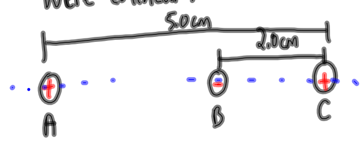
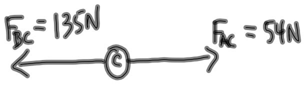
What if A B and C were colinear?



F_{net} on C ??



$F_{net(c)} = 54N - 135N$

$F_{net(c)} = -81N$

$\vec{F}_{net(c)} = 81N$ [L]