

Example #1

(a) repulsive

$$(b) F_E = k \left| \frac{q_1 q_2}{r^2} \right| = (8.99 \times 10^9) \left| \frac{(2.0 \times 10^{-6})(8.5 \times 10^{-6})}{(0.01)^2} \right|$$

$$F_E = 1528.3 \text{ N}$$

$$\boxed{F_E = 1500 \text{ N} \text{ or } 1.5 \times 10^3 \text{ N}}$$

Example #2

(a) attractive

$$(b) F_E = k \left| \frac{q_1 q_2}{r^2} \right| = (8.99 \times 10^9) \left| \frac{(3.2 \times 10^{-9})(1.5 \times 10^{-9})}{(1.5)^2} \right|$$

$$\boxed{F_E = 1.9 \times 10^{-8} \text{ N}}$$

Example #3

(a) FBD:



ΣF :

$$\Sigma F_x = F_2 = F_{3on2} - F_{1on2} = 0.029779 \text{ N} - 0.049445 \text{ N} = -0.019666 \text{ N}$$

$$F_{3on2} = k \left| \frac{q_3 q_2}{r_{32}^2} \right| = \frac{(8.99 \times 10^9)(5.3 \times 10^{-6})(2.5 \times 10^{-6})}{(2.0)^2} = 0.029779 \text{ N}$$

$$F_{1on2} = k \left| \frac{q_1 q_2}{r_{12}^2} \right| = \frac{(8.99 \times 10^9)(2.2 \times 10^{-6})(2.5 \times 10^{-6})}{(1.0)^2} = 0.049445 \text{ N}$$

$$\boxed{F_2 = 0.020 \text{ N} \text{ or } 2.0 \times 10^{-2} \text{ N}, -x \text{ direction}} \quad (a)$$

(b) FBD:



ΣF

$$\Sigma F_x = F_1 = F_{2on1} - F_{3on1} = 0.049445 \text{ N} - 0.011647 \text{ N} = 0.037797 \text{ N}$$

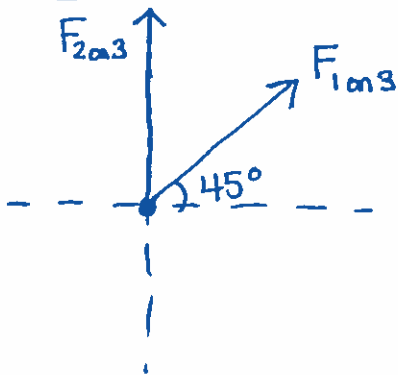
$$F_{2on1} = K \left| \frac{q_2 q_1}{r_{12}^2} \right| = \frac{(8.99 \times 10^9)(2.5 \times 10^{-6})(2.2 \times 10^{-6})}{(1.0)^2} = 0.049445 \text{ N}$$

$$F_{3on1} = K \left| \frac{q_3 q_1}{r_{31}^2} \right| = \frac{(8.99 \times 10^9)(5.3 \times 10^{-6})(2.2 \times 10^{-6})}{(3.0)^2} = 0.011647 \text{ N}$$

$$F_1 = 0.038 \text{ N} \text{ or } 3.8 \times 10^{-2} \text{ N, } +x \text{ direction}$$

Example #4

FBD:



$$F_{\text{net}} = \sqrt{(\Sigma F_x)^2 + (\Sigma F_y)^2} = \sqrt{(0.0014126)^2 + (0.00540864)^2}$$

$$F_{\text{net}} = .0056 \text{ or } 5.6 \times 10^{-3} \text{ N}$$

$$\theta = \tan^{-1} \left(\frac{|\Sigma F_y|}{|\Sigma F_x|} \right) = \tan^{-1} \left(\frac{0.00540864}{0.0014126} \right) = 75.363^\circ$$

$$\theta = 75^\circ \text{ above } +x \text{ axis}$$

$$\Sigma F_x = F_{1on3} \cos 45^\circ = 0.0014126 \text{ N}$$

$$\Sigma F_y = F_{1on3} \sin 45^\circ + F_{2on3} = 0.0014126 \text{ N} + 0.003996 \text{ N} = 0.00540864$$

$$F_{1on3} = \frac{K q_1 q_3}{r_{13}^2} = \frac{(8.99 \times 10^9)(2.0 \times 10^{-6})(2.0 \times 10^{-6})}{(3\sqrt{2})^2} = 0.0019978 \text{ N}$$

$$F_{2on3} = \frac{K q_2 q_3}{r_{23}^2} = \frac{(8.99 \times 10^9)(2.0 \times 10^{-6})(2.0 \times 10^{-6})}{(3.0)^2} = 0.003996 \text{ N}$$