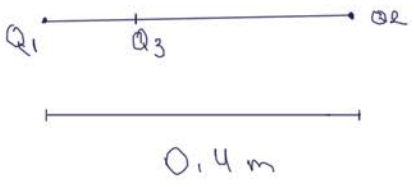
7) $Q_1 \rightarrow 2\ \mu C$

$Q_2 \rightarrow 8\ \mu C$

$Q_3 \rightarrow -3\ \mu C$



$$F_{13} - F_{23} = X$$

$$\frac{K Q_1 Q_3}{"d^2} - \frac{K Q_2 Q_3}{'d^2} = X$$

$$\frac{(9.10^9).(2.10^{-6}).-(3.10^{-6})}{0,1^2} = -5,4\ N$$

$$\frac{(9.10^9).(8.10^{-6}).-(3.10^{-6})}{0,3^2} = 2,4\ N$$

$$F_{13} - F_{23} = X$$

$$5,4 - 2,4 = X$$

$$X = 3\ N$$

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10) $F_{MP} = \dfrac{K \cdot |Q_M| \cdot |Q_P|}{r_{MP}^2}$

$$\frac{4 \cdot 10^4}{1} = \frac{9 \cdot 10^9 \cdot |Q|^2}{0,03} = 4 \cdot 10^{-17} \text{ N}$$

$$F_{MN} = \frac{K |Q_M| \cdot |Q_N|}{r_{MN}^2} = \frac{9 \cdot 10^9 \cdot 4 \cdot 10^{-17}}{0,02^2} = 9 \cdot 10^{-4} \text{ N}$$

$$F_{PN} = \frac{K \cdot |Q_P| \cdot |Q_N|}{r_{PN}^2} = \frac{9 \cdot 10^9 \cdot 4 \cdot 10^{-17}}{0,01^2} = 36 \cdot 10^{-4} \text{ N}$$

$F_N = F_{PN} - F_{MN} \rightarrow F = 36 \cdot 10^{-4} - 9 \cdot 10^{-4}$

$F_N = 2,7 \cdot 10^{-3} \text{ N}$

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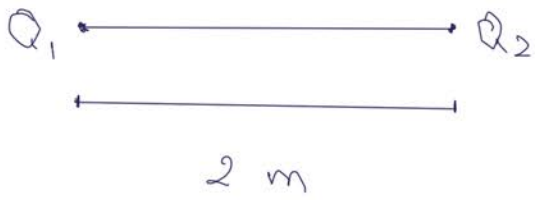
11) $Q_1 = +15\,\mu C$

$Q_2 = +6\,\mu C$



$$F_{13} - F_{23} = 0$$

$$F_{13} = F_{23}$$

$$F_{13} = \frac{K \cdot Q_1 \cdot Q_3}{x^2}$$

$$F_{23} = \frac{K \cdot Q_2 \cdot Q_3}{y^2}$$

$$\frac{K \cdot Q_2 \cdot Q_3}{y^2} = \frac{K \cdot Q_1 \cdot Q_3}{x^2}$$

$$\frac{Q_2}{y^2} = \frac{Q_1}{x^2} \qquad \frac{Q_2}{(2-x)^2} = \frac{Q_1}{x^2}$$

$$\frac{15}{x^2} = \frac{6}{(2-x)^2}$$

$$15 \cdot (2-x)^2 = 6x^2$$

$$(2-x) \cdot (2-x)$$

$$4 - 2x - 2x + x^2$$

$$15(4 - 4x + x^2)$$

$$60 - 60x + 15x^2$$

$$60 - 60x + 9x^2 = 0$$

$$\Delta = -60^2 - 4 \cdot 9 \cdot 60$$

$$\Delta = 3600 - 2160$$

$$\Delta = 1440$$

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11 pt 2)

$$x = \frac{-b \pm \sqrt{\Delta}}{2.a}$$

$$x = \frac{60 \pm \sqrt{1440}}{18}$$

$$x = \frac{2(5 - \sqrt{10})}{3} \cong 1,226$$

$$x = 1,226 \text{ m}$$

$$dQ_3 \cong 2\text{m} - 1,226\text{ m}$$

$$dQ_3 \cong 0,774$$

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