

Nome: Cacildo Erasmo Mabunda

Código: 2019483

1.

Dados

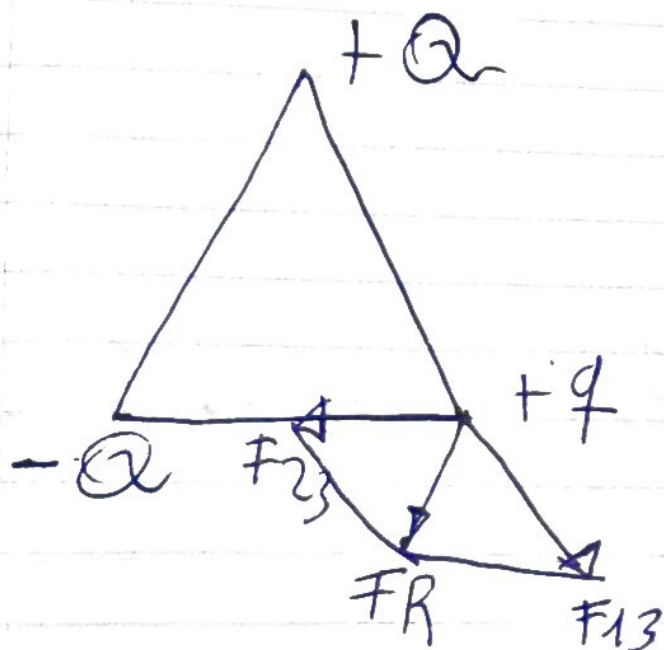
F/A

$$d = 20 \text{ cm} = 0,2 \text{ m}$$

$$+q_1 = 6 \text{ nC} = 6 \cdot 10^{-6} \text{ C}$$

$$+Q_2 = 8 \text{ nC} = 8 \cdot 10^{-6} \text{ C}$$

$$-Q_3 = 7 \text{ nC} = 7 \cdot 10^{-6} \text{ C}$$



$$F_{13} = K \frac{|Q_1| |Q_3|}{r^2}$$

$$F_{13} = 9 \cdot 10^9 \frac{6 \cdot 10^{-6} \cdot 7 \cdot 10^{-6}}{(0,2)^2}$$

$$F_{13} = 9 \cdot 10^9 \frac{6 \cdot 10^{-6} \cdot 7 \cdot 10^{-6}}{0,04}$$

$$F_{13} = 9450 \cdot 10^{-3} \text{ N}$$

$$F_{23} = K \frac{|Q_2| |Q_3|}{r^2}$$

$$F_{23} = 9 \cdot 10^9 \frac{8 \cdot 10^{-6} \cdot 7 \cdot 10^{-6}}{(0,2)^2}$$

$$F_{23} = 9 \cdot 10^9 \frac{8 \cdot 10^{-6} \cdot 7 \cdot 10^{-6}}{0,04}$$

$$F_{23} = 12600 \cdot 10^{-3} \text{ N}$$

2. Dados

FIR

$$d = 4 \text{ m}$$

$$Q_1 = Q_2 = 6 \cdot 10^{-6} \text{ C}$$

$$E_1 = -E_2$$

$$\frac{k_0 |Q_1|}{d_1^2} = -\frac{k_0 |Q_2|}{d_2^2}$$

$$\frac{6 \cdot 10^{-6}}{x^2} = -\frac{6 \cdot 10^{-6}}{(x+4)^2}$$

$$x^2 = (x+4)^2$$

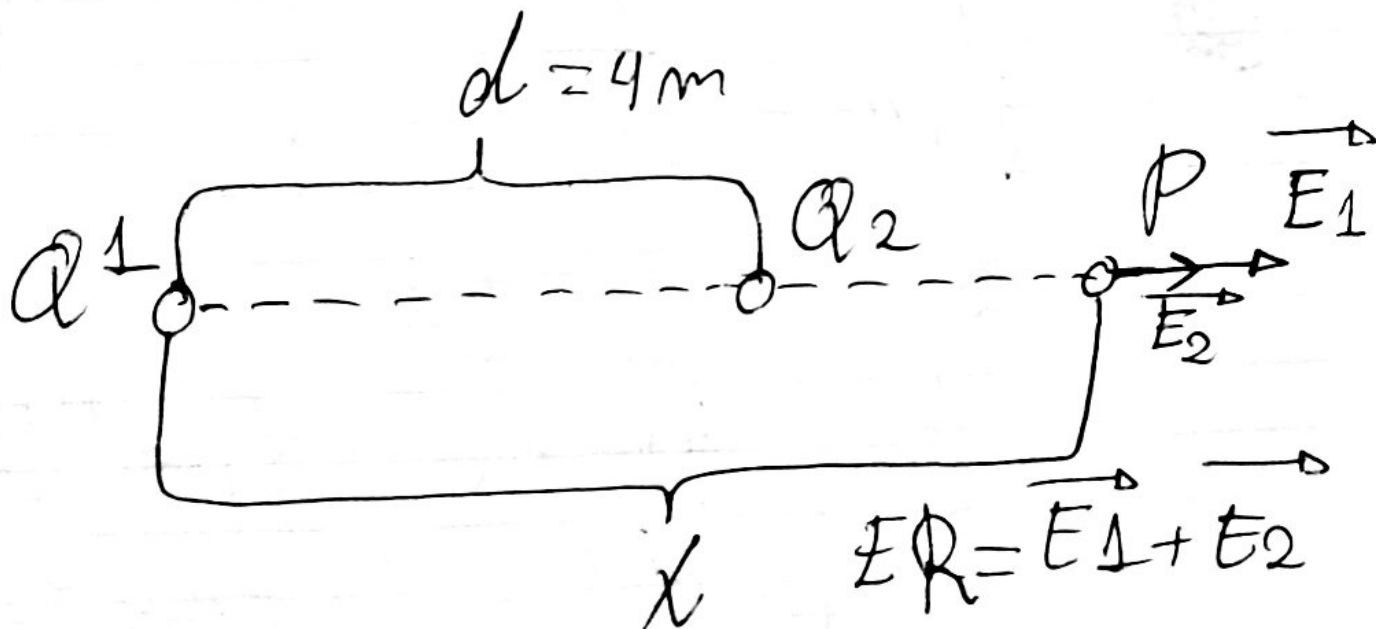
$$x^2 = (x^2 + 2x + 4 + 4^2) -$$

$$x^2 = (x^2 + 8x + 16) -$$

$$0 = 8x + 16$$

$$-8x = 16 (-1)$$

$$\boxed{x = +2 \text{ m}}$$



4)  
(cont.)

$$F_R = \sqrt{F_{13}^2 + F_{23}^2 + 2 F_{13} \cdot F_{23} \cos 120^\circ}$$

$$F_R = \sqrt{9450^2 + 12600^2 + 2 \cdot 9450 \cdot 12600 \cos 120^\circ}$$

$$F_R = \sqrt{9450^2 + 12600^2 + 2 \cdot 9450 \cdot 12600 \left(-\frac{1}{2}\right)}$$

$$F_R = \sqrt{9450^2 + 12600^2 - 9450 \cdot 12600}$$

$$F_R = \sqrt{9450^2 + 12600^2 - 119070000}$$

$$F_R = \sqrt{89302500 + 158760000 - 119070000}$$

$$F_R = 11357,48652 \text{ N}$$

3. a) Dados

$$Q_1 = 4 \cdot 10^{-8} \text{ C}$$

$$Q_2 = -4 \cdot 10^{-8} \text{ C}$$

$$d_1 = 10 \text{ cm} = 10 \cdot 10^{-2} \text{ m}$$

$$d_2 = 10 \text{ cm} = 10 \cdot 10^{-2} \text{ m}$$

$$d'_1 = 6 \text{ cm} = 6 \cdot 10^{-2} \text{ m}$$

$$d'_2 = 4 \text{ cm} = 4 \cdot 10^{-2} \text{ m}$$

F/R.

$$V_{a1} = \frac{K Q_1}{d_1}$$

$$V_{a1} = \frac{9 \cdot 10^9 \cdot 4 \cdot 10^{-8}}{10 \cdot 10^{-2}}$$

a)  $V_{a1} = ?$

b)  $V_{b1} = ?$

$$V_{a1} = \frac{36 \cdot 10^1}{10 \cdot 10^{-2}}$$

$$V_{a1} = 3,6 \cdot 10^3 \text{ V}$$

$$V_{a2} = \frac{K Q_2}{d_2}$$

$$V_{a2} = \frac{9 \cdot 10^9 \cdot (-4 \cdot 10^{-8})}{10 \cdot 10^{-2}}$$

$$V_{a2} = \frac{-36 \cdot 10^1}{10 \cdot 10^{-2}}$$

$$V_{a2} = -3,6 \cdot 10^3 \text{ V}$$

$$V_a = V_{a1} + V_{a2}$$

$$V_a = 3,6 \cdot 10^3 + (-3,6 \cdot 10^3)$$

$$V_a = 0$$

$$3\ b) \ V_{b1} = \frac{k Q_1}{d_1}$$

$$V_{b1} = \frac{9 \cdot 10^9 \cdot 4 \cdot 10^{-8}}{6 \cdot 10^2}$$

$$V_{b1} = \frac{36 \cdot 10^1}{6 \cdot 10^2}$$

$$V_{b1} = 6 \cdot 10^3 \text{ V}$$

$$V_{b2} = \frac{k Q_2}{d'_2}$$

$$V_{b2} = \frac{9 \cdot 10^9 \cdot (-4 \cdot 10^{-8})}{4 \cdot 10^2}$$

$$V_{b2} = \frac{-36 \cdot 10^1}{4 \cdot 10^2}$$

$$V_{b2} = -9 \cdot 10^3 \text{ V}$$

$$V_b = V_{b1} + V_{b2}$$

$$V_b = 6 \cdot 10^3 + (-9 \cdot 10^3)$$

$$V_b = -3 \cdot 10^3 \text{ V}$$

4 Dados

F/R

$$q = e = -1,6 \cdot 10^{-19} \quad F = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 \cdot 10^6 & 3 \cdot 10^6 & 0 \\ 0,030 & -0,15 & 0 \end{vmatrix}$$

$$F = -[(0,15)(2 \cdot 10^6)(-1,6 \cdot 10^{-19}) - (0,030)(3 \cdot 10^6)(-1,6 \cdot 10^{-19})]$$

$$F = 1,6 \times 10^6 \times 10^{-19} \cdot (0,15 \cdot 2 + 0,03 \cdot 3)$$

$$F = 1,6 \cdot 10^6 \cdot 10^{-19} \cdot (0,3 + 0,09)$$

$$F = 1,6 \cdot 10^6 \cdot 10^{-19} \cdot 0,39$$

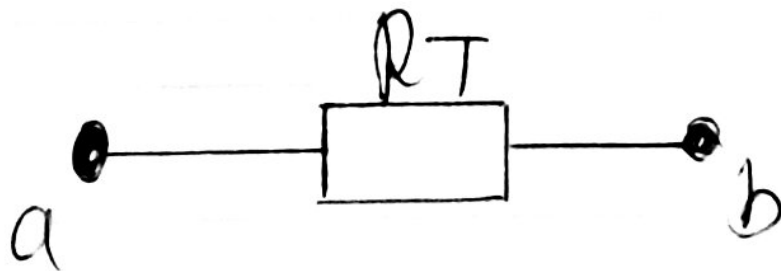
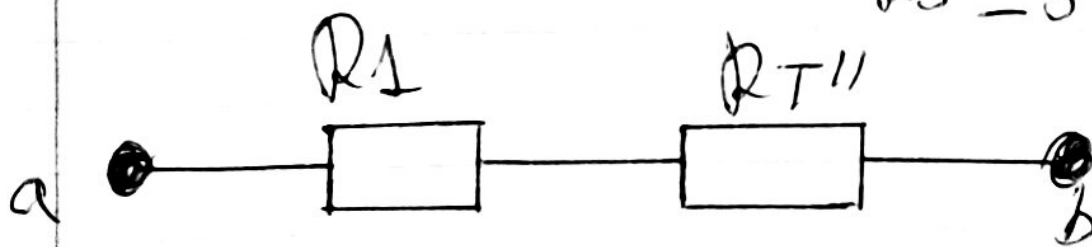
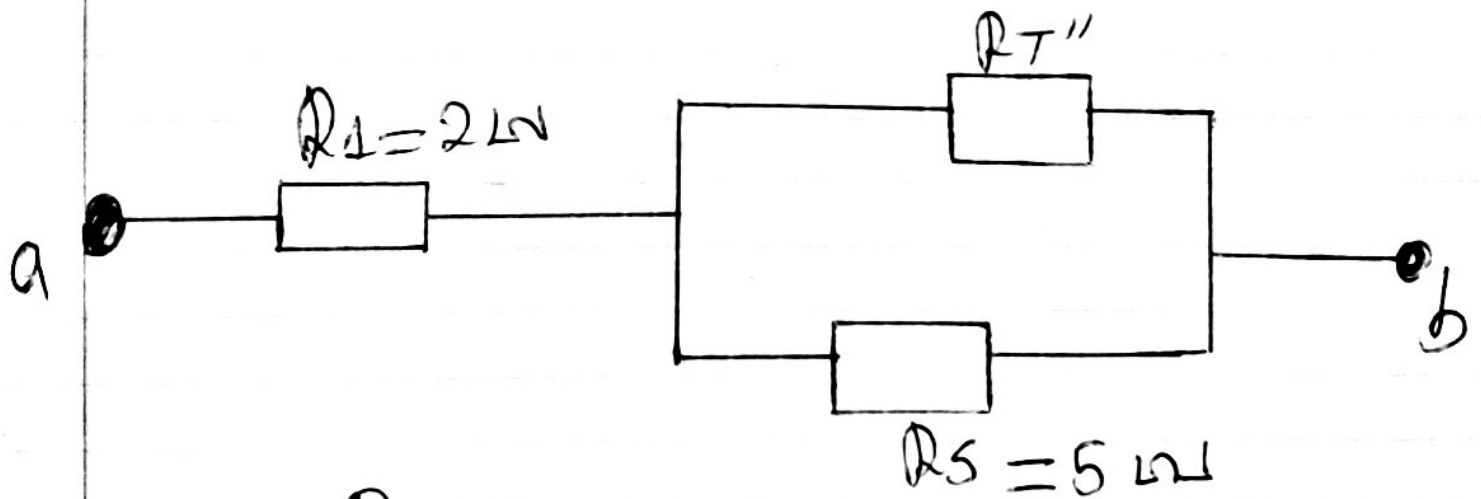
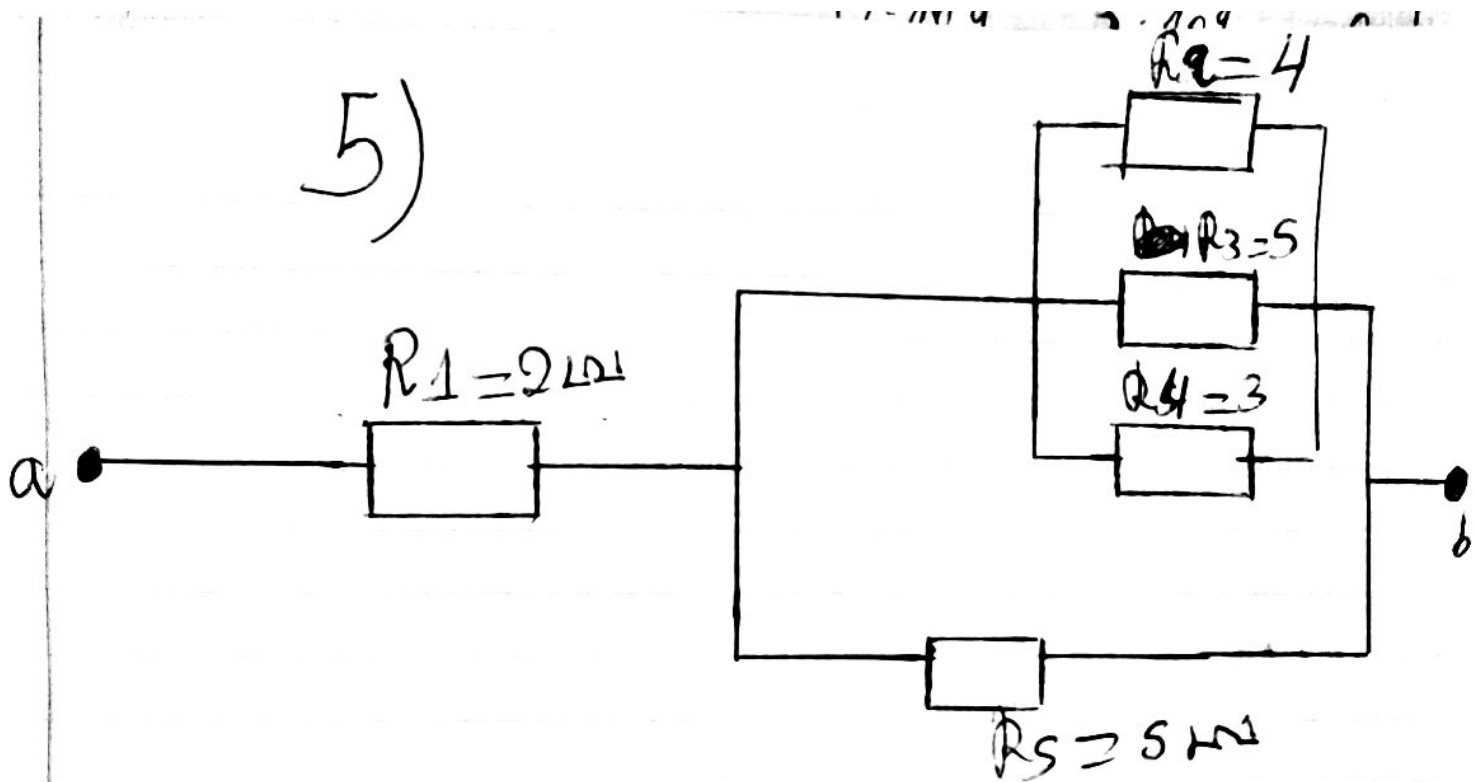
$$F = 0,624 \cdot 10^{-13}$$

$$F = 6,24 \cdot 10^{-14} \text{ N}$$

O módulo é de  $6,24 \cdot 10^{-14} \text{ N}$ , a direção e sentido é a da eixo  $z$  positiva.

Alexandre Vishell

5)





$$\frac{1}{R_{T1}} = \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

$$\frac{1}{R_{T1}} = \frac{1}{4} + \frac{1}{5} + \frac{1}{3}$$

$$R_{T1} = -1 \left( \frac{15 + 12 + 20}{60} \right)$$

$$R_{T1} = \frac{60}{47} = 1,27 \Omega$$

$$\frac{1}{R_{T2}} = \frac{1}{R_{T1}} + \frac{1}{R_5}$$

$$\frac{1}{R_{T2}} = \frac{1}{\frac{60}{47}} + \frac{1}{5}$$

$$\frac{1}{R_{T2}} = \frac{47}{60} + \frac{1}{5}$$

$$\frac{1}{R_{T2}} = \frac{47 + 12}{60}$$

$$R_{T2} = \frac{60}{59} = 1,01 \Omega$$

$$R_T = R_1 + R_T''$$

$$R_T = 2 \Omega + \frac{60}{59}$$

$$R_T = \frac{118 + 60}{59} = \frac{178}{59}$$

$$R_T = 3,01 \Omega$$

$$U_T'' = R_T'' \cdot I_T$$

$$U_T'' = \frac{60}{59} \cdot 40 = \frac{2400}{59} = 40,6 \text{ V}$$

$$U_2 = U_3 = U_4 = U_5 = U'' = 40,6 \text{ V}$$

$$U_1 = R_1 \cdot I_T$$

$$U_1 = 2 \cdot 40 \text{ A} = 80 \text{ A}$$

$$R = \frac{U}{I} \Leftrightarrow I = \frac{U}{R}$$

$$I_2 = \frac{U''}{R_2} = \frac{40,6V}{4\Omega} = 10,15A$$

$$I_3 = \frac{U''}{R_3} = \frac{40,6V}{5\Omega} = 8,12A$$

$$I_4 = \frac{U''}{R_4} = \frac{40,6V}{3\Omega} = 13,53A$$

$$I_5 = \frac{U''}{5} = \frac{40,6V}{3\Omega} = 8,2A$$

$$I_1 = \frac{U_1}{R_1} = \frac{80}{2} = 40A$$