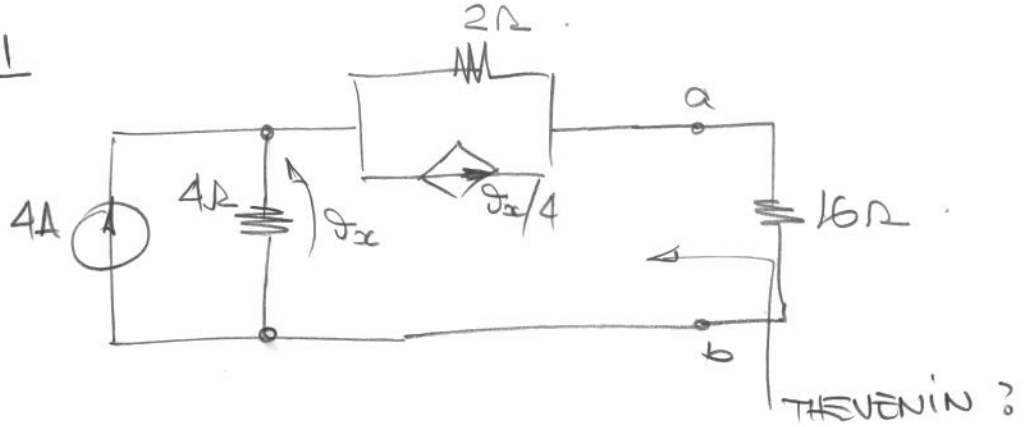
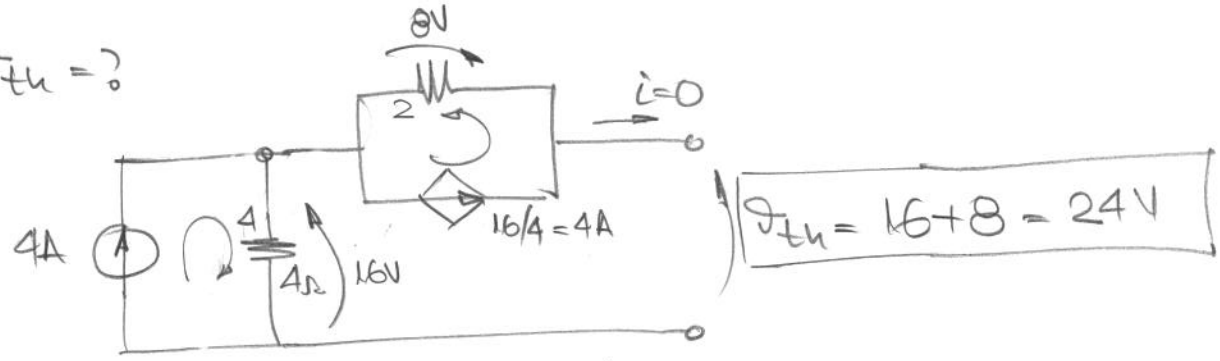
EASIB – 2º SEM 2010

TURMA A – 1º PROVA

Q1



a) $v_{th} = ?$

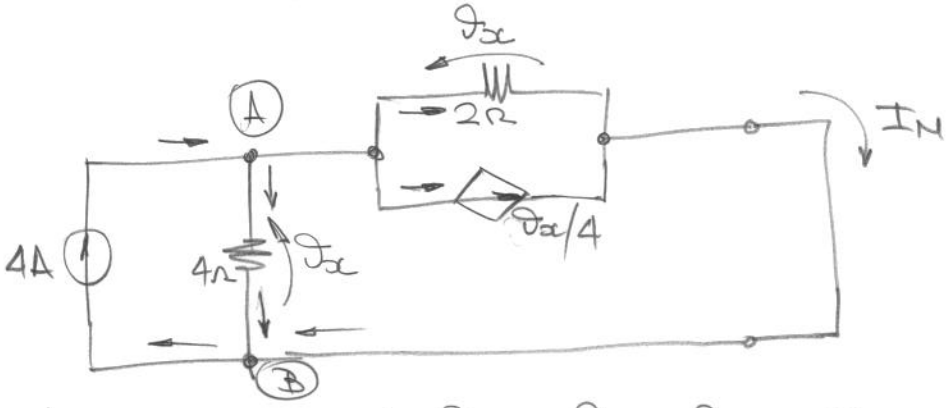


$$v_{th} = 16 + 8 = 24\,V$$

b) R_{th} – Como há uma fonte dependente, usaremos

$$R_{th} = v_{th}/I_N$$

$I_N = ?$



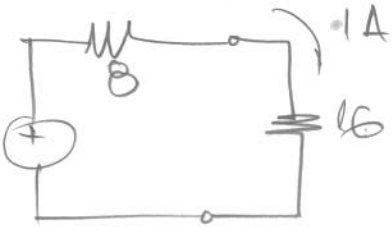
NO NÓ A: LKC → $4 - \frac{v_x}{4} - \frac{v_x}{2} - \frac{v_x}{4} = 0$

ou $v_x = 4\,V$

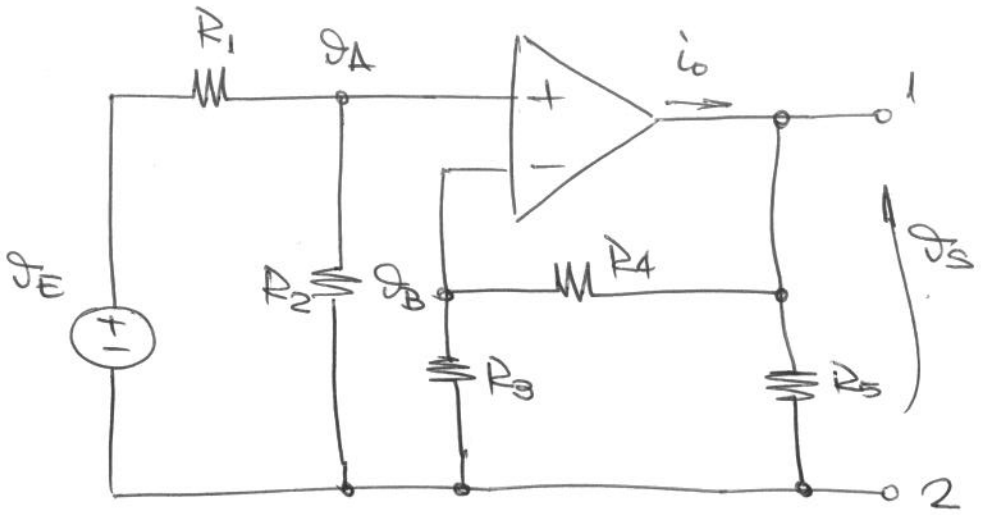
PORTANTO, EM B RESULTA: $-4 + I_N + \frac{4}{4} = 0$

$$I_N = 3\,A$$

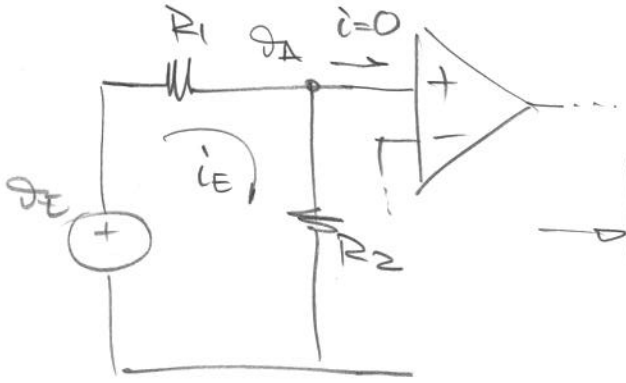
$$\therefore R_{th} = \frac{24}{3}\,\Omega = 8\,\Omega$$



Q2

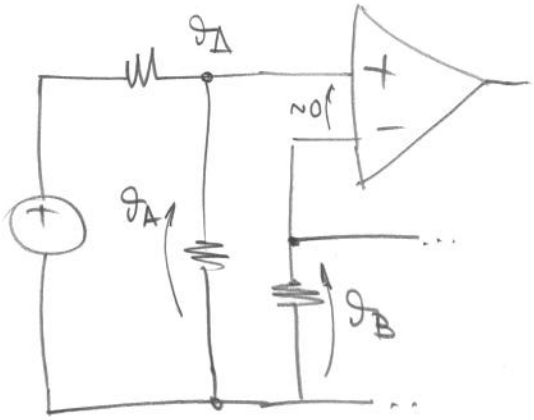


a) $\vartheta_A = ?$



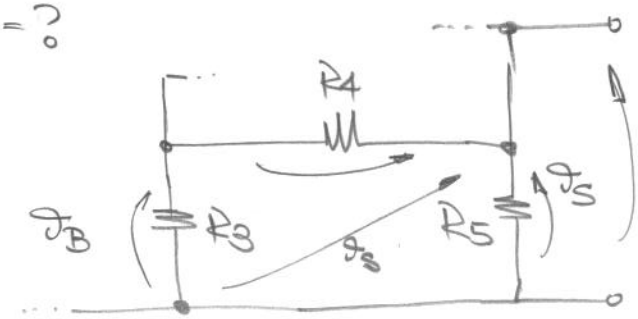
$$\vartheta_A = \frac{R_2}{R_1 + R_2}\,\vartheta_E$$

b) $\vartheta_B = ?$



$$\vartheta_B = \vartheta_A = \frac{R_2}{R_1 + R_2}\,\vartheta_E$$

a) $\vartheta_C = ?$

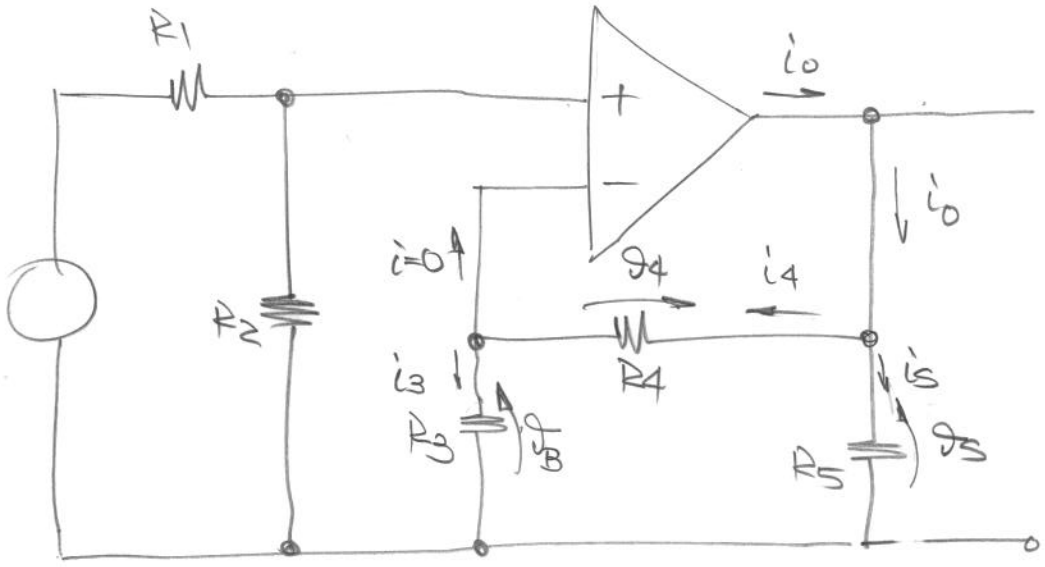


$$\vartheta_B = \vartheta_S \cdot \frac{R_3}{R_3 + R_4}$$

$$\therefore \vartheta_S = \vartheta_B \frac{R_3 + R_4}{R_3}$$

$$\vartheta_S = \left(\frac{R_2}{R_2 + R_1}\right)\left(\frac{R_3 + R_4}{R_3}\right)\vartheta_E$$

a)



DO CIRCUITO, TEMOS $i_o = i_4 + i_s$.

COMO $i_3 = i_4$, ENTÃO $\vartheta_3 + \vartheta_4 = \vartheta_S$ E

$$i_4 = \frac{\vartheta_S}{R_3 + R_4}$$

ALÉM DISSO, $i_s = \vartheta_S / R_5$. PORTANTO,

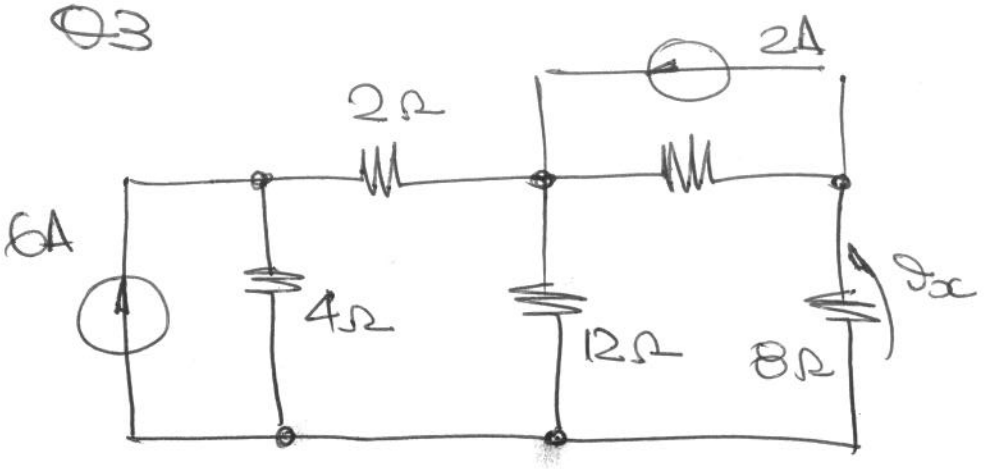
$$i_o = \left(\frac{1}{R_3 + R_4} + \frac{1}{R_5} \right) \vartheta_S$$

$$\boxed{i_o = \left(\frac{1}{R_3 + R_4} + \frac{1}{R_5} \right) \left(\frac{R_2}{R_2 + R_1} \right) \left(\frac{R_3 + R_4}{R_3} \right) \vartheta_E}$$

OU

$$\boxed{i_o = \left(\frac{R_3 + R_4 + R_5}{R_5} \right) \left(\frac{R_2}{R_1 + R_2} \right) \frac{1}{R_3} \vartheta_E}$$

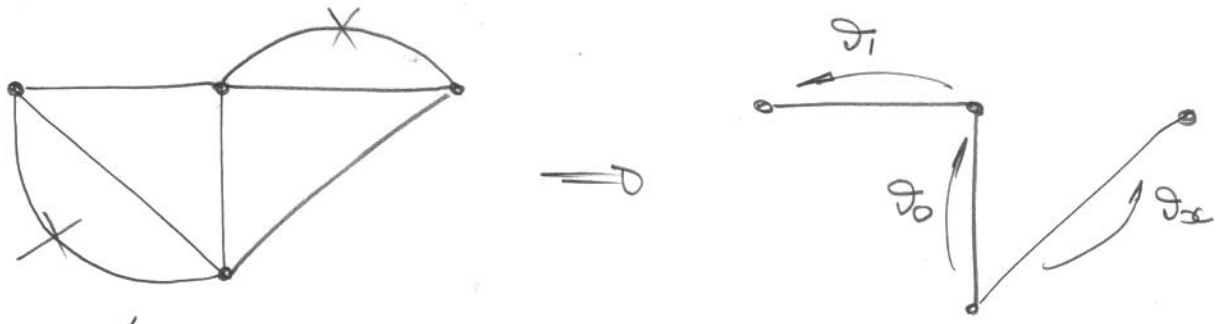
Q3



$\vartheta_x = ?$

GRAFO:

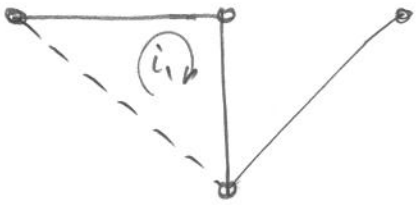
ÁRVORE:

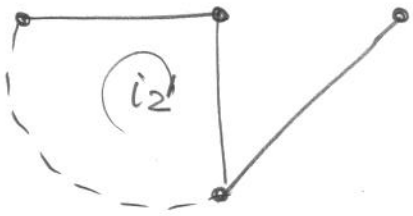


N = 4 NÓS
B = 7 BIPOLOS

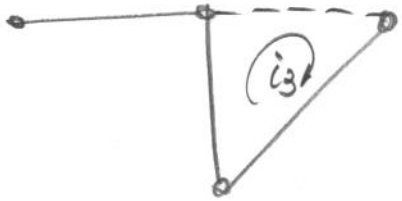
L = B − N + 1 = 4 ENLACES

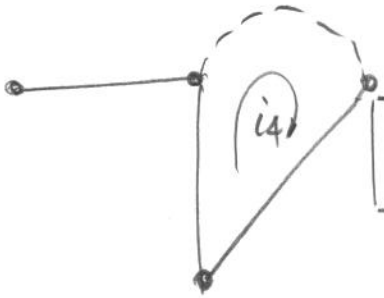
∴ 4 CORRENTES DE ENLACE.





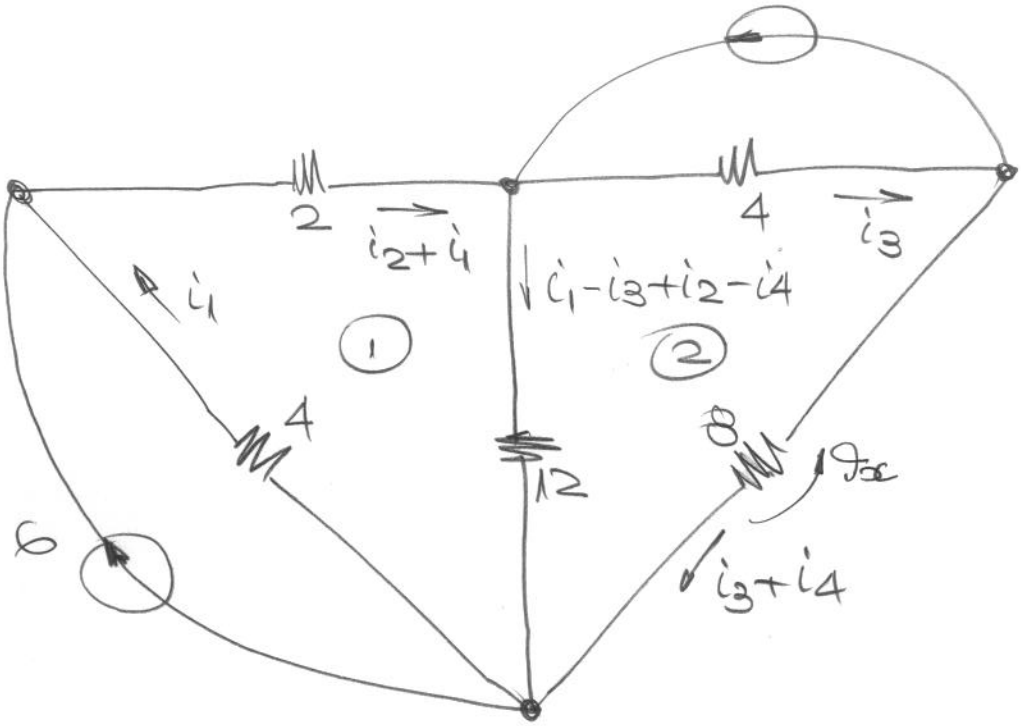
$i_2 = 6A$





$i_4 = -2A$

AGORA, USANDO ESSAS CORRENTES NO CIRCUITO



USANDO A LKT NA MALHA (1), JUNTAMENTE COM $i_2 = 6A$ e $i_4 = -2A$, TEMOS

$$\boxed{3i_1 - 2i_3 = -18}$$

P/ A MALHA (2), TEMOS: $\boxed{6i_1 - 12i_3 = -56}$

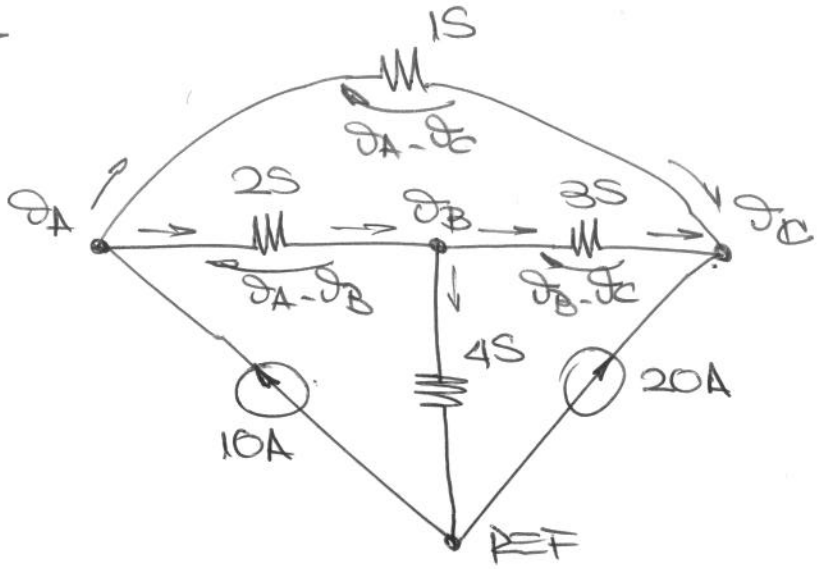
RESOLVENDO O SISTEMA

$$\begin{cases} 3i_1 - 2i_3 = -18 \\ 6i_1 - 12i_3 = -56 \end{cases} \Rightarrow \begin{matrix} i_1 = -13/3\ A \\ i_3 = 5/2\ A \end{matrix}$$

A TENSÃO v_x É

$$\boxed{v_x = 8 \times (i_3 + i_4) = 8\,(2{,}5 - 2) = 4V}$$

Q4



a) EQUAÇÕES NODAIS:

NÓ A: $10 - 2(\vartheta_A - \vartheta_B) - (\vartheta_A - \vartheta_C) = 0$

$$\boxed{-3\vartheta_A + 2\vartheta_B + \vartheta_C = -10}$$

NÓ B: $2(\vartheta_A - \vartheta_B) - 4\vartheta_B - 3(\vartheta_B - \vartheta_C) = 0$

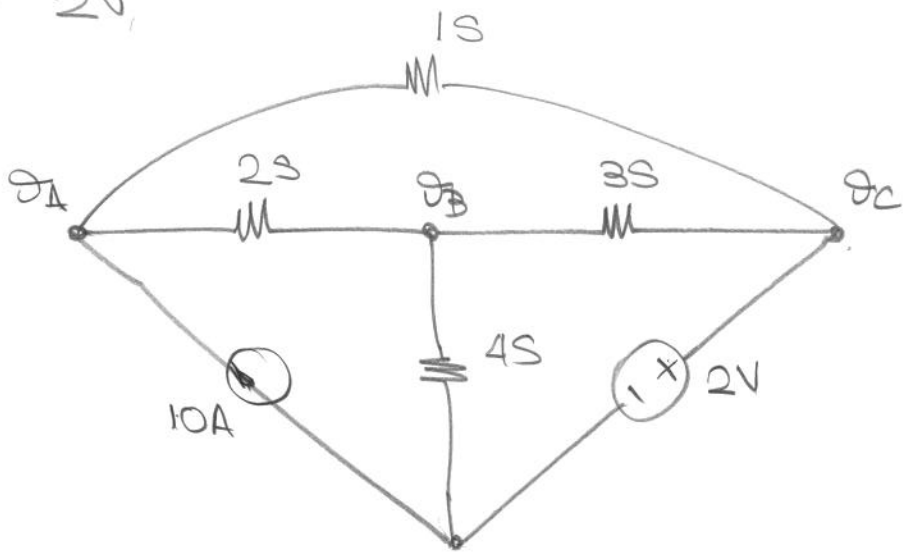
$$\boxed{2\vartheta_A - 9\vartheta_B + 3\vartheta_C = 0}$$

NÓ C: $(\vartheta_A - \vartheta_C) + 3(\vartheta_B - \vartheta_C) + 20 = 0$

$$\vartheta_A + 3\vartheta_B - 4\vartheta_C = -20$$

$$\begin{cases} -3\vartheta_A + 2\vartheta_B + \vartheta_C = -10 \\ 2\vartheta_A - 9\vartheta_B + 3\vartheta_C = 0 \\ \vartheta_A + 3\vartheta_B - 4\vartheta_C = -20 \end{cases} \Longleftarrow$$

b) SUBSTITUIR O GERADOR DE 20A POR UM DE 2V



AS EQ. REFERENTES AOS NÓS A E B NÃO MUDAM. NO ENTANTO, AGORA TEMOS $\vartheta_C = 2V$. PORTANTO, AS EQ. DOS NÓS A E B FICAM

$$-3\vartheta_A + 2\vartheta_B + 2 = -10 \rightarrow -3\vartheta_A + 2\vartheta_B = -12 \quad (1)$$

$$2\vartheta_A - 9\vartheta_B + 6 = 0 \rightarrow 2\vartheta_A - 9\vartheta_B = -6 \quad (2)$$

$$-3\vartheta_A + 2\vartheta_B = -12 \rightarrow \vartheta_B = -\frac{12 + 3\vartheta_A}{2}$$

$$2\vartheta_A - 9\left(-\frac{12+3\vartheta_A}{2}\right) = -6$$

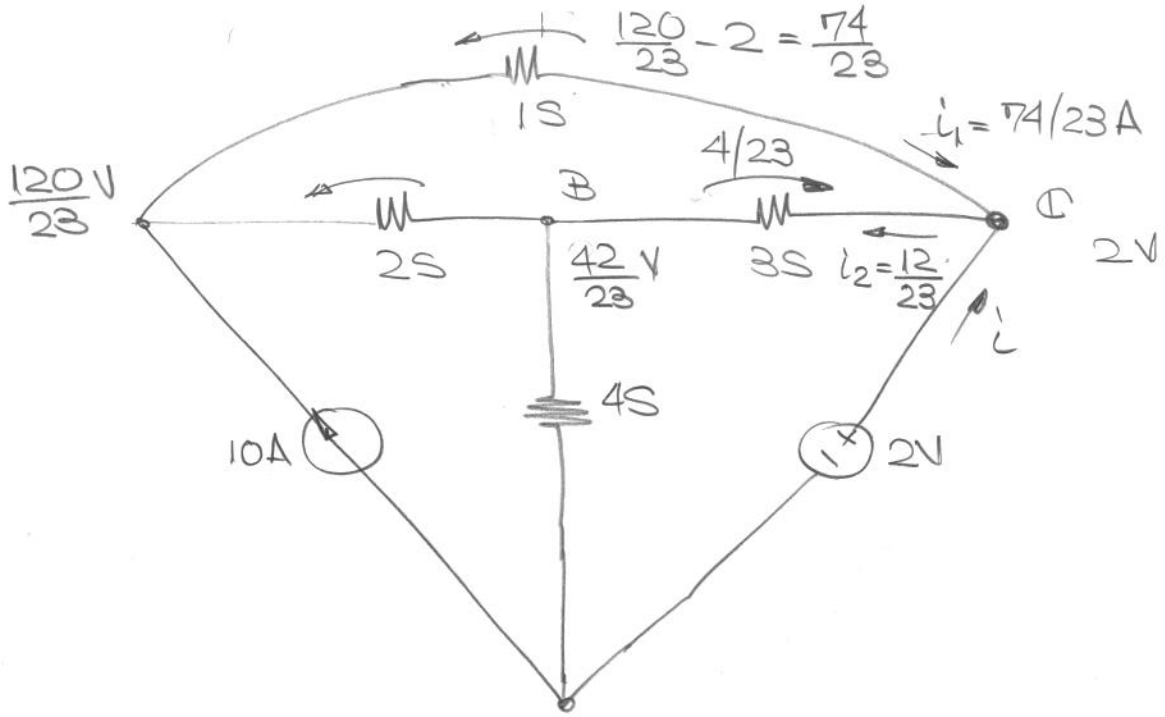
$$2\vartheta_A + 54 - \frac{27}{2}\vartheta_A = -6 \rightarrow \vartheta_A\left(2 - \frac{27}{2}\right) = -60$$

$$\boxed{\vartheta_A = -60 \cdot \frac{2}{(4-27)} = \frac{120}{23}\,V}$$

POTÊNCIA DO GERADOR DE 10A:

$$\boxed{P = 10A \times \frac{120}{23}V = \frac{1200}{23}\,W}$$

c) ANÁLISE DA FONTE DE TENSÃO



PARA SABERMOS SE A FONTE DE 2V FORNECE OU DISSIPA POTÊNCIA TEMOS QUE DETERMINAR A POLARIDADE DE SUA CORRENTE (i)

PARA TAL PRECISAMOS, ANTES, DAS TENSÕES

$$v_B = -\frac{12 + 3.120/23}{2} = -6 + \frac{3.60}{23} =$$

$$= \frac{-6.23 + 180}{23} = \frac{42}{23} \rightarrow \boxed{v_B = 42/23\,V}$$

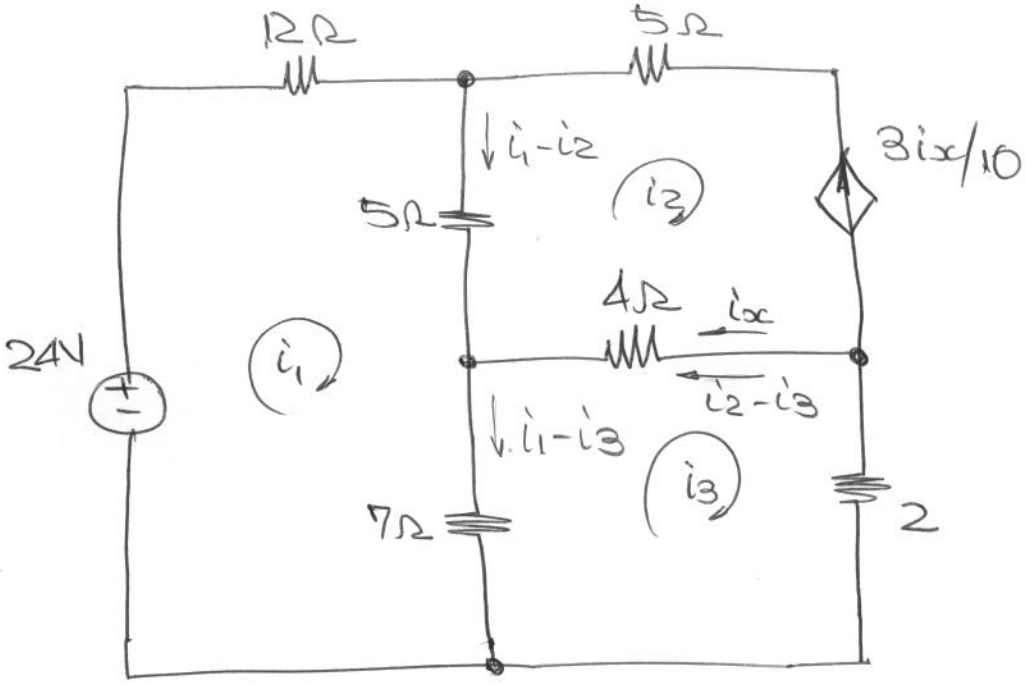
PORTANTO, NO NÓ C TEMOS

$$i_1 - i_2 + i = 0 \rightarrow \boxed{i = i_2 - i_1 = \frac{12}{23} - \frac{74}{23} = -\frac{62}{23}\,A}$$

COMO A CORRENTE ESTÁ EFETIVAMENTE ENTRANDO NO TERMINAL DE MAIOR POTENCIAL DO GERADOR, O GERADOR DE 2V DISSIPA POTÊNCIA.

05

ANÁLISE DE MALHAS



MALHA 1:

$$24 - 12i_1 - 5(i_1 - i_2) - 7(i_1 - i_3) = 0$$

$$\boxed{-24i_1 + 5i_2 + 7i_3 = -24}$$

MALHA 2: $i_2 = -\frac{3}{10}(i_2 - i_3) \rightarrow \boxed{13i_2 - 3i_3 = 0}$

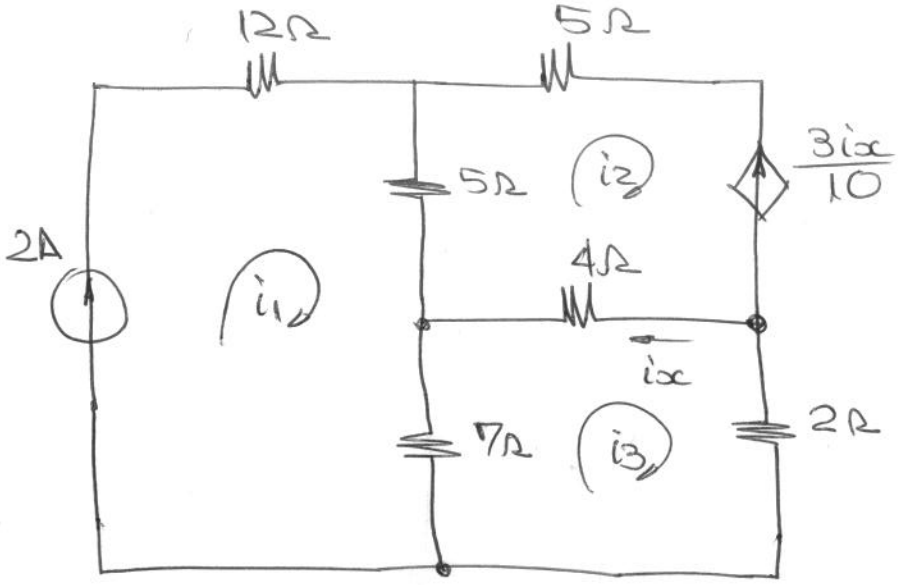
MALHA 3:

$$-7(i_1 - i_3) - 4(i_2 - i_3) + 2i_3 = 0$$

$$\boxed{-7i_1 - 4i_2 + 13i_3 = 0}$$

$$\begin{cases} -24i_1 + 5i_2 + 7i_3 = -24 \\ 13i_2 - 3i_3 = 0 \\ -7i_1 - 4i_2 + 13i_3 = 0 \end{cases}$$

b) Correntes de malha



$i_1 = 2A$ ✗

MALHA 3: $-7i_1 - 4i_2 + 13i_3 = 0$

$\rightarrow \boxed{-4i_2 + 13i_3 = 14}$

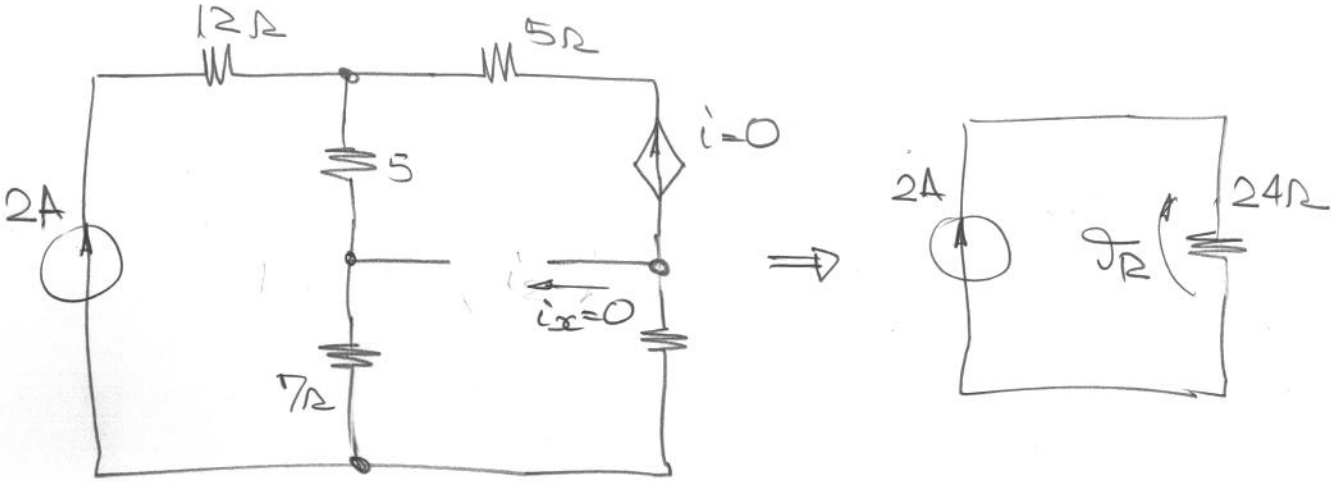
MALHA 2 $\boxed{13i_2 - 3i_3 = 0} \rightarrow i_3 = \frac{13}{3} i_2$

$$-4i_2 + 13 \cdot \frac{13}{3} i_2 = 14$$

$$\frac{-12 + 169}{3} i_2 = 14 \rightarrow \boxed{i_2 = \frac{3 \cdot 14}{157} = \frac{42}{157} A}$$ ✗

$$\boxed{i_3 = \frac{13}{3} \cdot \frac{42}{157} = \frac{182}{157} A}$$ ✗

c) Resistor de 4Ω rompeu-se. Qual a potência fornecida pela fonte de 2A



$v_R = 2 \times 24 = 48V \longrightarrow \boxed{P = 48 \times 2 = 96W}$