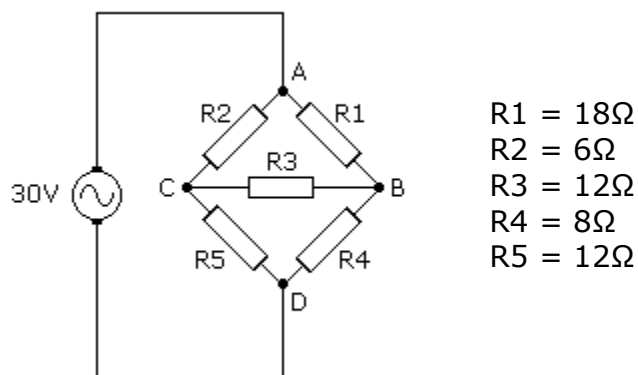


REDES EM Δ - Y (Triângulo - Estrela)

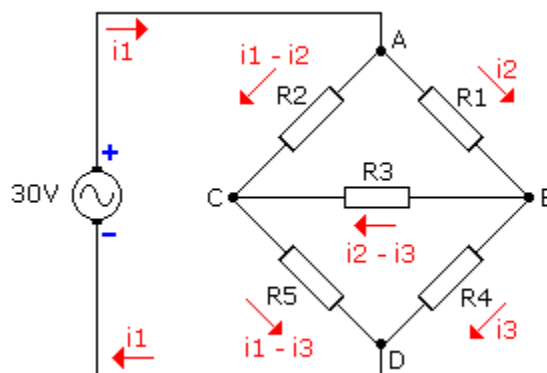
Exercícios resolvidos

Objetivos: aplicar as conversões Δ - Y e aplicar as Leis de Kirchhoff.

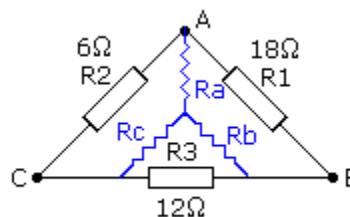
EXERCÍCIO 1: Dado o circuito abaixo, calcule a corrente e a tensão nos resistores:



Atribuindo as correntes (considerando a parte superior da fonte +):



Convertendo os pontos A, B e C em estrela:



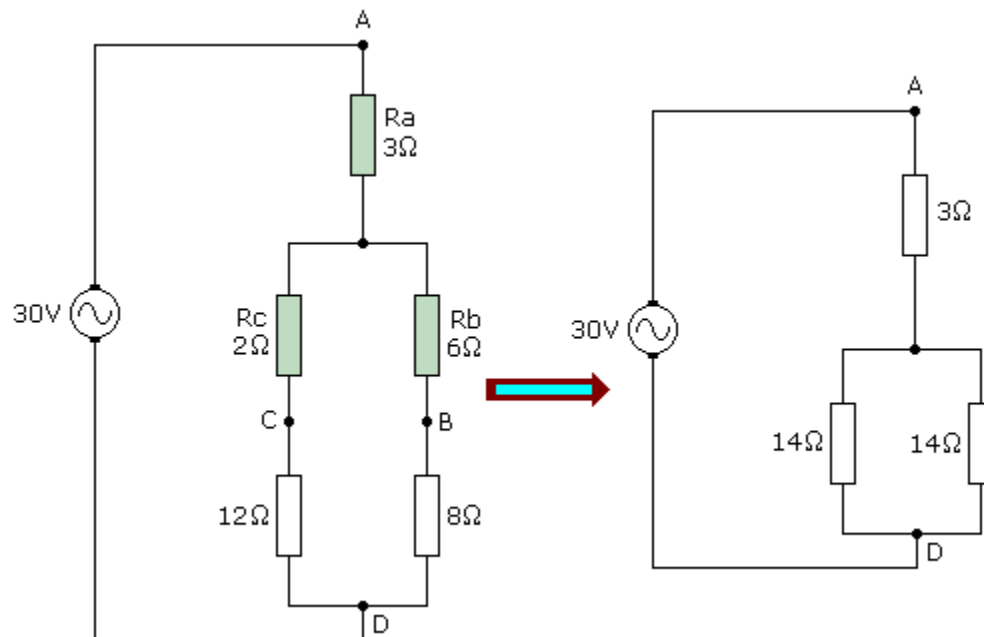
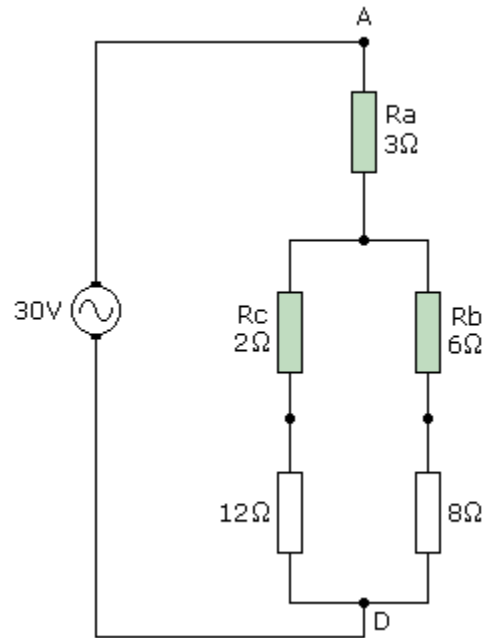
$$6 + 18 + 12 = 36 \text{ (índice para o denominador)}$$

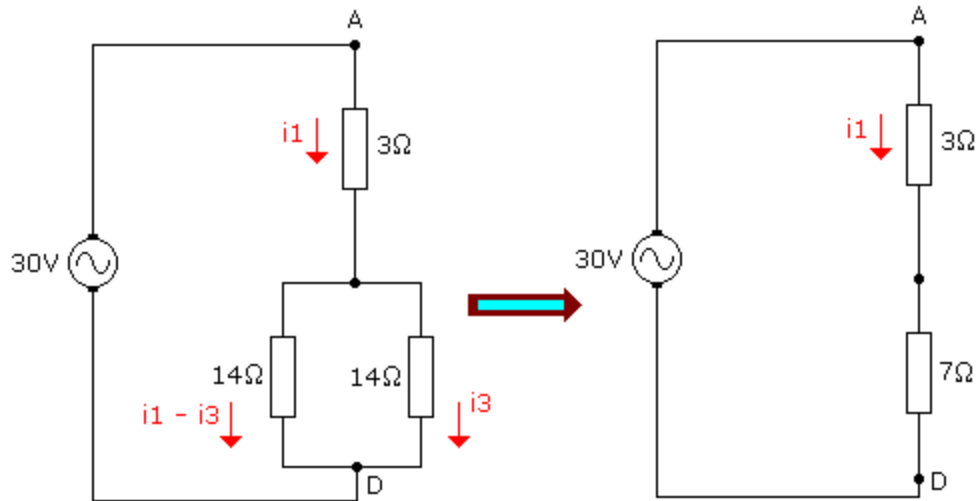
$$R_a = \frac{6 \cdot 18}{36} = \frac{108}{36} = 3\Omega$$

$$R_b = \frac{18 \cdot 12}{36} = \frac{216}{36} = 6\Omega$$

$$R_c = \frac{12 \cdot 6}{36} = \frac{72}{36} = 2\Omega$$

Daí então, teremos o seguinte circuito equivalente:

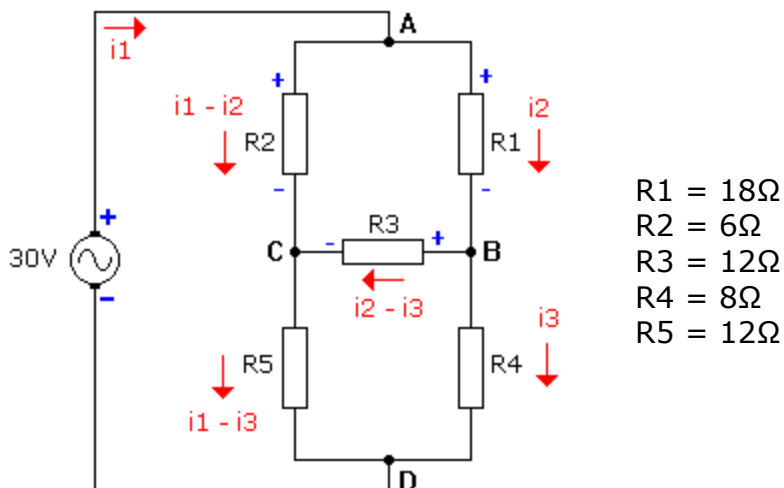




$$i_1 = \frac{30}{10} = 3A \text{ (a corrente } i_1 \text{ é a corrente total)}$$

$$i_3 = \frac{3 \cdot 14}{28} = \frac{42}{28} = 1,5A$$

Para calcular i_2 , aplica-se LKT (sentido horário) entre os pontos A, B, C A:



$$\begin{aligned}
 -18(i_2) - 12(i_2 - i_3) + 6(i_1 - i_2) &= 0 \\
 -18(i_2) - 12(i_2 - 1,5) + 6(3 - i_2) &= 0 \\
 -18(i_2) - 12i_2 + 18 + 18 - 6i_2 &= 0 \\
 -18i_2 - 12i_2 + 18 + 18 - 6i_2 &= 0 \\
 -36i_2 + 36 &= 0 \\
 -36i_2 &= -36 \Rightarrow i_2 = 1^a
 \end{aligned}$$

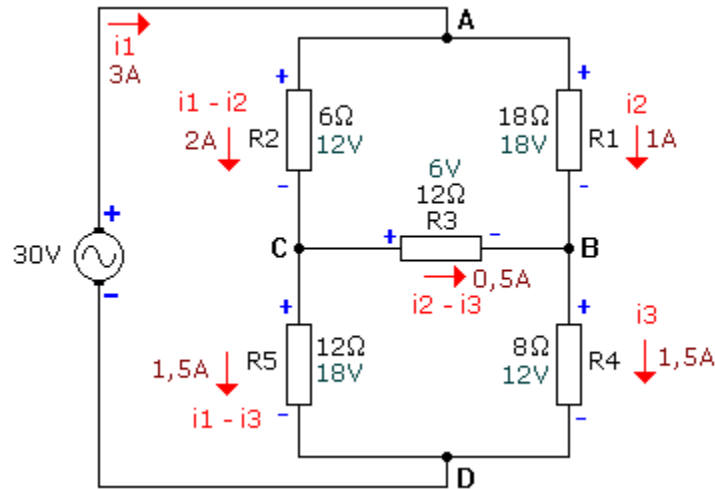
Temos então as seguintes correntes calculadas:

$$i_1 = 3A \rightarrow i_1 - i_2 = 3 - 1 = 2A$$

$$i_2 = 1A \rightarrow i_2 - i_3 = 1 - 1,5 = -0,5A \text{ (corrente flui de C para B)}$$

$$i_3 = 1,5A \rightarrow i_1 - i_3 = 3 - 1,5 = 1,5A$$

Veja a seguir o levantamento energético do circuito, com as tensões e correntes em cada resistor.



APLICANDO LKT:

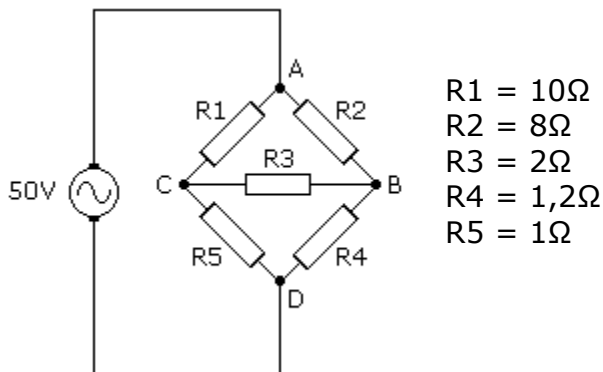
$$A - C - B - D \rightarrow 30 - 12 - 6 - 12 = 0$$

$$A - B - C - D \rightarrow 30 - 18 + 6 - 18 = 0$$

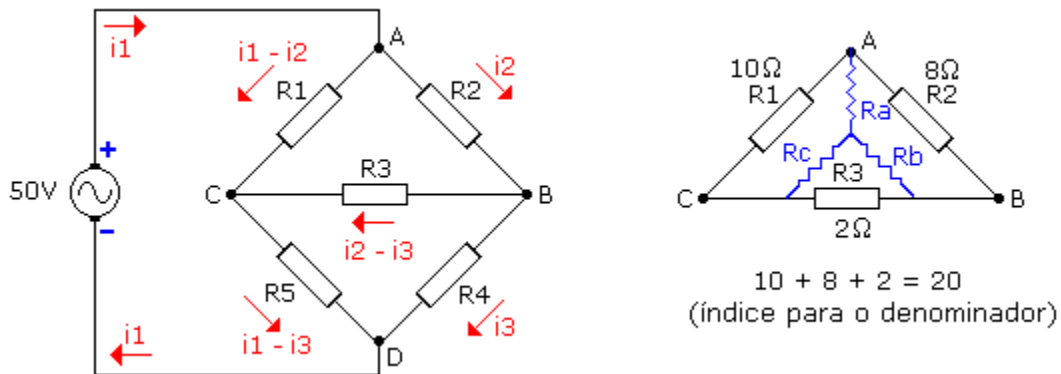
$$A - B - D \rightarrow 30 - 18 - 12 = 0$$

$$A - C - D \rightarrow 30 - 12 - 18 = 0$$

EXERCÍCIO 2: Dado o circuito abaixo, calcule a corrente e a tensão nos resistores:



Atribuindo as correntes (considerando a parte superior da fonte +):

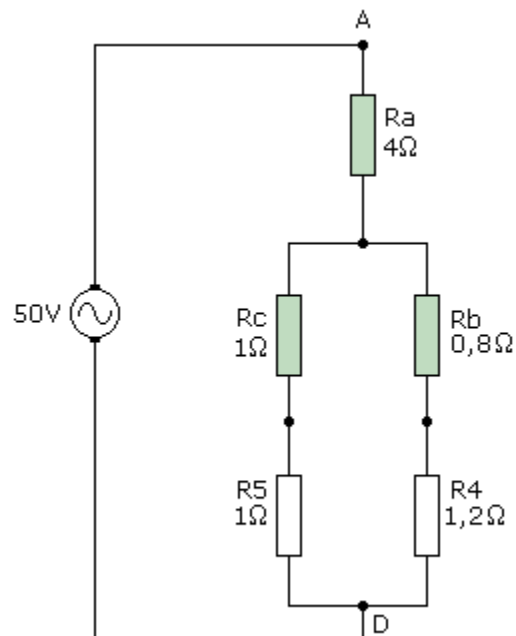


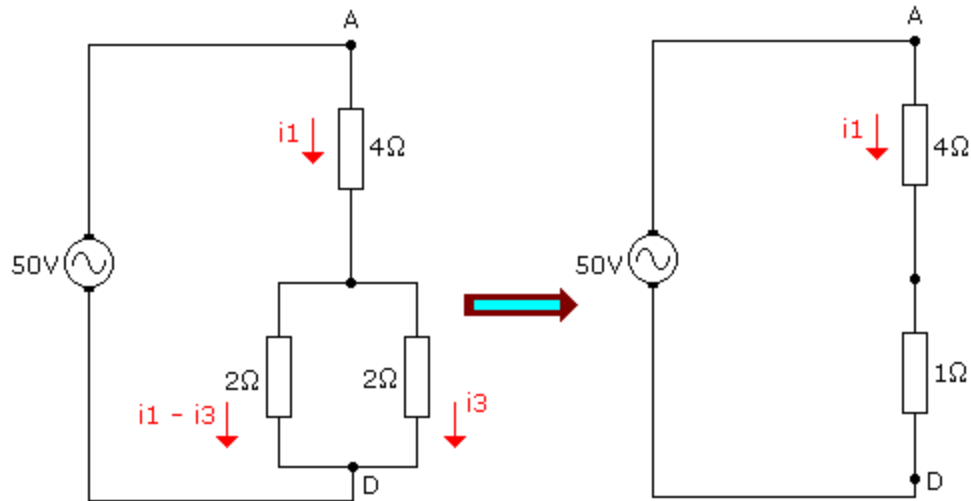
$$R_a = \frac{10 \cdot 8}{20} = \frac{80}{20} = 4\Omega$$

$$R_b = \frac{2 \cdot 8}{20} = \frac{16}{20} = 0,8\Omega$$

$$R_c = \frac{2 \cdot 10}{20} = \frac{20}{20} = 1\Omega$$

Daí então, teremos o seguinte circuito equivalente:



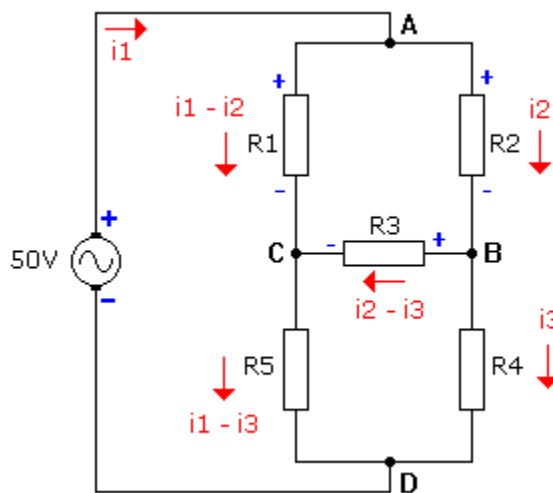


RT entre os pontos A e D = 5Ω

$$i_1 \text{ (corrente total)} = \frac{50}{5} = 10A$$

$$i_3 = \frac{10 \cdot 2}{4} = \frac{20}{4} = 5A$$

Percorrendo A, B, C, A para calcular i_2 : (saindo de A)



$$\begin{aligned} R_1 &= 10\Omega \\ R_2 &= 8\Omega \\ R_3 &= 2\Omega \\ R_4 &= 1,2\Omega \\ R_5 &= 1\Omega \end{aligned}$$

$$\begin{aligned} -8i_2 - 2(i_2 - i_3) + 10(i_1 - i_2) &= 0 \\ -8i_2 - 2i_2 + 2i_3 + 10i_1 - 10i_2 &= 0 \\ -8i_2 - 2i_2 + 2(5) + 10(10) - 10i_2 &= 0 \\ -20i_2 + 10 + 100 &= 0 \\ -20i_2 &= -110 \end{aligned}$$

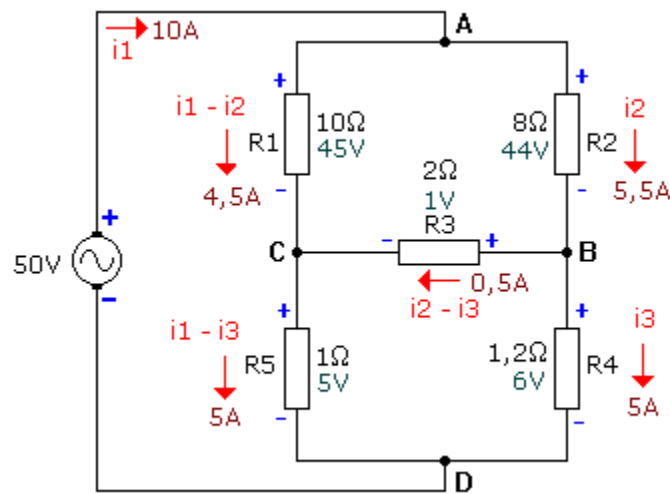
$$i_2 = \frac{110}{20} = 5,5A$$

Correntes calculadas:

$$i_1 = 10A \rightarrow i_1 - i_2 = 10 - 5,5 = 4,5A$$

$$i_2 = 5,5A \rightarrow i_2 - i_3 = 5,5 - 5 = 0,5A \text{ (de B para C)}$$

$$i_3 = 5A \rightarrow i_1 - i_3 = 10 - 5 = 5A$$



Aplicando LKT:

$$A, B, C, D: 50 - 44 - 1 - 5 = 0$$

$$A, B, D: 50 - 44 - 6 = 0$$

$$A, C, B, D: 50 - 45 + 1 - 6 = 0$$

$$A, C, D: 50 - 45 - 5 = 0$$