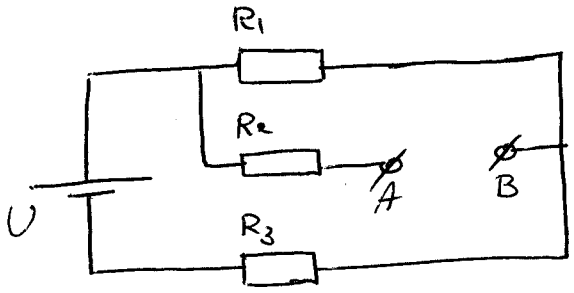
Thevenin & Norton.

1) Eeg:



$U = 24V$

$R_1 = 100\Omega$.

$R_2 = 20\Omega$

$R_3 = 300\Omega$.

Leer: U_{AB} met $R_{AB} = 200\Omega$, gebruik Thevenin

Opl:

A: Open klemspanning U_{AB}:

R_2 wordt niet door stroom doorlopen $\Rightarrow U_{AB} = U_{R_1} = U_{th}$

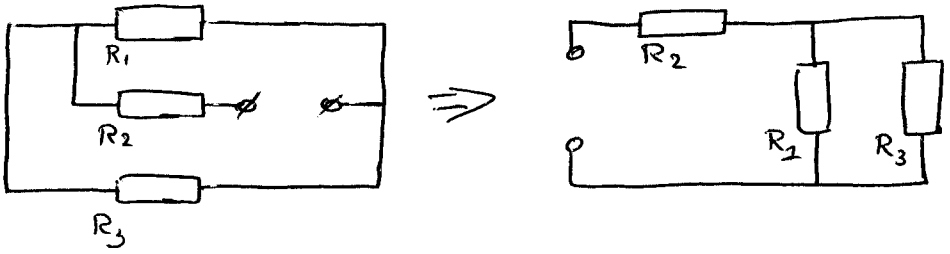
$\Rightarrow U_{R_1} = I \cdot R_1$ en $I = \frac{U}{R_1 + R_3}$

$\Rightarrow$ combineren: $U_{R_1} = \frac{U}{R_1 + R_3} \cdot R_1$

$= \frac{24}{100+300} \cdot 100$

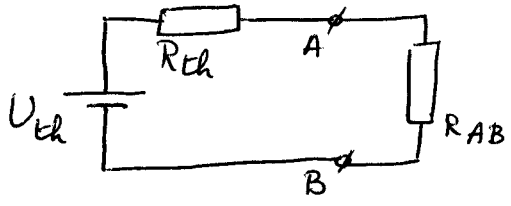
$= \underline{\underline{6V = U_{th}}}$

B: R_{th}: bron vervangen door kortsluiting, kijken vanuit A-B:



$R_{th} = R_2 + \frac{R_1 \cdot R_3}{R_1 + R_3} = 20 + \frac{100 \cdot 300}{100+300} = 20 + 75 = 95\Omega$

C: Vervangingsschema:



$U_{AB} = U_{th} \cdot \frac{R_{AB}}{R_{th} + R_{AB}}$

$= 6 \cdot \frac{200}{95+200}$

$= \underline{\underline{4,0678\ V}}$

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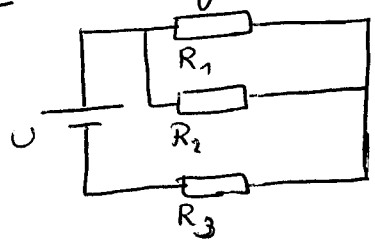
2) Geg: zie opgave 1

Gev: U_{AB} met $R_{AB} = 200\,\Omega$.

Opl:

A: Verbinding A–B kortsluiten: $I_{R_2} = I_N$



$$R_t = (R_1 // R_2) + R_3$$
$$= \frac{100 \cdot 20}{100+20} + 300$$
$$= 16{,}66 + 300 = 316{,}66\,\Omega.$$

$$I = \frac{U}{R_t} = \frac{24}{316{,}66} = 0{,}07579\,A$$

$$U_{R_2} = U - I \cdot R_3$$
$$= 24 - 0{,}07579 \cdot 300$$
$$= 24 - 22{,}737$$
$$= 1{,}2632\,V$$

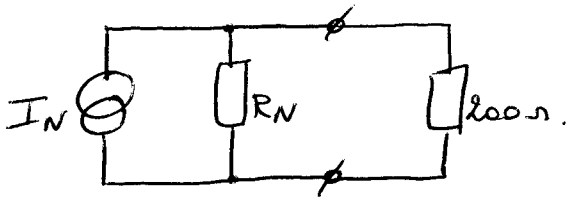
$$I_N = \frac{U_{R_2}}{R_2} = \frac{1{,}2632}{20} = 0{,}06316\,A = \underline{63{,}16\,mA}$$

B: R_N berekenen door bron te vervangen door een verbinding:

(zelfde berekening als oef. 1)

$\Rightarrow R_{th} = \underline{95\,\Omega} = R_N$

C: Nortonschema:



$$U_{AB} = I \cdot \frac{R_N \cdot R_{AB}}{R_N + R_{AB}} = 0{,}06316 \cdot \frac{95 \cdot 200}{95+200} = \underline{4{,}0678\,V}$$

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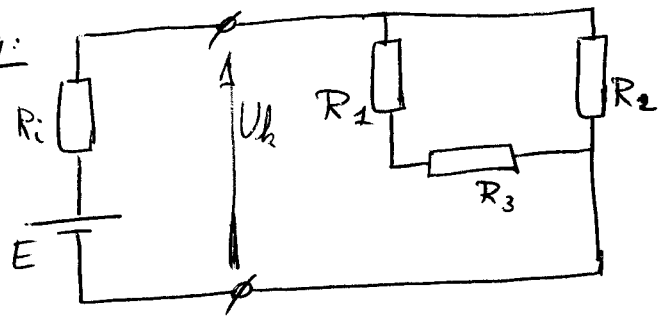
3) Leg:



$E = 12V$
$R_i = 2\Omega$
$R_1 = 7\Omega$
$R_2 = 9\Omega$
$R_3 = 11\Omega$.

Ges: U_k an R_{th}

Lsg:

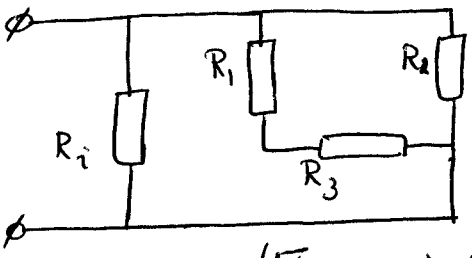
A: U_k

$$R_t = R_i + \left[(R_1 + R_3) // R_2\right]$$
$$= 2 + \left[(7+11) // 9\right]$$
$$= 2 + \left[18 // 9\right]$$
$$= 2 + 6$$
$$= 8\Omega.$$

$$I = \frac{E}{R_t} = \frac{12}{8} = 1{,}5A$$

$$U_k = E - I \cdot R_i$$
$$= 12 - 1{,}5 \cdot 2$$
$$= \underline{\underline{9V = U_k}}$$

B: R_{th}



$$R_{th} = R_i // \left(\left[(R_1 + R_3) // R_2\right]\right)$$
$$= 2 // 6$$
$$= \underline{\underline{1{,}5\Omega. = R_{th}}}$$

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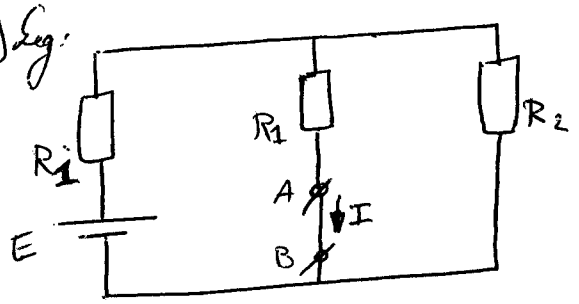
4) Eg:



$E = 12V$

$R_i = 2\Omega$

$R_1 = 7\Omega$

$R_2 = 9\Omega$.

Gev: I_{R_1}

Opl: met Thevenin.

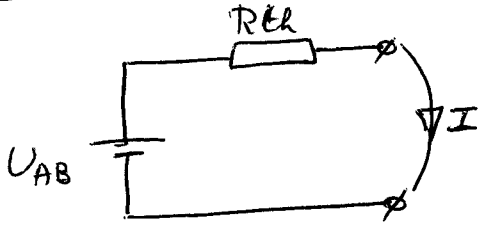
A: Open klemspanning U_{AB}, R_1 wordt niet door stroom doorlopen.

$$U_{AB} = E \cdot \frac{R_2}{R_i + R_2} = 12 \cdot \frac{9}{2+9} = 9{,}81818\,V$$

B: R_{th} ⇒ E vervangen door een verbinding

$$R_{th} = R_1 + (R_2 // R_i)$$
$$= 7 + \left(\frac{9 \cdot 2}{9+2}\right)$$
$$= 7 + 1{,}63636$$
$$= 8{,}6364\,\Omega.$$

C: Schema:



$$I = \frac{U_{AB}}{R_{th}}$$
$$= \frac{9{,}81818}{8{,}6364}$$
$$= 1{,}13684\,A$$