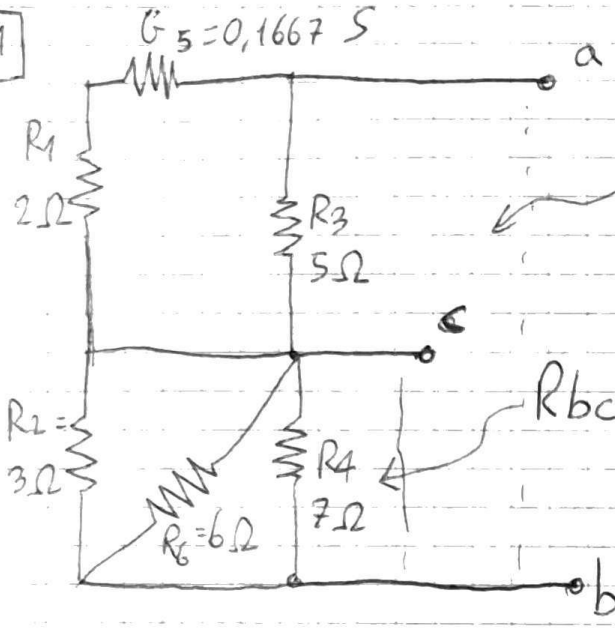
1° PROVA IN ITINERE 30/10/2026

1



R_{bc} è il parallelo di R_2, R_6 e R_4.

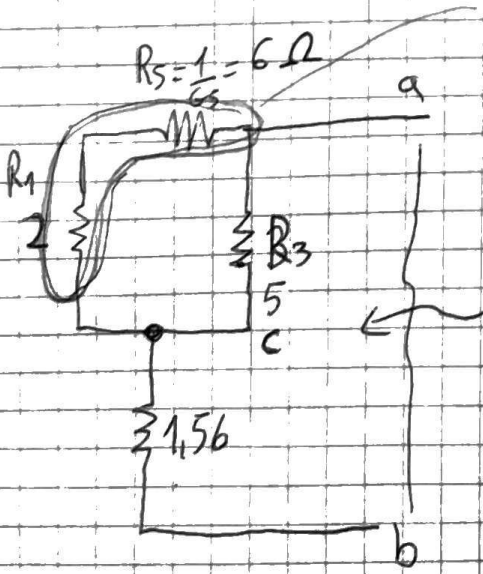
$$R_{bc} = (G_{bc})^{-1} = (G_2 + G_6 + G_4)^{-1} = \left(\frac{1}{R_2} + \frac{1}{R_6} + \frac{1}{R_4}\right)^{-1}$$

(oppure usare calcolatrice!)

$$= \left(\frac{1}{3} + \frac{1}{6} + \frac{1}{7}\right)^{-1}$$

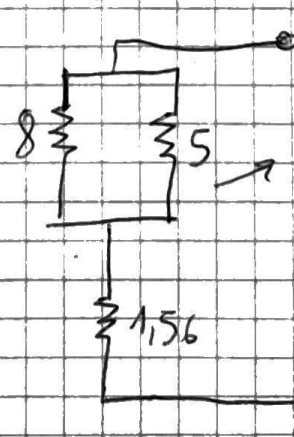
$$= \left(\frac{14 + 7 + 6}{42}\right)^{-1} = \left(\frac{27}{42}\right)^{-1} = \frac{42}{27}$$

$$= 1{,}56\ \Omega$$



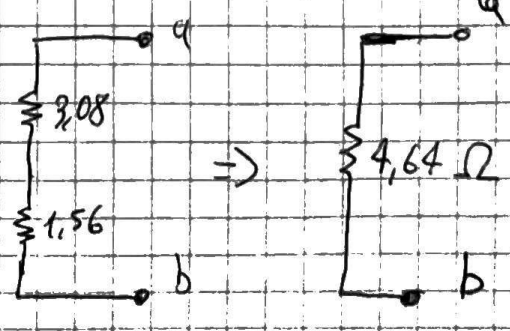
E' SERIE

$6 + 2 = 8$

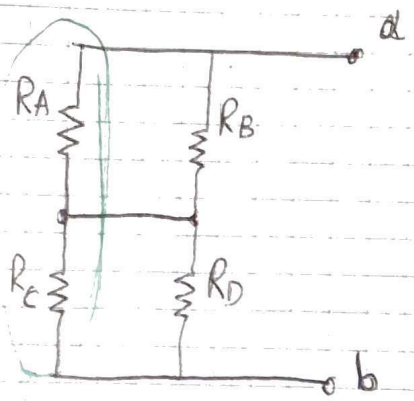


$$5 // 8 = \frac{5 \cdot 8}{5 + 8} = \frac{40}{13}$$

$$= 3{,}08\ \Omega$$



ATTENZIONE:

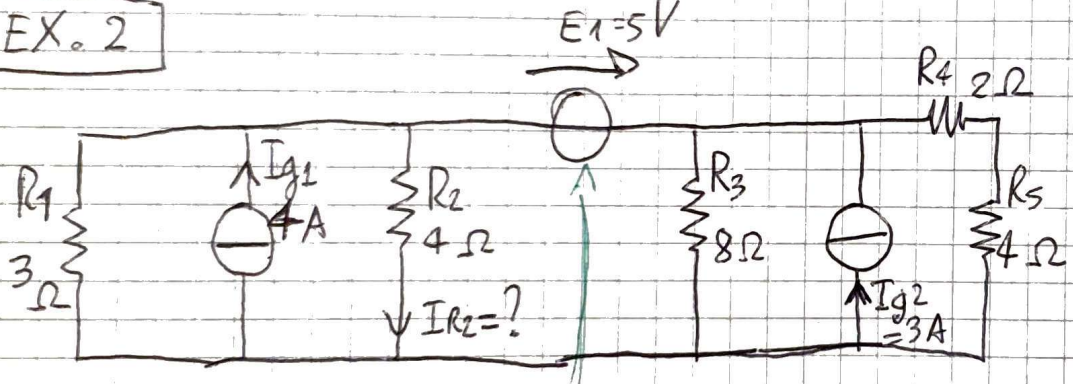


$$R_{ab} \neq (R_A + R_C) /\!/ (R_B + R_D)$$

$$R_{ab} = (R_A /\!/ R_B) + (R_C /\!/ R_D)$$

R_1 e R_2 NON sono in SERIE (la corrente che le attraversa è in generale diversa)

EX. 2



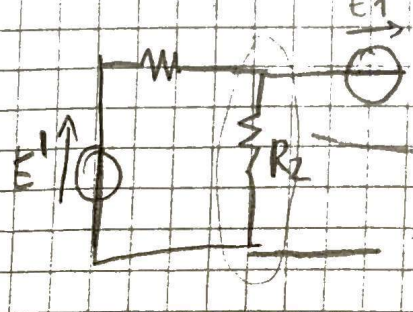
DETERMINARE

1. $I_{R2} = ?$
2. $I_{E1} = ?$
3. $P_{E1} = ?$

QUESTO GENERATORE DÀ FASTIDIO:
NON MI FA APPLICARE MILLMAN
NÉ SOMMARE I GENERATORI DI CORRENTE.

NON POSSO TRASFORMARLO DIRETTAMENTE (XCHÈ È IDEALE).

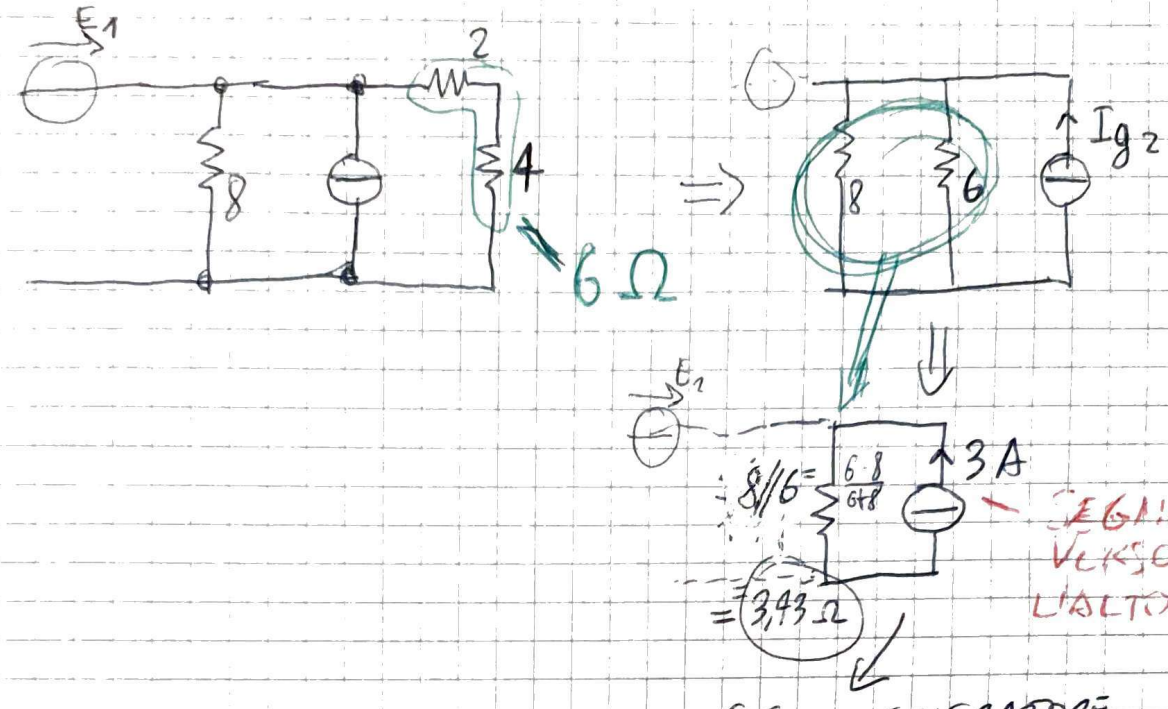
SE TRASFORMO IL GEN. DI CORRENTE A SINISTRA NON RIESCO A SOMMARLO CON E_1 PERCHÈ C'È DI MEZZO R_2 (CHE VOGLIO TENERLA XCHÈ CONTIENE L'INCOGNITA)



SICCOME C'È R_2 NON POSSO SOMMARCI

⇓

AGISCO A DESTRA DI E_1

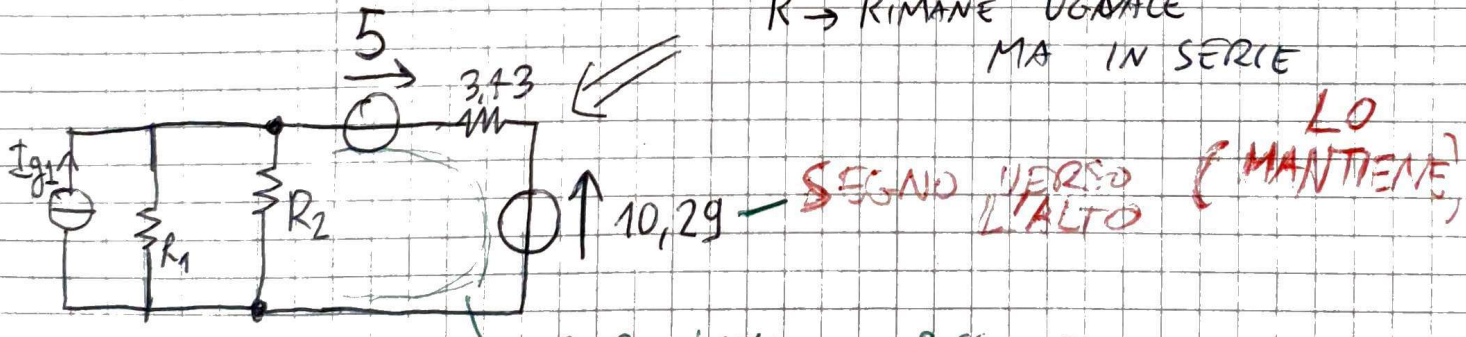


QST GENERATORE REALE LO TRASFORMO IN GEN REALE DI TENSIONE

TENSIONE A VUOTO ←

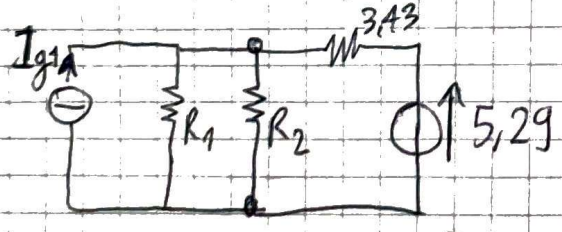
$E_{TH} = 3 \cdot 3{,}43 = 10{,}29$ V

R → RIMANE UGUALE MA IN SERIE

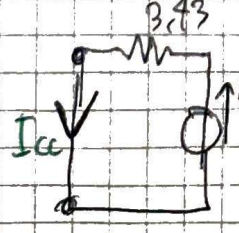


LO MANTIENE

PER KVL POSSO SOMMARLI



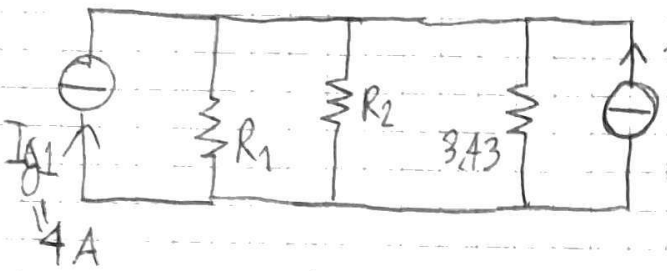
→ ADESSO HO RETE BINODALE. POSSO RISOLVERE FACILMENTE CON MILLMAN



RICONVERTO IN GEN CORRENTE ← USO QUESTA ←

- O CON CONVERSIONE DI GEN. IN GEN DI CORRENTE E SOMMA CORRENTI

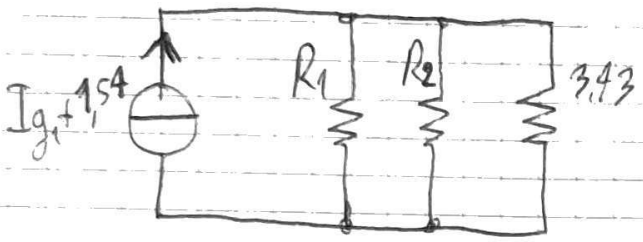
$I_{cc} = \frac{5{,}29\ V}{3{,}43\ \Omega} = 1{,}54$ A



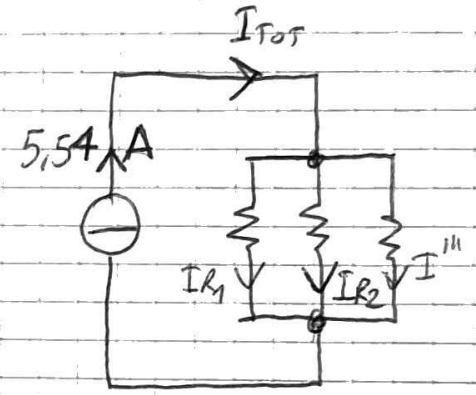
QUESTI DUE GENERATORI DI CORRENTE SONO IN PARALLELO

⇓

SI POSSONO SOMMARE



⟹ E' EQUIVALENTE



PARTITORE DI CORRENTE A TRE GAMBE (USO CONDUTTANZE)

$$\frac{I_{TOT}}{\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{3,43}} = \frac{I_{R2}}{\frac{1}{R_2}} \Rightarrow I_{R_2} = \frac{0,25}{0,33+0,25+0,29} \cdot 5,54$$

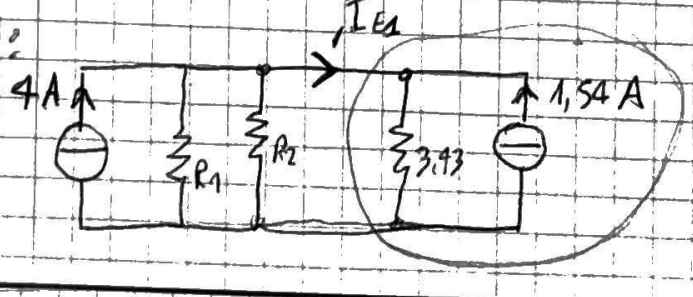
$$= 1,59 \text{ A}$$

2. CALCOLO I_{E_1}.

I_{E_1} PASSA NEL "PONTE" CENTRALE (DOVE C'E' E_1).

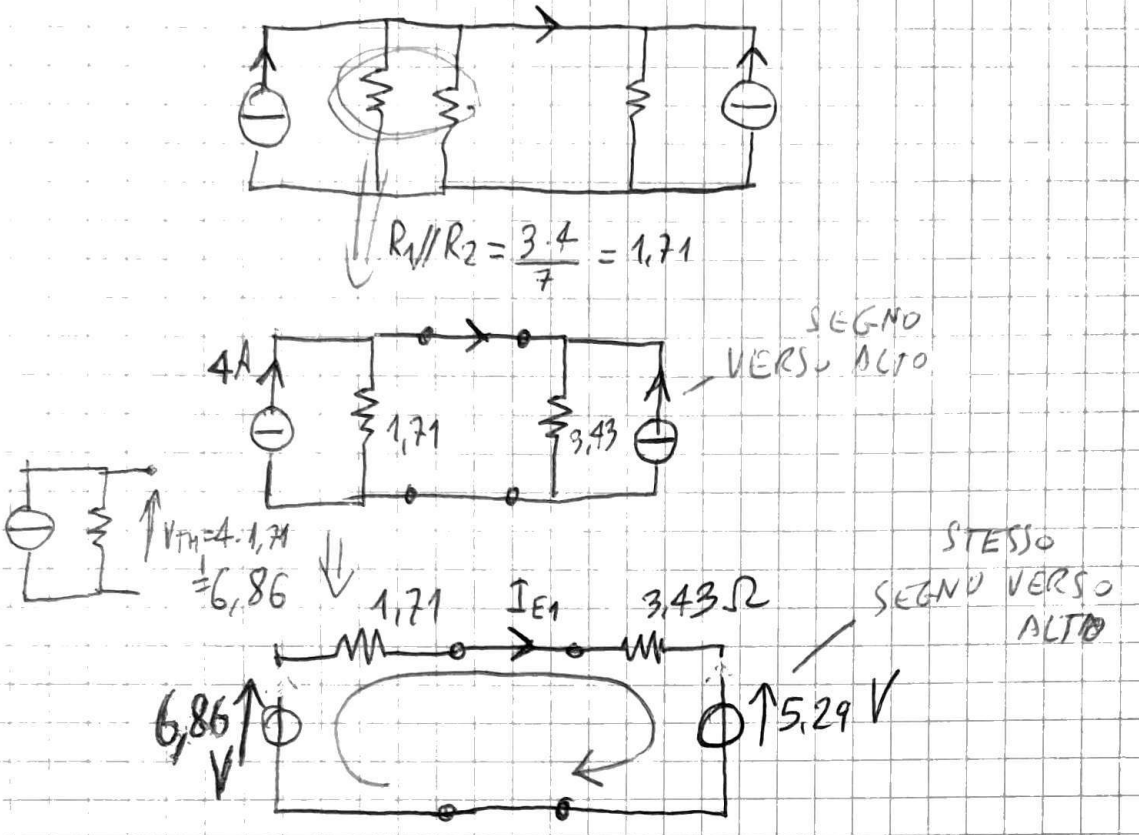
DEVO RITORNARE IN UNA CONFIGURAZIONE DOVE CIO' CHE ERA A DESTRA O A SINISTRA E' RIMASTO LI' (E NON SPOSTATO)

AD ESEMPIO:



QUESTA PARTE ERA A DESTRA (CON E_1 INCLUSO)

E' + FACILE RAGIONARE CON GENERATORI DI TENSIONE ORA



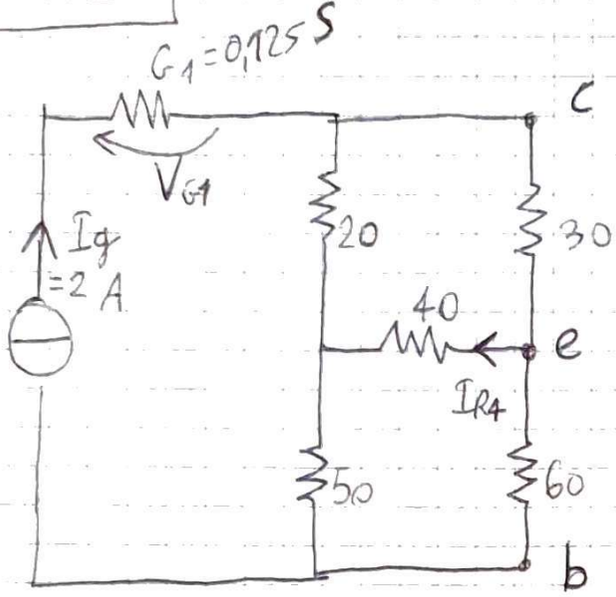
$$KVL \Rightarrow 6{,}86 - 5{,}29 = \Sigma R \cdot I$$

$$I_{E1} = \frac{6{,}86 - 5{,}29}{1{,}71 + 3{,}43} = 0{,}31 \text{ A}$$

$$P_{E1} = E_1 \cdot I_{E1} = 5 \cdot 0{,}31 = 1{,}53 \text{ W}$$

POTENZA EROGATA X CHE' I_{E1} ESCE DAL MORSETTO + DI E_1!

EX 3



DETERMINARE

- $V_{G1} = ?$
- $V_{cb} = ?$
- $V_{eb} = ?$
- $P_{I_g} = ?$
- $I_{R4} = ?$

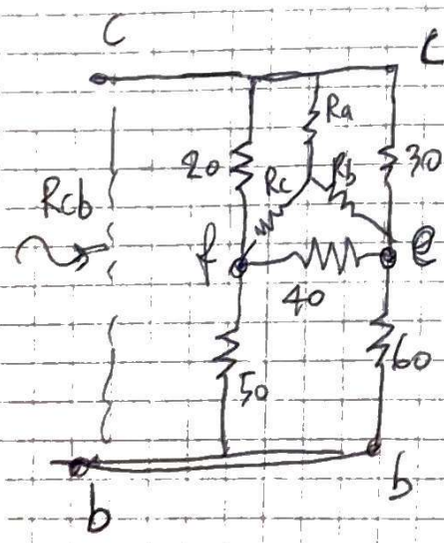
V_{G1} si calcola subito, perchè la corrente è impressa.

$$V_{G1} = R_1 \cdot I_g = \frac{I_g}{G_1} = \frac{2}{0{,}125} = 16\ V$$

V_{cb} → va eliminata la configurazione a ponte usando trasformate Y/Δ

$$V_{cb} = R_{cb} \cdot I_g$$

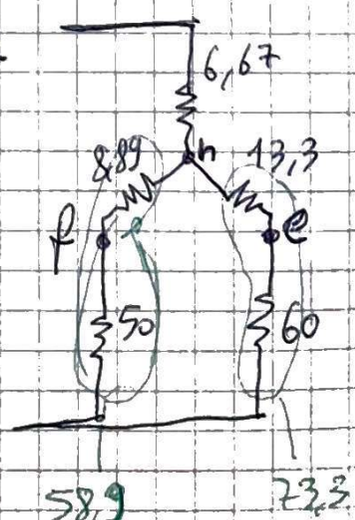
TRASF. Δ → Y

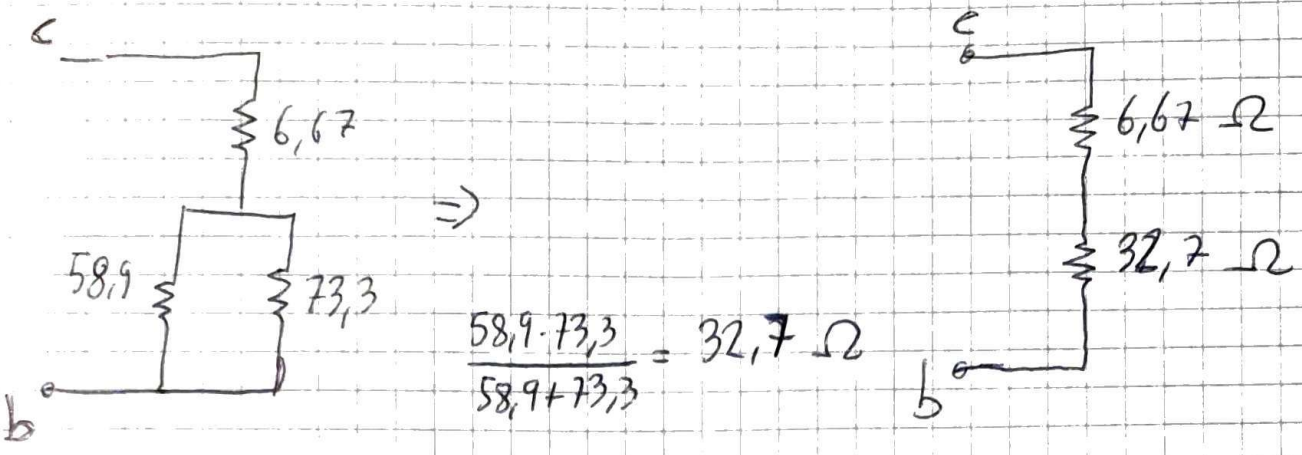


$$R_a = \frac{20 \cdot 30}{20+30+40} = 6{,}67\ \Omega$$

$$R_b = \frac{30 \cdot 40}{90} = 13{,}3\ \Omega$$

$$R_c = \frac{20 \cdot 40}{90} = 8{,}89\ \Omega$$

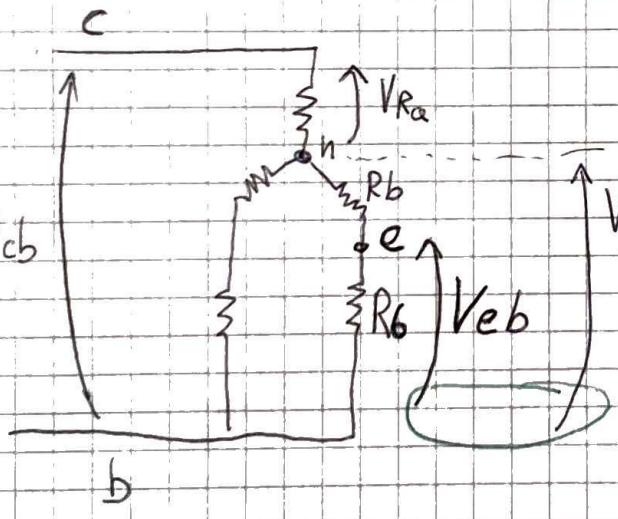




$R_{cb} = 39,2\ \Omega$

$V_{cb} = I_g \cdot R_{cb} = 78,4\ V$

PER CALCOLARE V_{eb}, D CALCOLO I_{eb} CON PARTITORE DI CORRENTE E POI $V_{eb} = I_{eb} \cdot 60$ ($\uparrow R_6$) OPPURE RAGIONO CON I PARTITORI DI TENSIONE



POSSO APPLICARE PARTITORE TENSIONE QUI (RESISTENTE IN SERIE)

$$\frac{V_{eb}}{R_6} = \frac{V_{nb}}{R_b + R_6} \Rightarrow V_{eb} = \frac{R_6}{R_b + R_6} \cdot V_{nb}$$

MA $V_{cb} = V_{Ra} + V_{nb}$

MI MANCA ANCORA V_{nb}

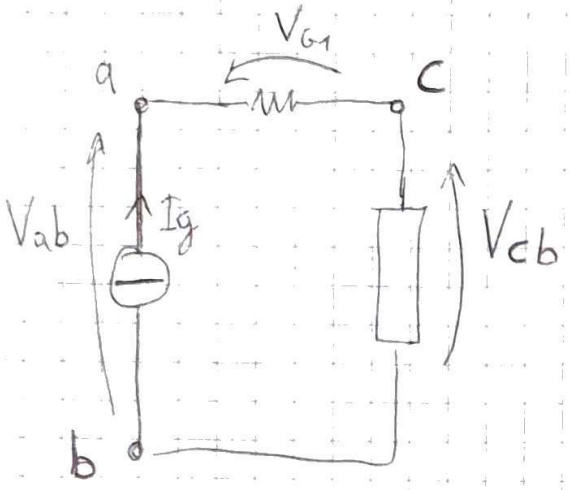
$V_{nb} = V_{cb} - V_{Ra}$

$\stackrel{!}{=} 78,4 - R_a \cdot I_g = 78,4 - 6,67 \cdot 2 = 65,1\ V$

QUINDI $V_{eb} = \frac{60}{13,3+60} \cdot 65,1 = 53,3\ V$

Potenza generata

$$P_{Ig} = I_g \cdot E = I_g \cdot V_{ab}$$

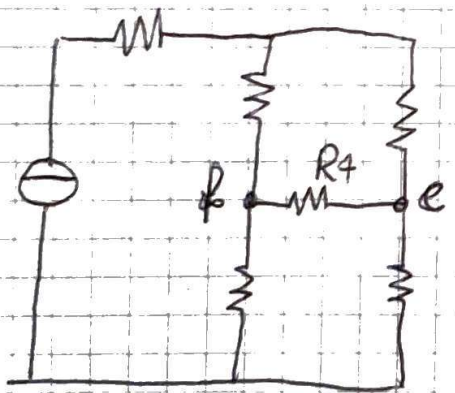


$$V_{ab} = V_{G1} + V_{cb}$$
$$\overset{!}{=} 16 + 78{,}4$$
$$\overset{!}{=} 94{,}4\ V$$

$$P_{Ig} = 2 \cdot 94{,}4 = 188{,}8\ W$$

- I_{R4} CON THEVENIN

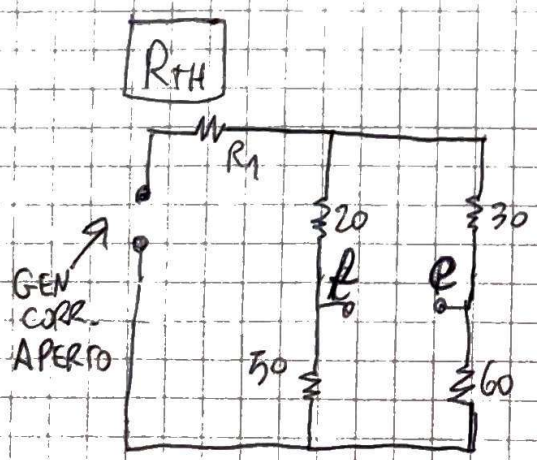
PER CALCOLARE I_{R4} MI SERVE R_4 → TORNO CONFIGURAZIONE INIZIALE.



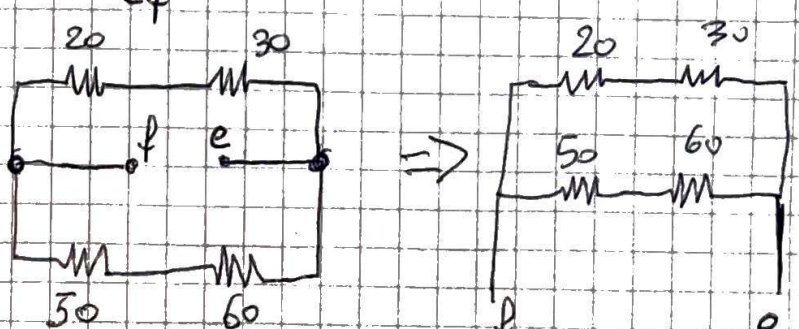
R_4 E' IL CARICO

VA TOLTO PER CALCOLARE

R_{TH} e V_{TH}



$R_{TH_{ef}}$ ← TRA e-f

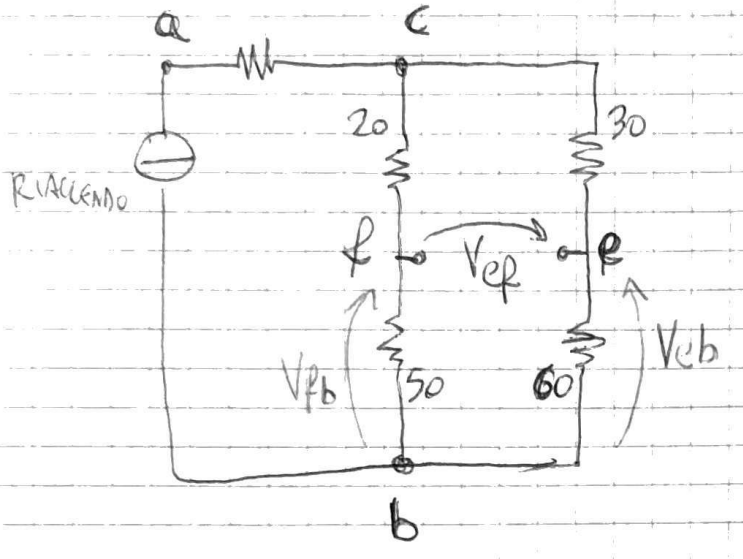


$$R_{TH_{ef}} = (20+30) // (50+60) = 34{,}4\ \Omega$$

PER CALCOLARE $V_{TH_{ef}}$

MAGLIONO CON PARTITORI DI TENSIONE

CON CON CORRENTI E CADUTE DI TENSIONE



AD ESEMPIO ← IN QUESTA MAGLIA

$$V_{fb} + V_{ef} = V_{eb}$$

$$\Downarrow$$

$$V_{ef} = V_{eb} - V_{fb}$$

↑ NOTA CHE E' DIVERSA DA V_{eb} di PRIMA, PERCHÈ SIAMO A VUOTO DI THEVENIN (SENZA R_4)!

CALCOLO R_{cb}^{VUOTO}

$$V_{cb_{VUOTO}} = I_g \left(20+50\right) /\!/ \left(30+60\right)$$

$$= 2 \cdot 70 /\!/ 90 = 2 \cdot \frac{70 \cdot 90}{70+90} = 78{,}8 \text{ V}$$

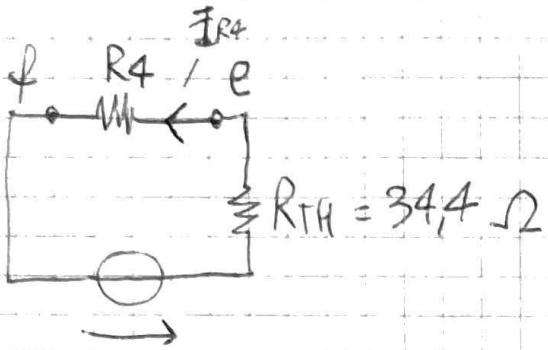
CON $V_{cb_{VUOTO}}$ POSSO CALCOLARE V_{eb} e V_{fb} (VUOTO) CON PARTITORE TENSIONE

$$\frac{V_{cb_{VUOTO}}}{30+60} = \frac{V_{eb}^{VUOTO}}{60} \qquad V_{eb}^{VUOTO} = \frac{60}{90} \cdot 78{,}8 = 52{,}5 \text{ V}$$

$$\frac{V_{cb}^{VUOTO}}{20+50} = \frac{V_{fb}^{VUOTO}}{50} \qquad V_{fb} = \frac{50}{70} \cdot 78{,}8 = 56{,}3 \text{ V}$$

$$V_{ef_{TH}} = 52{,}5 - 56{,}3 = -3{,}8 \text{ V}$$

CIRCUITO EQUIVALENTE:

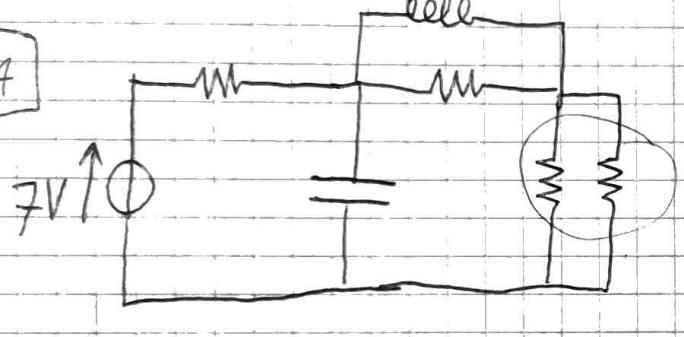


$$I_{R4} = \frac{V_{TH_{ef}}}{R_{TH}+R_4} = \frac{-3,8}{34,4+40} = -0,051\ A$$

↓

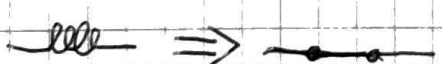
HA VERSO DISCORDE RISPETTO A QUELLO SEGNATO NEL DISEGNO

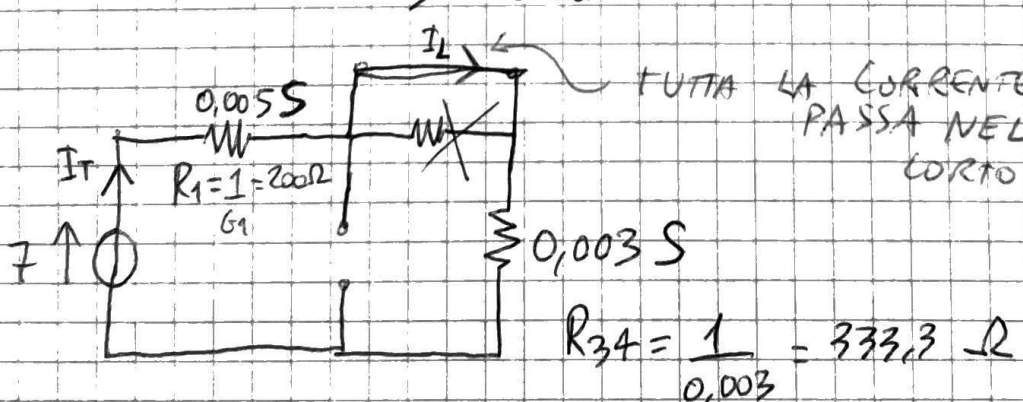
EX 4



$G_{eq} = G_4 + G_3 = 0,003\ S$

A REGIME $\frac{1}{T} \Rightarrow$ 

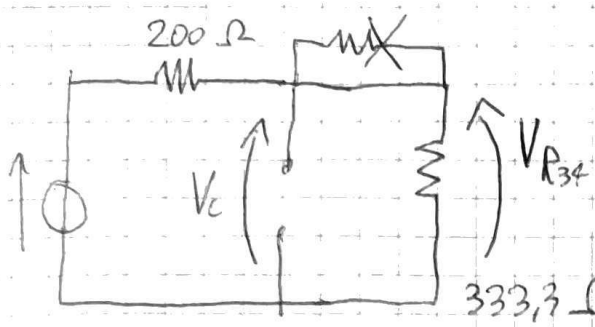




$$R_{34} = \frac{1}{0,003} = 333,3\ \Omega$$

$$I_T = I_L = \frac{V}{R_1+R_{34}} = \frac{7}{533,3} = 0,013\ A$$

$$W_L = \frac{1}{2} L I_L^2 = \frac{1}{2} \cdot 0,2 \cdot 0,013^2 = 16,9\ \mu J$$

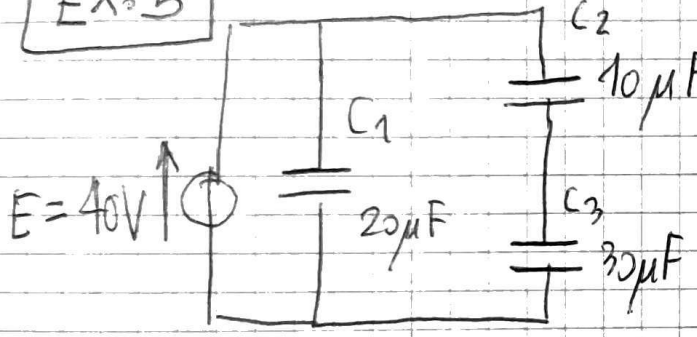


$$V_C = V_{R34}$$
$$= I_T \cdot R_{34}$$
$$= 0{,}013 \cdot 333{,}3 = 4{,}37\ V$$

$$W_c = \frac{1}{2} C V_c^2 = \frac{1}{2} \cdot 20 \cdot 10^{-6} \cdot 4{,}37^2 = 191\ \mu J$$

↑ μ!

EX. 5



(SERIE)

$$\hookrightarrow C_{23} = \frac{C_2 C_3}{C_3 + C_2} = \frac{300 \cdot 10^{-12}}{40 \cdot 10^{-6}} = 7{,}5\ \mu F$$

(PARALLELO)

$$C_{eq} = C_1 + C_{23} = (20 + 7{,}5) \cdot 10^{-6} = 27{,}5 \cdot 10^{-6} = 27{,}5\ \mu F$$

$$C = \frac{q}{V} \Rightarrow q_{TOT} = C_{eq} \cdot E = 27{,}5 \cdot 10^{-6} \cdot 40$$
$$= 1100\ \mu C$$

↖ OCCHIO AI MULTIPLI!

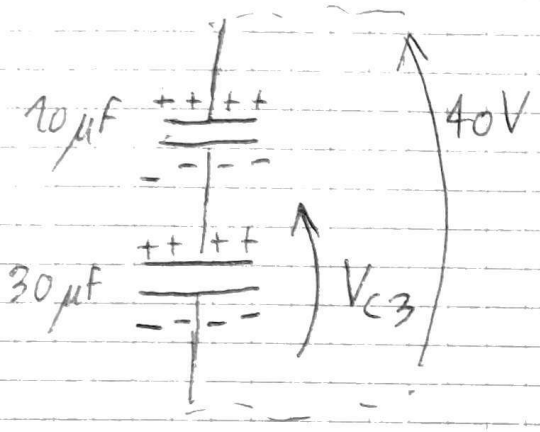
LA q si divide nei 2 RAMI IN PARALLELO (come una CORRENTE)

$$q_{23} = C_{23} \cdot E = 7{,}5 \cdot 10^{-6} \cdot 40 = 300\ \mu C$$

LA CARICA q_{23}

SI DISTRIBUISCE IN OGNUNO DEI CONDENSATORI

DELLA SERIE



$$C_3 = \frac{q_{23}}{V_{C3}}$$

$$\Downarrow$$

$$V_{C3} = \frac{q_{23}}{C_3} = \frac{300\ \mu C}{30\ \mu F} = 10\ V$$

$$\Downarrow$$

SUL CONDENSATORE

+ GRANDE DELLA SERIE

C'È LA C.D.T. + PICCOLA.