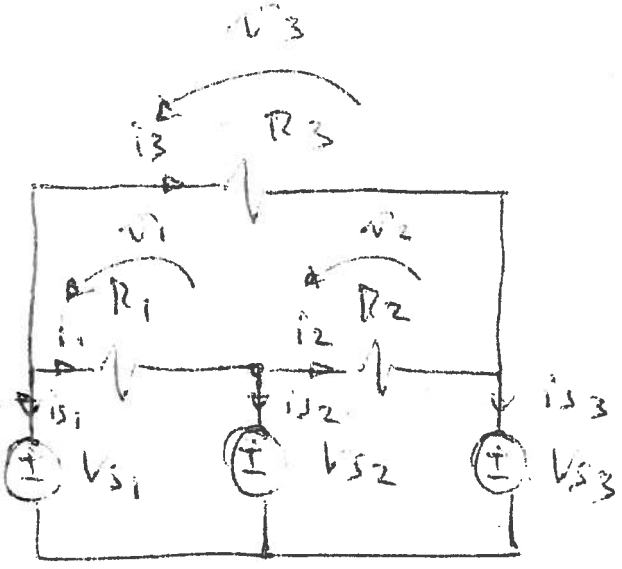


$V_{s1} = 5\ V$
$V_{s2} = 10\ V$
$V_{s3} = 5\ V$

$R_1 = 100\ \Omega$
$R_2 = 100\ \Omega$
$R_3 = 50\ \Omega$

LKT) $V_1 - V_{s1} + V_{s2} = 0 \Rightarrow V_1 = V_{s1} - V_{s2} = -5\ V$

$V_2 - V_{s2} + V_{s3} = 0 \Rightarrow V_2 = V_{s2} - V_{s3} = 10 - 5 = 5\ V$

$V_3 - V_{s1} + V_{s3} = 0 \Rightarrow V_3 = V_{s1} - V_{s3} = 0$

Dalle leggi di Ohm:

$$i_1 = v_1/R_1 = \frac{-5}{100} = -\frac{1}{20}\ A$$

$$i_2 = \frac{v_2}{R_2} = \frac{5}{100} = \frac{1}{20}\ A$$

$$i_3 = \frac{v_3}{R_3} = 0$$

Dopo aver assegnato le i_{s_1}, i_{s_2} e i_{s_3}

$$i_{s_1} + i_1 + i_3 = 0 \Rightarrow i_{s_1} = -i_1 = \frac{1}{20}\ A$$

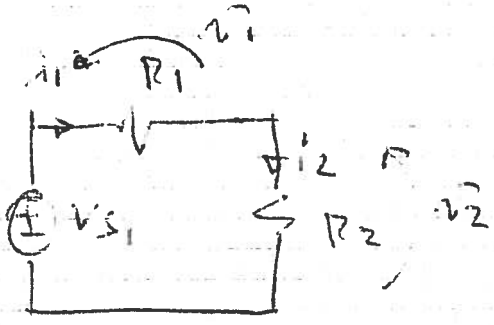
$$i_{s_2} + i_2 - i_1 = 0 \Rightarrow i_{s_2} = i_1 - i_2 = -\frac{1}{20} - \frac{1}{20} = -\frac{1}{10}\ A$$

$$i_{s_3} - i_2 - i_3 = 0 \Rightarrow i_{s_3} = i_2 + i_3 = \frac{1}{20}\ A$$

Verifichiamo la conservazione dell'energia

$$v_1 i_1 + v_2 i_2 + v_3 i_3 + v_{s_1} i_{s_1} + v_{s_2} i_{s_2} + v_{s_3} i_{s_3} = \frac{1}{4} + \frac{1}{4} + 0 + \frac{1}{4} - 1 + \frac{1}{4} = 0$$

ESERCIZIO 12 Calcolare v_1 e v_2



$v_{s_1} = 20\ V$

$R_1 = 2\ \Omega$

$R_2 = 3\ \Omega$

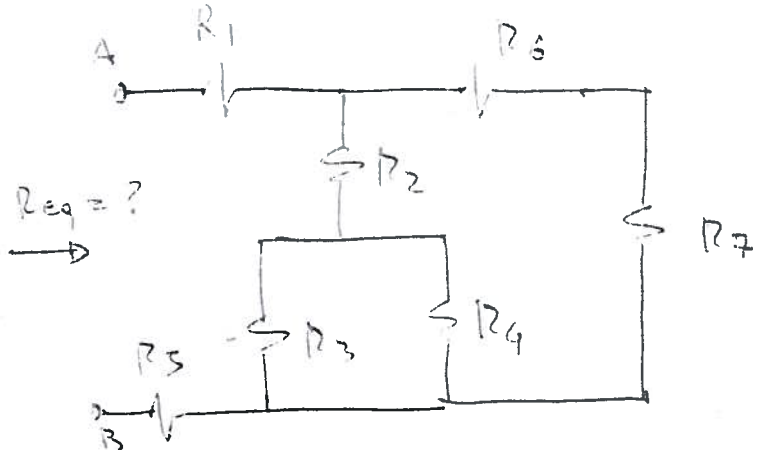
$i_1 = i_2 = i$ $\quad v_1 = R_1 i_1$ e $v_2 = R_2 i_2 \Rightarrow$

$$v_{s_1} - v_1 - v_2 = 0 \Rightarrow v_{s_1} - R_1 i - R_2 i = 0 \Rightarrow$$

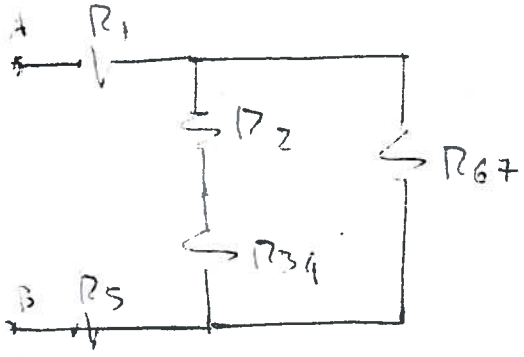
$$i = \frac{v_{s_1}}{R_1 + R_2} = \frac{20}{5} = 4\ A$$

$$v_1 = R_1 i = v_{s_1} \frac{R_1}{R_1 + R_2} = 8\ V \qquad v_2 = R_2 i = v_{s_1} \frac{R_2}{R_1 + R_2} = 12\ V$$

ESEMPIO DI RESISTENZE EQUIVALENTI



$R_1 = 4\,\Omega$
$R_2 = 2\,\Omega$
$R_3 = 6\,\Omega$
$R_4 = 3\,\Omega$
$R_5 = 8\,\Omega$
$R_6 = 1\,\Omega$
$R_7 = 5\,\Omega$

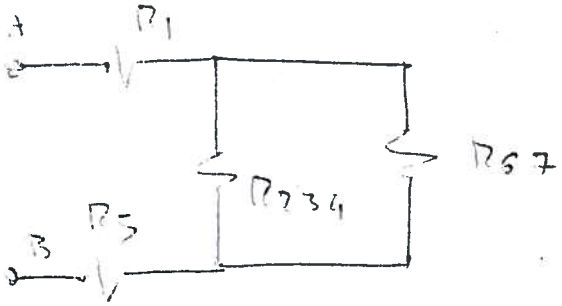


$R_{67} = R_6 + R_7 = 6\,\Omega$

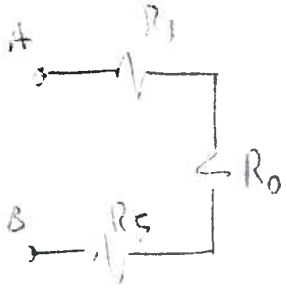
$R_{34} = R_3 \,//\, R_4 = \frac{R_3 R_4}{R_3 + R_4} = 2\,\Omega$

$\frac{1}{R_{34}} = \frac{1}{R_3} + \frac{1}{R_4} = \frac{1}{6} + \frac{1}{3} = \frac{1}{2}\,S$

$\Rightarrow R_{34} = 2\,\Omega$



$R_{234} = 4\,\Omega$



$\frac{1}{R_0} = \frac{1}{R_{234}} + \frac{1}{R_{67}} = \frac{1}{4} + \frac{1}{6} =$

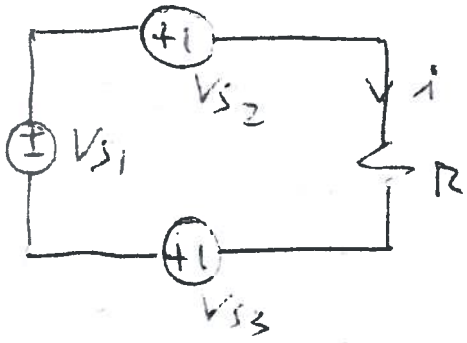
$= \frac{6+4}{24} = \frac{5}{12}\,S$

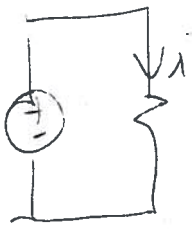
$\Rightarrow R_0 = \frac{12}{5}\,\Omega$ $\quad R_{AB} = R_1 + R_5 + R_0 =$

$= 4 + 8 + \frac{12}{5} = 12 + \frac{12}{5} = \frac{72}{5}\,\Omega$

ESERCIZIO 13 Ricavare la corrente i

(7)





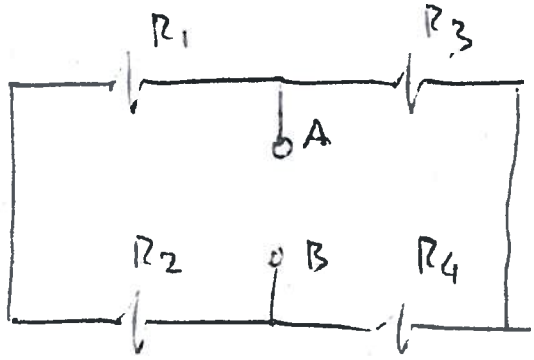
$V_{S1} = 4V$
$V_{S2} = 2V$
$V_{S3} = 8V$
$R = 2\Omega$

NO

$$i = \frac{V_{S1} - V_{S2} + V_{S3}}{R} = \frac{4 - 2 + 8}{2} = 5A$$

ESERCIZIO 14 Calcolare la resistenza equivalente

(1) X



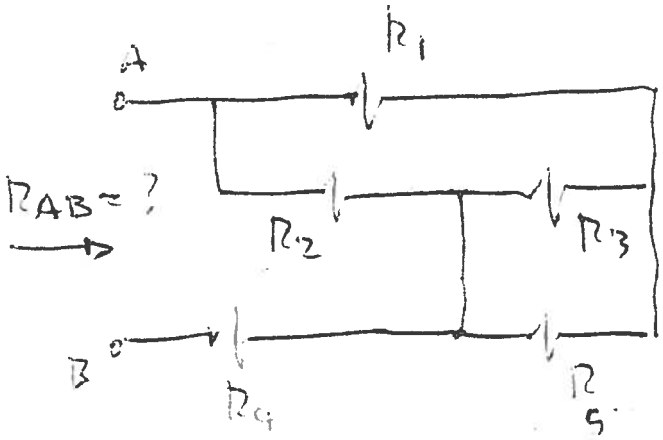
$R_1 = 2\Omega$
$R_2 = 4\Omega$
$R_3 = 1\Omega$
$R_4 = 1\Omega$

$$R_{AB} = (R_1 + R_2) /\!/ (R_3 + R_4) = 6 /\!/ 2 = \frac{1}{\frac{1}{6} + \frac{1}{2}} =$$

$$= \frac{3}{2}\Omega$$

ESERCIZIO 15 Calcolare la resistenza equivalente

(2) X



$R_1 = \frac{2}{3}\ \Omega$

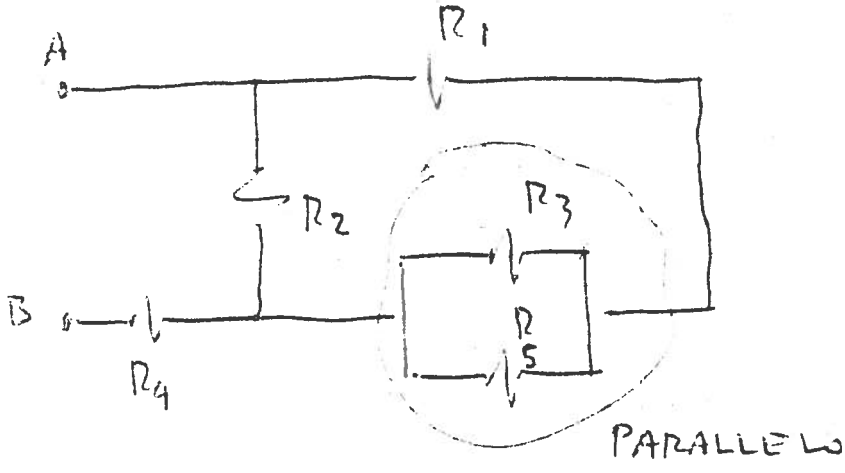
$R_2 = 2\ \Omega$

$R_3 = 4\ \Omega$

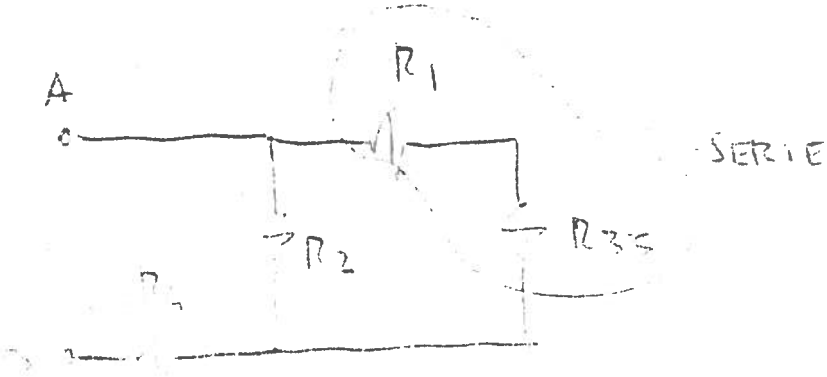
$R_4 = 1\ \Omega$

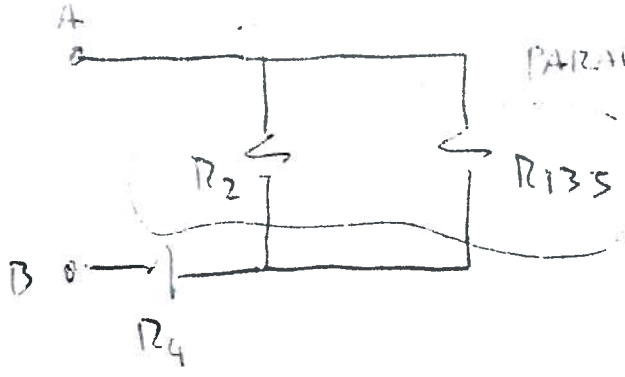
$R_5 = 2\ \Omega$

Ridisegniamo il circuito:



$$R_{35} = R_3 /\!/ R_5 = \frac{1}{\frac{1}{R_3} + \frac{1}{R_5}} = \frac{1}{\frac{1}{4} + \frac{1}{2}} = \frac{4}{3}\ \Omega$$





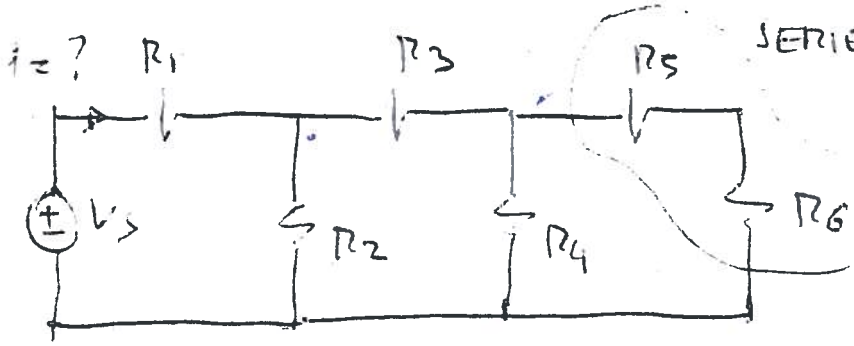
$R_{135} = R_1 + R_{35} = \frac{2}{3} + \frac{4}{3} = \frac{6}{3} = 2\,\Omega$

$$R_0 = R_2 /\!/ R_{135} = \frac{1}{\frac{1}{R_2} + \frac{1}{R_{135}}} = \frac{1}{\frac{1}{2} + \frac{1}{2}} = 1\,\Omega$$

$R_{AB} = R_0 + R_4 = 2\,\Omega$

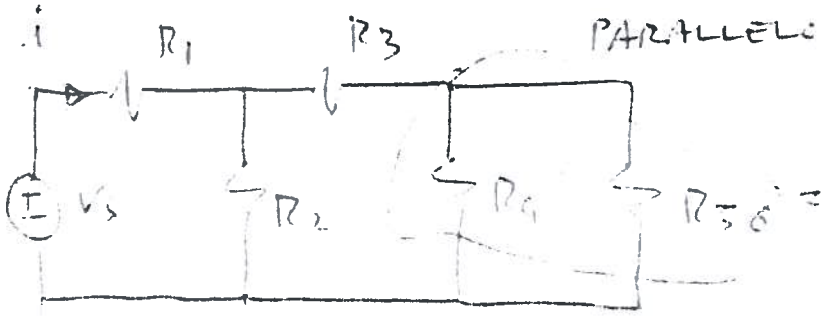
(3) X

ESERCIZIO 16 Calcolare la corrente i



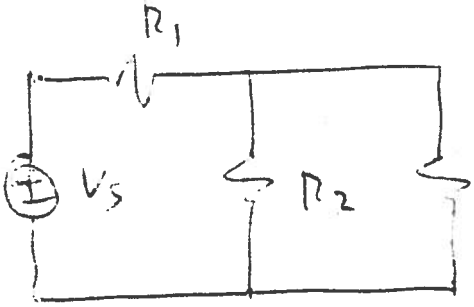
$V_s = 50\,V$
$R_1 = 2\,\Omega$
$R_2 = 4\,\Omega$
$R_3 = 2\,\Omega$
$R_4 = 4\,\Omega$
$R_5 = 2\,\Omega$
$R_6 = 2\,\Omega$

Semplificando il circuito tramite il concetto di resistenza equivalente

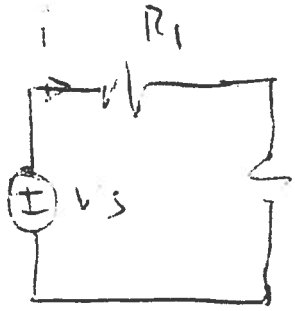


$R_{56} = R_5 + R_6 = 4\,\Omega$

$$R_{456} = R_4 // R_{56} = \frac{1}{\frac{1}{4} + \frac{1}{4}} = 2\,\Omega$$



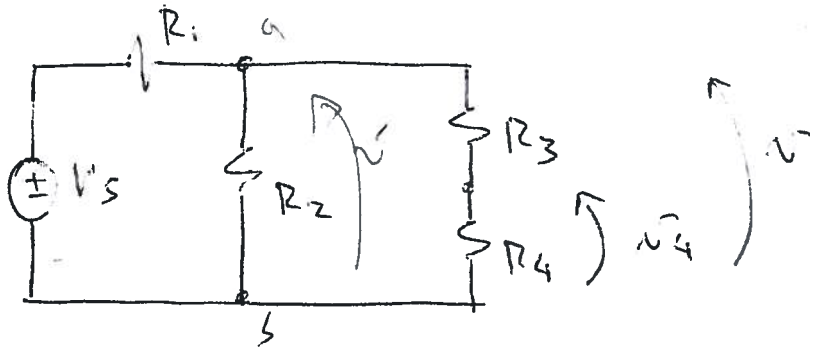
$R_{456} + R_3 = R_0 = 4\,\Omega$



$R_2 // R_0 = 2\,\Omega$

$$\therefore i = \frac{V_s}{R_1 + R_2 // R_0} = \frac{25}{2}\ A$$

Calcolare v_4 e v.



$V_s = 10\ V$

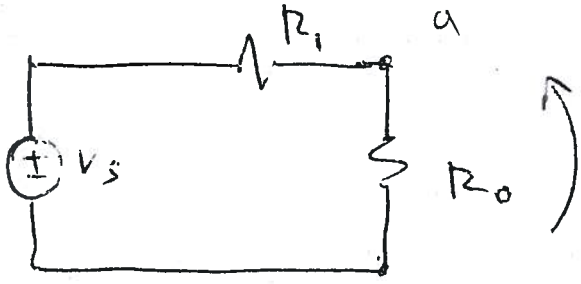
$R_1 = 1\ \Omega$

$R_2 = 2\ \Omega$

$R_3 = 3\ \Omega$

$R_4 = 1\ \Omega$

$$R_0 = R_2 // (R_3 + R_4) = \frac{1}{\frac{1}{2} + \frac{1}{4}} = \frac{4}{3}\ \Omega$$



$$v = V_s \frac{R_0}{R_0 + R_4} = \frac{40}{7}\ V$$

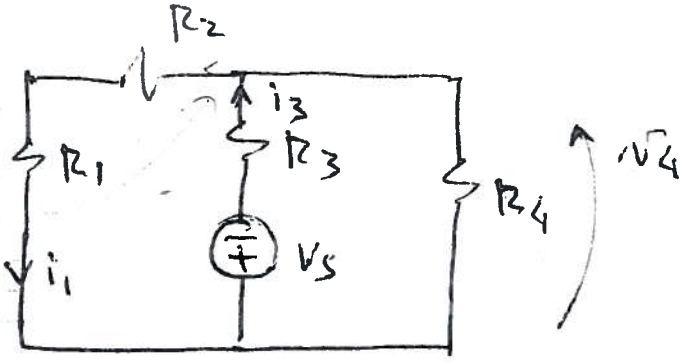
Per calcolare v_4 si torna al circuito di partenza

$$v_4 = v \frac{R_4}{R_3 + R_4} = \frac{10}{7}\ V$$

PARTITORE DI TENSIONE

(5) X

Calcolare i_1, v_4 e i_3



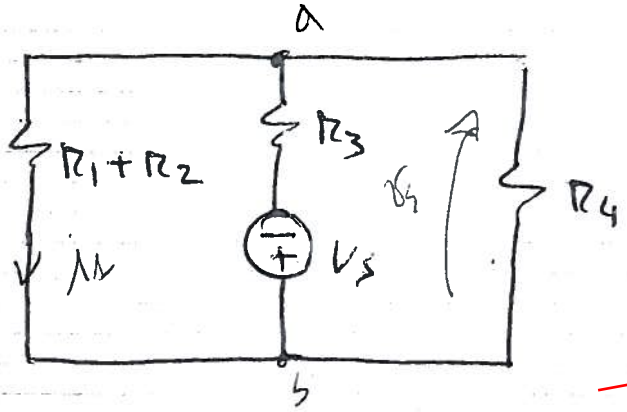
$V_s = 6\,V$

$R_1 = R_2 = 1\,\Omega$

$R_3 = 3\,\Omega$

$R_4 = 2\,\Omega$

R_1 e R_2 sono in serie



$(R_1 + R_2)$ e R_4 sono in parallelo

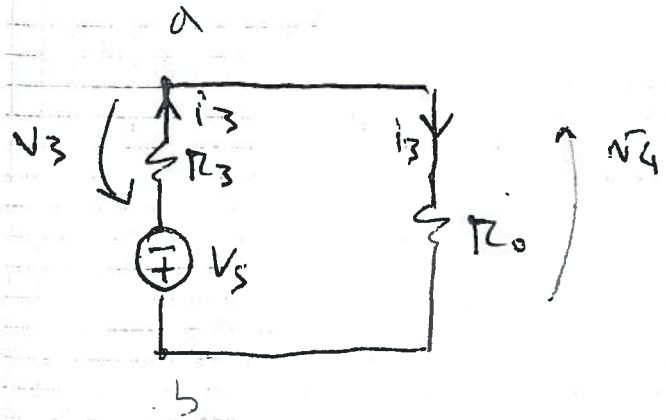
$R_{12} = R_1 + R_2 = 2\,\Omega$

$G_{12} = \frac{1}{R_1 + R_2} = \frac{1}{2}\,S$

$G_4 = \frac{1}{R_4} = \frac{1}{2}\,S$

$G_0 = G_{12} + G_4 = 1\,S$, $R_0 = \frac{1}{G_0}$

$R_0 = R_{12} // R_4 = 1\,\Omega$



$V_4 = R_0 i_3$

$V_3 = R_3 i_3$

$V_3 + V_s + V_4 = 0 \Rightarrow (R_3 + R_0)\, i_3 = -V_s$

$i_3 = -\frac{V_s}{R_0 + R_3} = -\frac{3}{2}\,A$

$$V_4 = R_0 i_3 = -\frac{3}{2} V$$

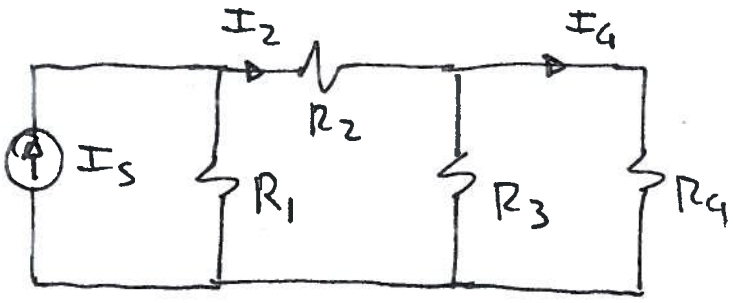
$$i_1 = \frac{V_4}{R_1 + R_2} = -\frac{3}{4} A$$

$$v_4 = -\frac{v_3 R_0}{R_0 + R_3} = -\frac{3}{2} V$$

$$i_3 = \frac{v_4}{R_0} = -\frac{3}{2} A$$

$$i_1 = \frac{v_4}{R_1 + R_2} = -\frac{3}{4} A$$

ESERCIZIO 2 Determinare I_2 e I_4



$I_S = 5\ A$

$R_1 = 3\ \Omega$

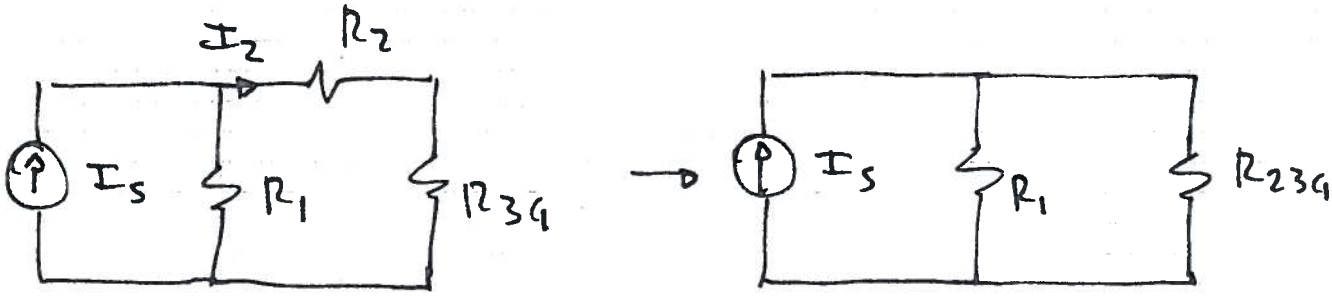
$R_2 = 1\ \Omega$

$R_3 = 2\ \Omega$

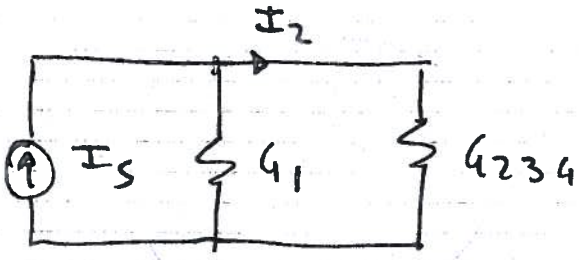
$R_4 = 2\ \Omega$

$G_{34} = G_3 + G_4 = \frac{1}{2} + \frac{1}{2} = 1\ S \Rightarrow R_{34} = 1\ \Omega$

$R_{34} = R_3 // R_4 = 1\ \Omega$



$R_{234} = R_2 + R_{34} = 2\ \Omega$



$G_1 = \frac{1}{R_1} = \frac{1}{3}\ S$

$G_{234} = \frac{1}{R_{234}} = \frac{1}{2}\ S$

$$I_2 = I_S \cdot \frac{G_{234}}{G_1 + G_{234}} = 5 \cdot \frac{\frac{1}{2}}{\frac{1}{3} + \frac{1}{2}} = 3\ A$$

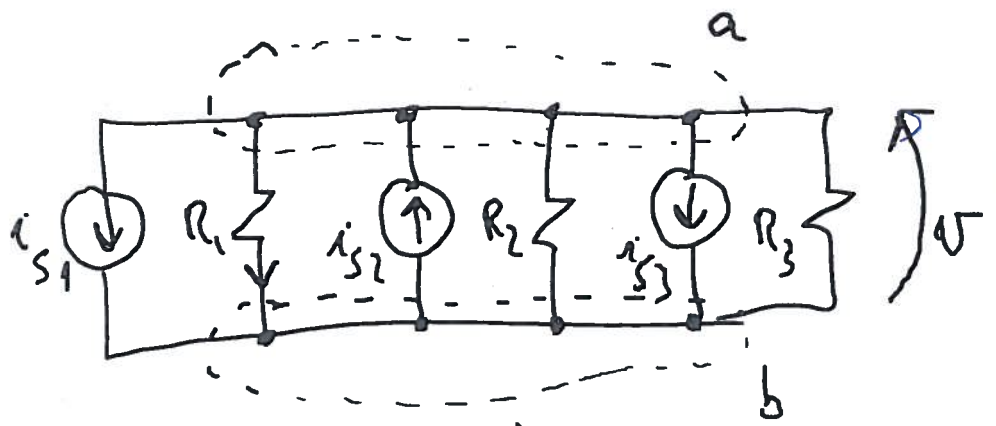
Torniamo al circuito di partenza:

$$I_4 = I_2 \cdot \frac{G_4}{G_3 + G_4} = \frac{3}{2}\ A$$

$$I_2 = I_S \frac{R_1}{R_1 + R_{234}} = 3A$$

$$I_4 = I_2 \frac{R_4}{R_3 + R_4} = \frac{3}{2} A$$

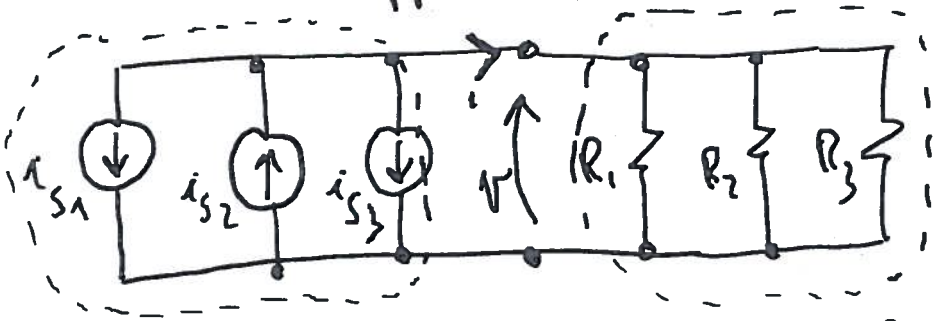
CIRCUITI BINODALI



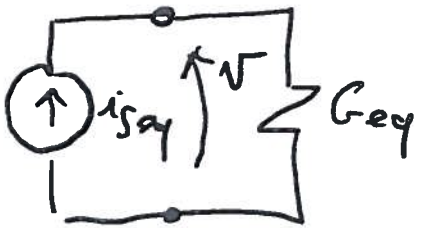
$i_{S1} = 1\,A \quad i_{S2} = 2\,A \quad i_{S3} = 3\,A$

$R_1 = 1\,\Omega \quad R_2 = \frac{1}{2}\,\Omega \quad R_3 = \frac{1}{3}\,\Omega$

LKC a (oppure b) + LΩ $\Rightarrow$ V = ...



$\Rightarrow$



$i = -i_{S1} + i_{S2} - i_{S3}$

$= i_{Seq}$

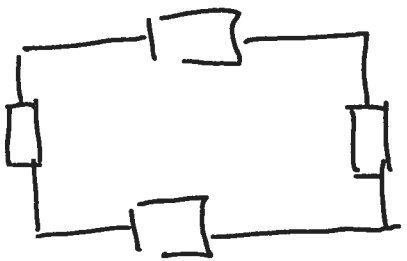
$G_{eq} = G_1 + G_2 + G_3$

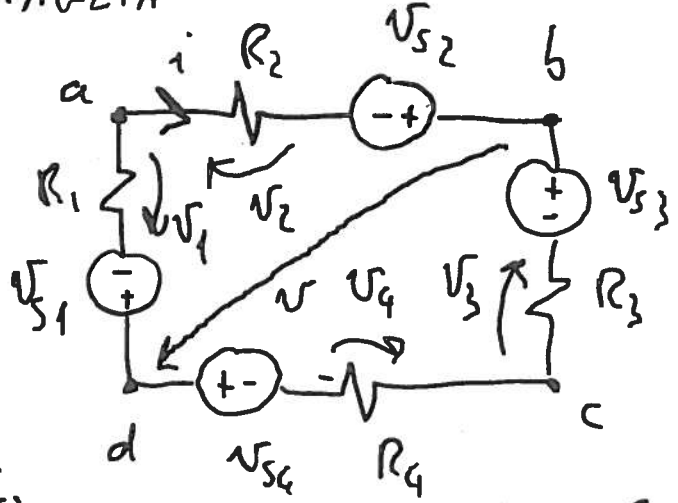
$V = \frac{i_{Seq}}{G_{eq}} = \frac{-i_{S1} + i_{S2} - i_{S3}}{G_1 + G_2 + G_3}$

$= -\frac{1}{3}\,V$

$\Rightarrow$ MICCHANN

CIRCUITI A UNA MAGLIA





$V_{S1} = 1\,V \quad V_{S2} = 2\,V$

$V_{S3} = 3\,V \quad V_{S4} = 4\,V$

$R_1 = 1\,\Omega \quad R_2 = 2\,\Omega$

$R_3 = 3\,\Omega \quad R_4 = 4\,\Omega$

LKT $\quad -V_{S1} - V_1 - V_2 + V_{S2} - V_{S3}$

$\quad -V_3 - V_4 + V_{S4} = 0$

$+ L\Omega$: $\quad V_1 = R_1 i \quad V_2 = R_2 i$

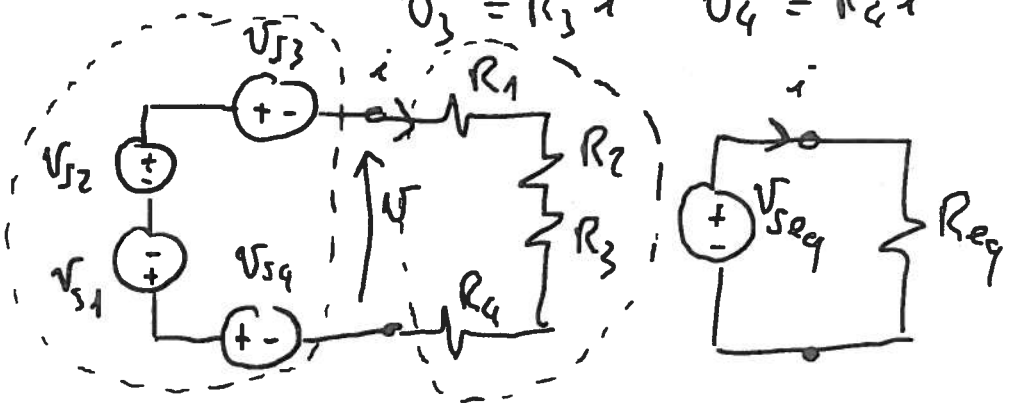
$V_3 = R_3 i \quad V_4 = R_4 i$

V_{Seq} → $-V_{S1} + V_{S2} - V_{S3} + V_{S4}$

$\Rightarrow \quad i = \dfrac{-V_{S1} + V_{S2} - V_{S3} + V_{S4}}{R_1 + R_2 + R_3 + R_4}$

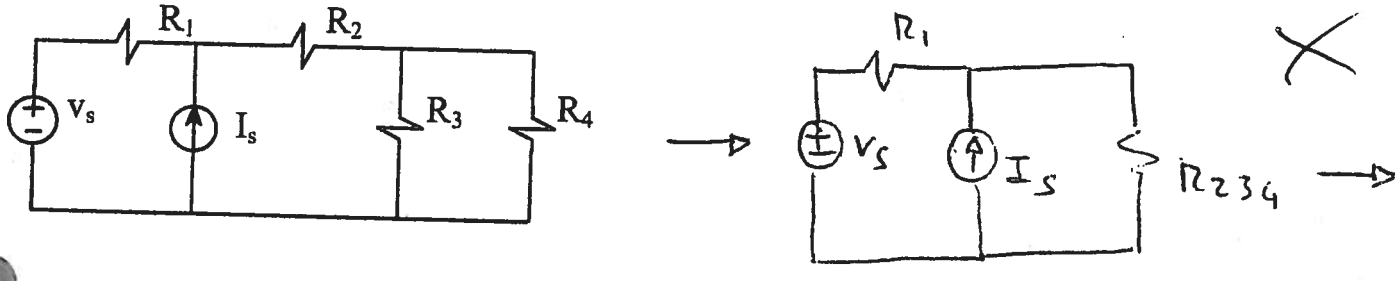
R_{eq}

$= \frac{1}{5}\,A$

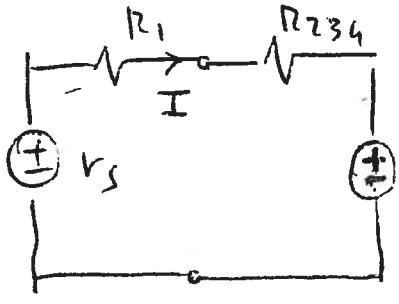


$V = V_{S1} - V_{S2} + (R_1 + R_2)\,i = -\frac{2}{5}\,V$

Esercizio 2 (*): Nel circuito di figura, funzionante in regime stazionario, calcolare la potenza generata da V_s.
Dati: V_s= 12 V; I_s=2 A; R_1=6 Ω; R_2=6 Ω; R_3=4 Ω; R_4=2 Ω



$$R_{234} = R_2 + R_3 \parallel R_4 = \frac{22}{3}\,\Omega = 7,\overline{3}\,\Omega$$



$$I = \frac{V_S - R_{234} I_S}{R_1 + R_{234}} = -0,2\ A$$

$$P_{V_S} = V_S I = -2,4\ W$$

NOME: COGNOME: MATRICOLA:

POLITECNICO DI MILANO

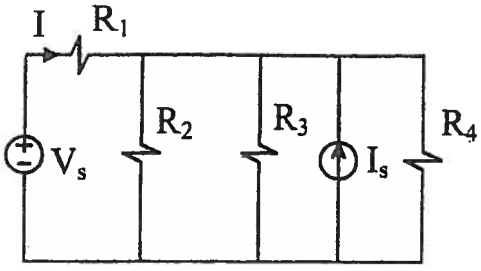
Insegnamento di ELETTROTECNICA - Ing. Edile - Nuovo Ordinamento - Prof. L. Di Rienzo

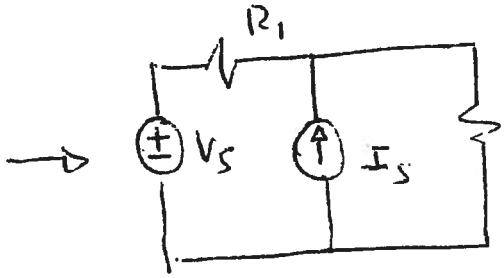
Prova d'esame del 21 settembre 2005 - *Parte I*

ND

Esercizio 1: Nel circuito resistivo di figura determinare il valore della corrente I.

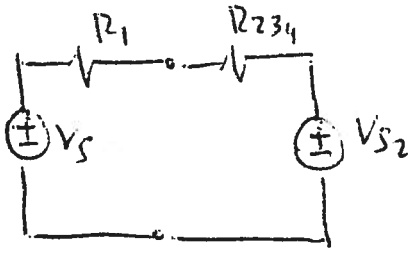
Dati: V_S= 10 V; I_S= 10 A; R_1 =5 Ω; R_2 =6 Ω; R_3 = 8 Ω; R_4 = 12 Ω;





$R_{234} = (R_2 // R_3) // R_4$

$= 2,\overline{6}\ \Omega$



$$I = \frac{V_S - R_{234} I_S}{R_1 + R_{234}} = -2,1734\ A$$

$V_{S2} = R_{234} I_S$

Esercizio 2 (*): Nel circuito di figura, funzionante in regime stazionario, calcolare la potenza generata da V_s.

Dati: V_s= 12 V; I_s=2 A; R_1=6 Ω; R_2=6 Ω; R_3=4 Ω; R_4=2 Ω

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Prova d'esame del 26 novembre 2004 - *Tema A*

Esercizio 1: Nel circuito resistivo di Fig. 1 determinare il valore della corrente *i* che fluisce nel resistore di resistenza R_3. Calcolare inoltre la potenza erogata dal generatore di tensione Vs.

Dati: V_S= 10 V; I_{S1} = 2 A; I_{S2} = 2 A; R_1 =10 Ω; R_2 =6 Ω; R_3 = 24 Ω.

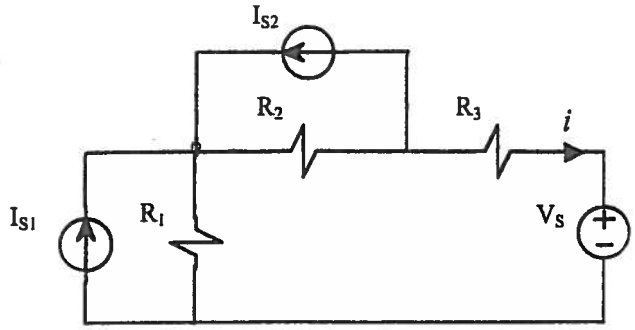
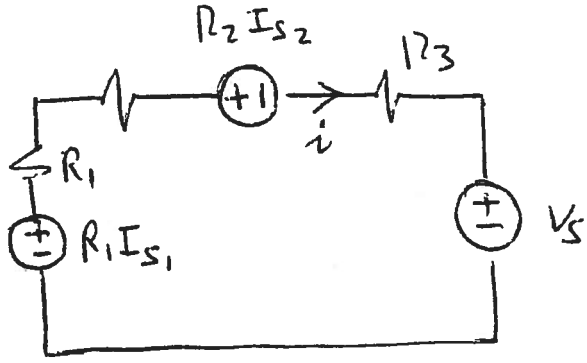
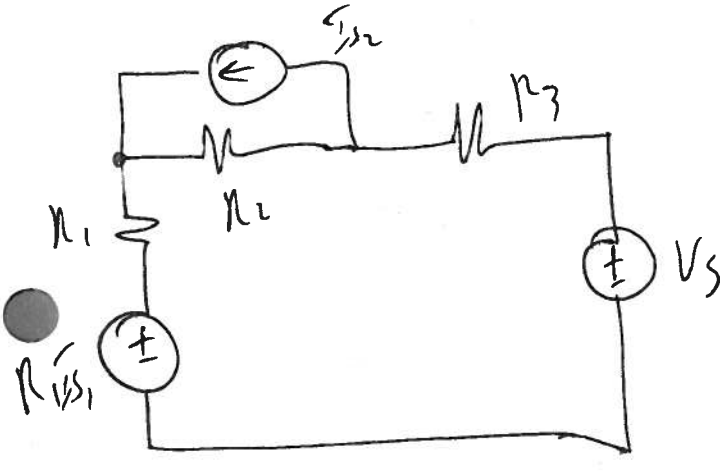


Fig. 1



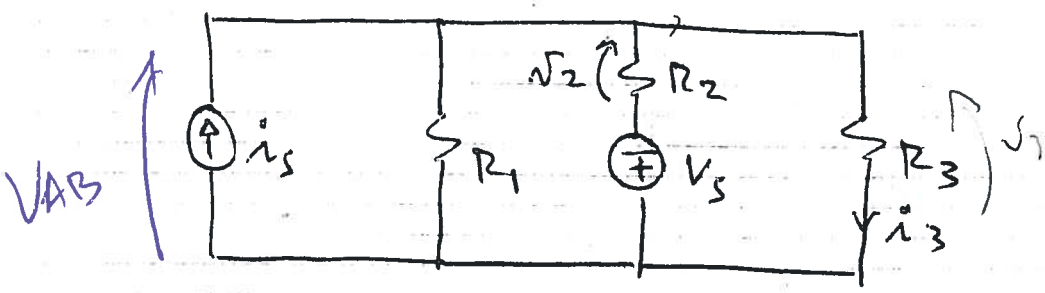
$$i = \frac{R_1 I_{S1} - R_2 I_{S2} - V_S}{R_1 + R_2 + R_3} = -0{,}05\ A$$

$$P_{V_S} = -V_S \cdot i = 0{,}5\ W \quad \text{(erogata)}$$



TRASFORMAZIONE GENERATORI

Calcolare i_3 e v_2



$i_s = 4A$

$v_s = 3V$

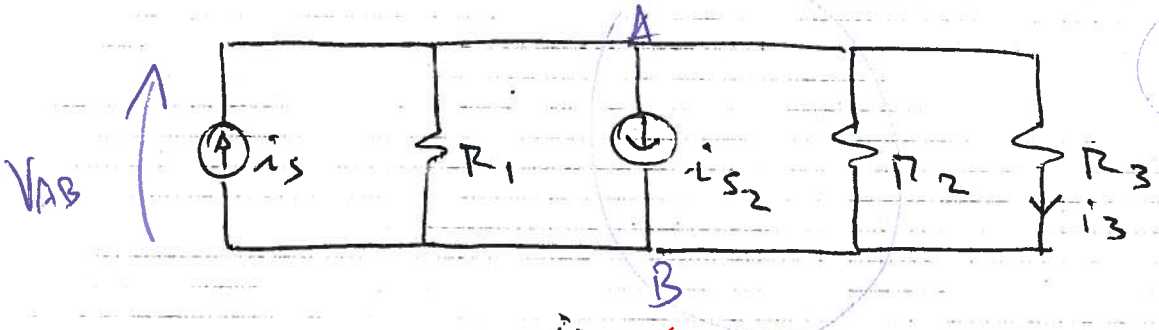
$R_1 = 2\Omega$

$R_2 = 2\Omega$

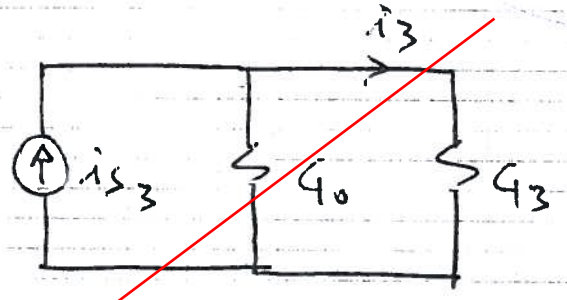
$R_3 = 1\Omega$

Cominciamo a calcolare i_3.

Trasformiamo la serie $v_s - R_2$ in parallelo



$$i_{s_2} = \frac{v_s}{R_2} = \frac{3}{2} A$$



$$G_0 = \frac{1}{R_1} + \frac{1}{R_2} = 1S$$

$$G_3 = \frac{1}{R_3} = 1S$$

$$i_{s_3} = 1s - i_{s_2} = \frac{5}{2} A$$

$$i_3 = i_{s_3} \frac{G_3}{G_0 + G_3} = \frac{5}{2} \cdot \frac{1}{2} = \frac{5}{4} A$$

Per calcolare v_2 dobbiamo tornare al circuito di partenza!

Aplicando ao LKT:

$$V_5 + R_3 i_3 - V_2 = 0 \Rightarrow$$

$$V_2 = V_5 + R_3 i_3 = \frac{17}{4} V$$

$$V_{AB} = \frac{I_5 - I_{S2}}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}} = \frac{4 - \frac{3}{2}}{\frac{1}{2} + \frac{1}{2} + 1}$$

$$= \frac{5}{4} V$$

$$I_{S3} = \frac{V_{AB}}{R_3} = \frac{5}{4} A$$

$$V_2 = V_{AB} + V_5 = \frac{17}{4} V$$

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Prova d'esame del 21 febbraio 2005 - *Parte I*

Esercizio 1: Nel circuito resistivo di Fig. 1 determinare il valore della corrente *I*.
Dati: $I_{S1} = 6$ A; $I_{S2} = 10$ A; $V_S = 4$ V; $R_1 = 1\ \Omega$; $R_2 = 2\ \Omega$; $R_3 = 3\ \Omega$

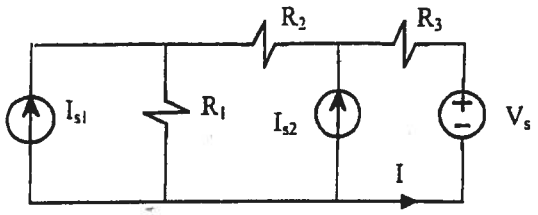

Fig. 1

$$I_S = \frac{R_1 I_{S1}}{R_1 + R_2} + I_{S2}$$

$$I = \frac{V_S - (R_1 + R_2) I_S}{R_1 + R_2 + R_3} = -5,\bar{3}\ \text{A}$$

Esercizio 2 (*): Nel circuito di Fig. 2, funzionante in regime stazionario, determinare il valore della corrente I_3 che fluisce

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Prova d'esame del 27 giugno 2012 – Esercizi

Esercizio 1 (6 punti): Nel circuito resistivo di Fig. 1 calcolare la tensione *v*.
Dati: $I_s = 3$ A; $R = 4\ \Omega$.

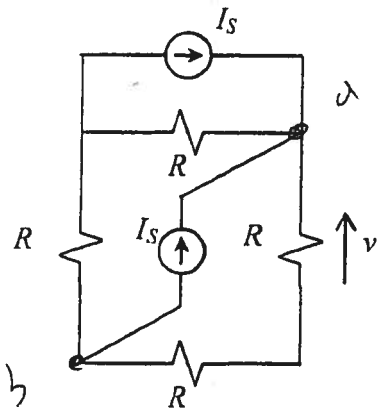
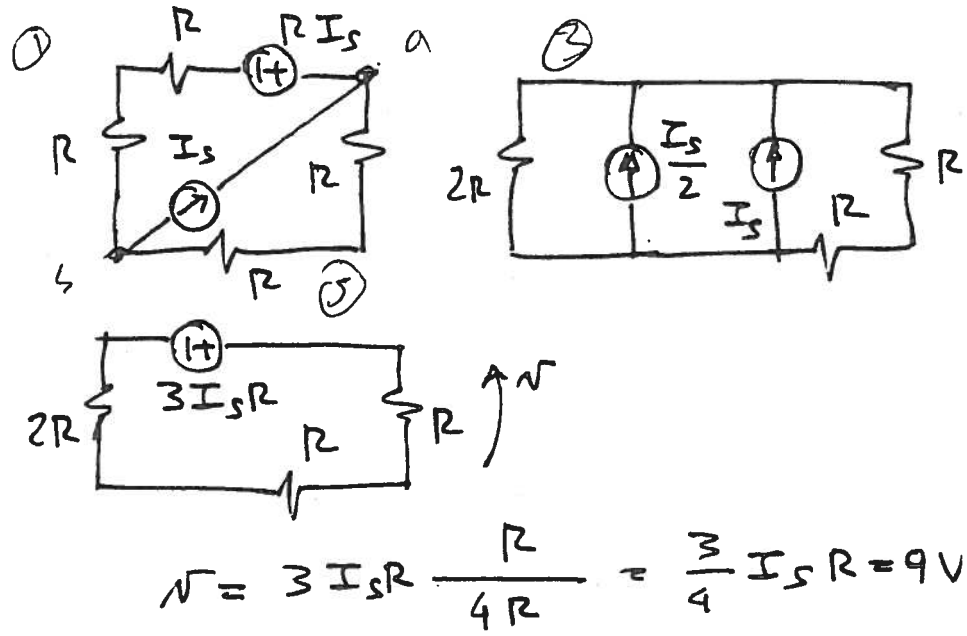


Fig. 1



$$v = 3 I_S R \frac{R}{4R} = \frac{3}{4} I_S R = 9\ \text{V}$$

Esercizio 2 (6 punti): Nel circuito con trasformatore ideale di Fig. 2, funzionante in regime sinusoidale, determinare la potenza complessa erogata dal generatore di tensione, il valore efficace della tensione V_{R2} e l'angolo di sfasamento tra tale tensione e la tensione del generatore.
Dati: $V_s = 8$ V (valore efficace); $R_1 = 4\ \Omega$; $R_2 = 8\ \Omega$; $X_L = 5\ \Omega$; $X_C = -6\ \Omega$.

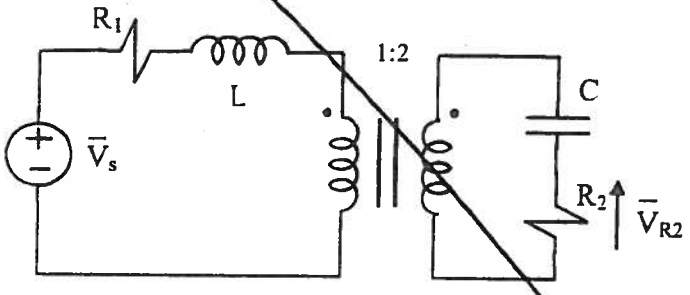
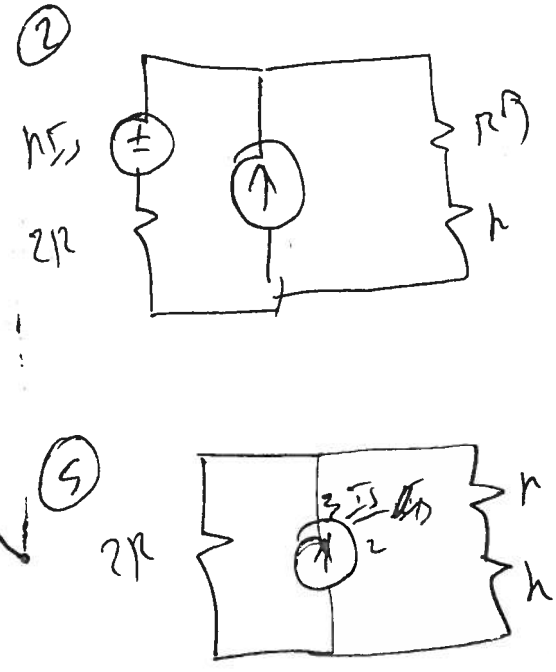


Fig. 2



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Prova d'esame del 27 giugno 2012 – Esercizi

Esercizio 1 (6 punti): Nel circuito resistivo di Fig. 1 calcolare la tensione *v*.
Dati: $I_s = 3$ A; $R = 4\ \Omega$.

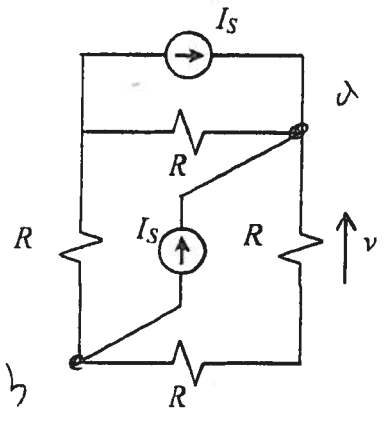
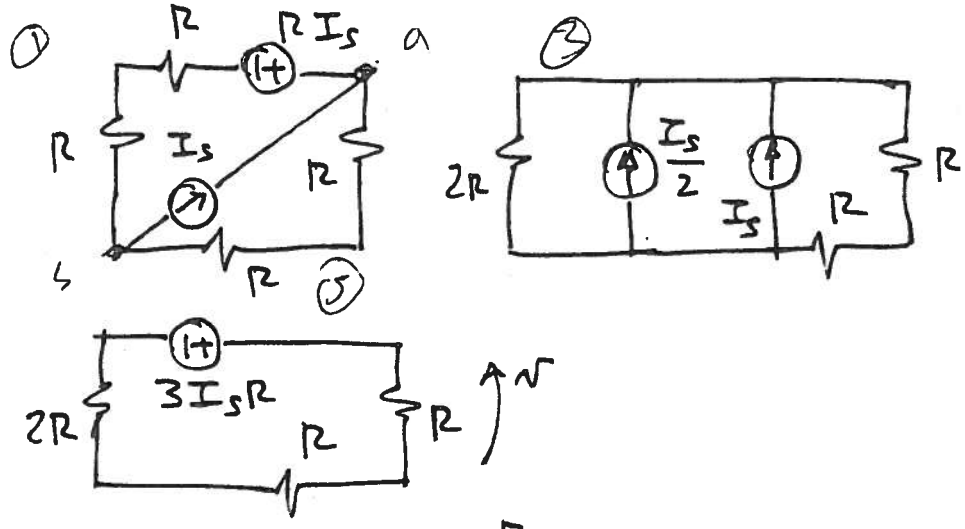


Fig. 1



$$v = 3I_SR\,\frac{R}{4R} = \frac{3}{4}I_SR = 9\text{ V}$$

Esercizio 2 (6 punti): Nel circuito con trasformatore ideale di Fig. 2, funzionante in regime sinusoidale, determinare la potenza complessa erogata dal generatore di tensione, il valore efficace della tensione V_{R2} e l'angolo di sfasamento tra tale tensione e la tensione del generatore.
Dati: $V_s = 8$ V (valore efficace); $R_1 = 4\ \Omega$; $R_2 = 8\ \Omega$; $X_L = 5\ \Omega$; $X_C = -6\ \Omega$.

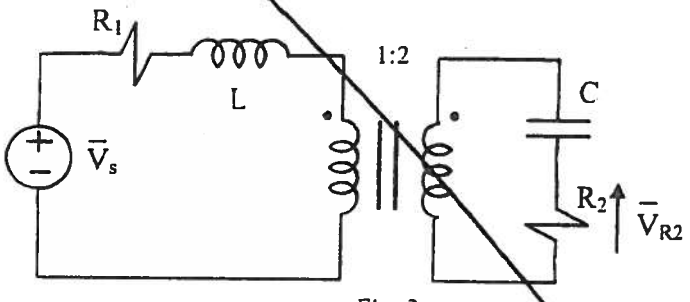


Fig. 2