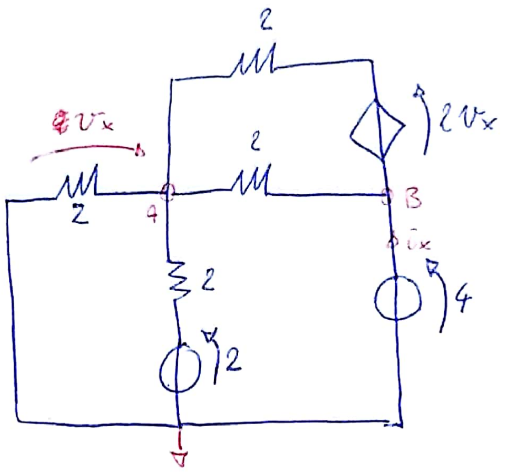
Ex 1



$V_x = V_A$ (vincoli)

$V_B = 4$

Nodi:

$$\begin{pmatrix} 2 & -1 \\ -1 & 1 \end{pmatrix}\begin{pmatrix} V_A \\ V_B \end{pmatrix} = \begin{pmatrix} 1 + \frac{2V_A}{2} \\ i_x - \frac{2V_A}{2} \end{pmatrix} = \begin{pmatrix} 1 \\ i_x \end{pmatrix} + V_A \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} V_A \\ 4 \end{pmatrix} = \begin{pmatrix} 1 \\ i_x \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} + i_x \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

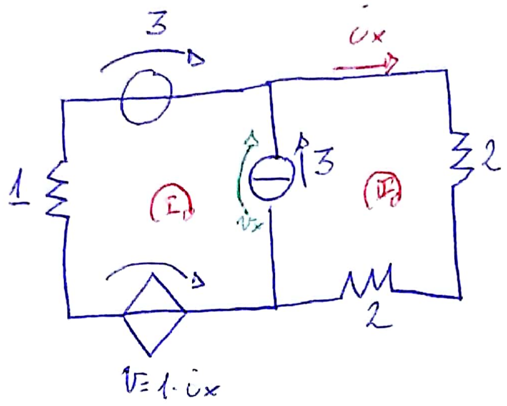
$$\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} V_A \\ i_x \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} + \begin{pmatrix} 4 \\ -4 \end{pmatrix} = \begin{pmatrix} 5 \\ -4 \end{pmatrix}$$

det $= -1$

$$\begin{vmatrix} 5 & 0 \\ -4 & -1 \end{vmatrix} = -5 \qquad V_A = \frac{-5}{-1} = 5V$$

$$\begin{vmatrix} 1 & 5 \\ 0 & -4 \end{vmatrix} = -4 \qquad i_x = +4A$$

Ex 2



Vincoli

$i_x = I_{m2}$

$I_{m2} - I_{m1} = 3$

$I_{m2} = I_{m1} + 3$

$$\begin{pmatrix} 1 & 0 \\ 0 & 4 \end{pmatrix}\begin{pmatrix} I_{m1} \\ I_{m2} \end{pmatrix} = \begin{pmatrix} 3 - V_x - I_{m2} \\ V_x \end{pmatrix} = \begin{pmatrix} 3 \\ 0 \end{pmatrix} + V_x\begin{pmatrix} -1 \\ 1 \end{pmatrix} + I_{m2}\begin{pmatrix} -1 \\ 0 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 1 \\ 0 & 4 \end{pmatrix}\begin{pmatrix} I_{m1} \\ I_{m1} + 3 \end{pmatrix} = \begin{pmatrix} 3 \\ 0 \end{pmatrix} + V_x\begin{pmatrix} -1 \\ 1 \end{pmatrix}$$

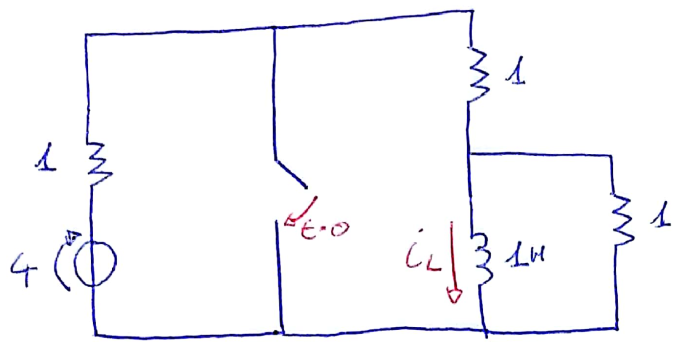
$$\begin{pmatrix} 2 & 1 \\ 4 & -1 \end{pmatrix}\begin{pmatrix} I_{m1} \\ V_x \end{pmatrix} = \begin{pmatrix} 3 \\ 0 \end{pmatrix} + \begin{pmatrix} -3 \\ -12 \end{pmatrix} = \begin{pmatrix} 0 \\ -12 \end{pmatrix} \qquad \det = -6$$

$$\begin{vmatrix} 0 & 1 \\ -12 & -1 \end{vmatrix} = 12 \rightarrow I_{m1} = \frac{12}{-6} = -2\,A$$

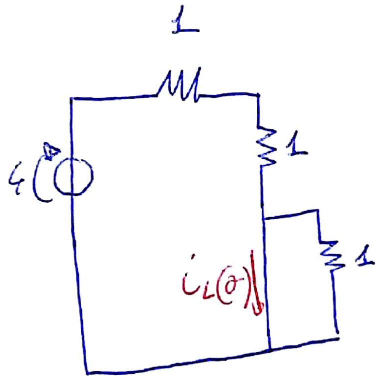
$$I_{m2} = I_{m1} + 3 = 1\,A$$

Pvg = 3*(-2) = -6W in CDG, quindi assorbiti

Ex 3



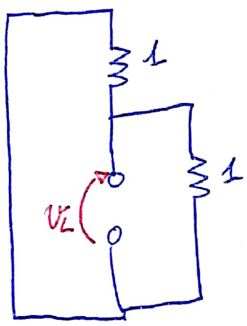
t<0



Per t=0⁻ si ha

$$i_L(0^-) = \frac{4}{2} = 2A$$

t>0

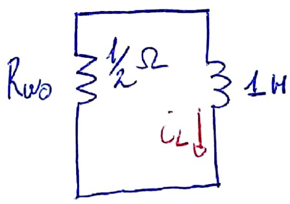


$E_{TH} = 0$ (nessun generatore)

$R_{TH} = 1 // 1 = 1/2 = R_{NO} \Rightarrow \tau = GL = 2$

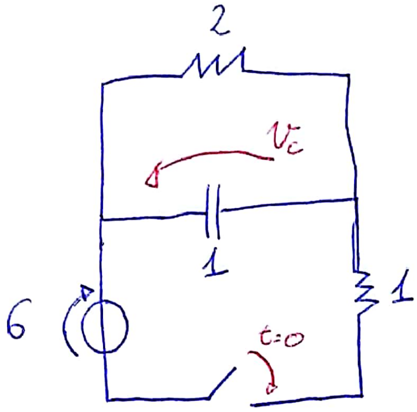
$i_L(\infty) = I_{NO} = 0$

$\rightarrow$

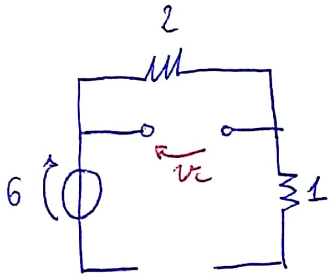


$$i_L(t) = i_L(\infty) + \left(i_L(0) - i_L(\infty)\right) e^{-t/\tau} = 2\,e^{-t/2}$$

Ex 4



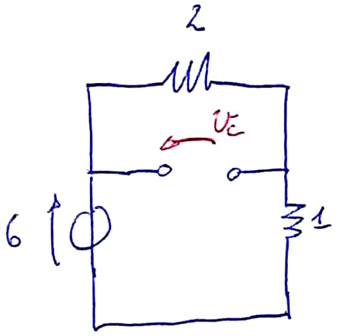
t<0



$V_c(0^-) = 0$

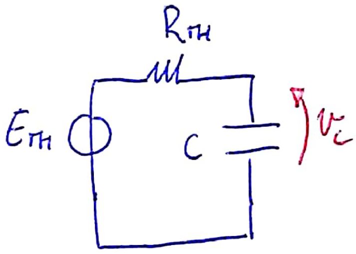
Nella maglia non scorre corrente se l'interruttore è aperta, quindi sulla resistenza da 2Ω non cade tensione.

t>0



$$E_{TH} = 6 \cdot \frac{2}{2+1} = 4V = V_c(\infty)$$

$$R_{TH} = 2 /\!/ 1 = \frac{2}{3} \Rightarrow \tau = RC = \frac{2}{3}$$



$$V_c(t) = V_c(\infty) + \left(V_c(0) - V_c(\infty)\right)e^{-t/\tau} =$$

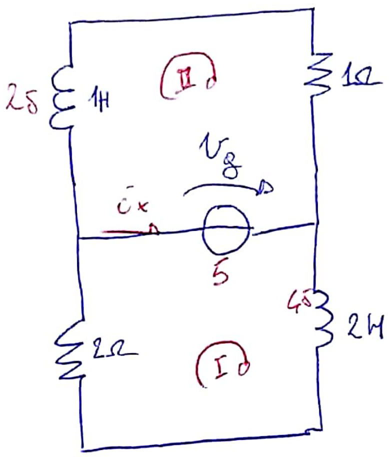
$$= 4 + \left(\;\; - 4\right)e^{-\frac{3}{2}t}$$

Ex 5

$v_g(t) = 5\cos(2t) \rightarrow \overline{V}_g = 5$

$Z_{L_1} = 2j$

$Z_{L_2} = 4j$



Maglie:

$$\begin{pmatrix} 2+4j & 0 \\ 0 & 1+2j \end{pmatrix} \begin{pmatrix} \overline{I}_{m_1} \\ \overline{I}_{m_2} \end{pmatrix} = \begin{pmatrix} 5 \\ -5 \end{pmatrix}$$

$$\det = (2+4j)(1+2j) = 2+4j+4j-8 = 8j-6$$

$$\frac{1}{8j-6} \begin{pmatrix} 1+2j & 0 \\ 0 & 2+4j \end{pmatrix} \begin{pmatrix} 5 \\ -5 \end{pmatrix} = \begin{pmatrix} \frac{5+10j}{8j-6} \\ \frac{-10-20j}{8j+6} \end{pmatrix}.$$

$$\overline{I}_{m_1} = \frac{(5+10j)(-8j-6)}{64+36} = \frac{-40j-30+80-60j}{100} = -j+\frac{1}{2}$$

$$\overline{I}_{m_2} = \frac{(-10-20j)(-8j-6)}{100} = \frac{80j+60-160+120j}{100} = 2j-1$$

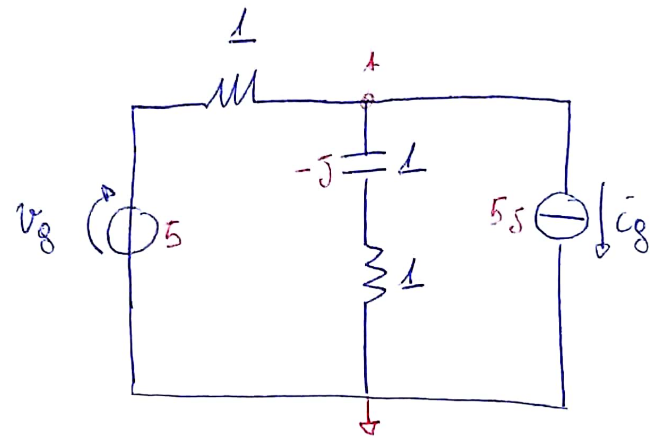
$$\overline{i}_x = I_{m_1} - I_{m_2} = -3j+\frac{3}{2}$$

$$S_{V_g} = \frac{1}{2}\overline{V}\overline{I}^* = \frac{1}{2}(5)\left(\frac{3}{2}+3j\right) = \underset{P}{\boxed{\frac{15}{4}}} + \underset{Q}{\boxed{\frac{15}{2}}}j$$

Ex 6

$v_g(t) = 5\cos(t) \Rightarrow 5$

$i_g(t) = 5\cos(t + \pi/2) \Rightarrow 5j$



Nodi

$$\left(1 + \frac{1}{1-j}\right)V_A = 5 - 5j$$

$$\frac{1-j+1}{1-j}\,V_A = 5 - 5j$$

$$V_A = (5-5j)\cdot\frac{1-j}{2-j} = (\cancel{5}-\cancel{5}j)\cdot\frac{(1-j)(2+j)}{\cancel{5}} = (1-j)(1-j)(2+j)$$

$$= (\cancel{1} - 2j \cancel{-1})(2+j) = -4j + \cancel{4}\,2$$

$$S_{i_g} = \frac{1}{2}\bar{V}\bar{I}^* = \frac{1}{2}(-4j+2)(5j) = \overset{P}{\boxed{10}} + \overset{Q}{\boxed{5}}\,j$$

$I_g = 5j$

ma in CDG, $\bar{I} = -\bar{I}_g = -5j$

e quindi $\bar{I}^* = 5j$