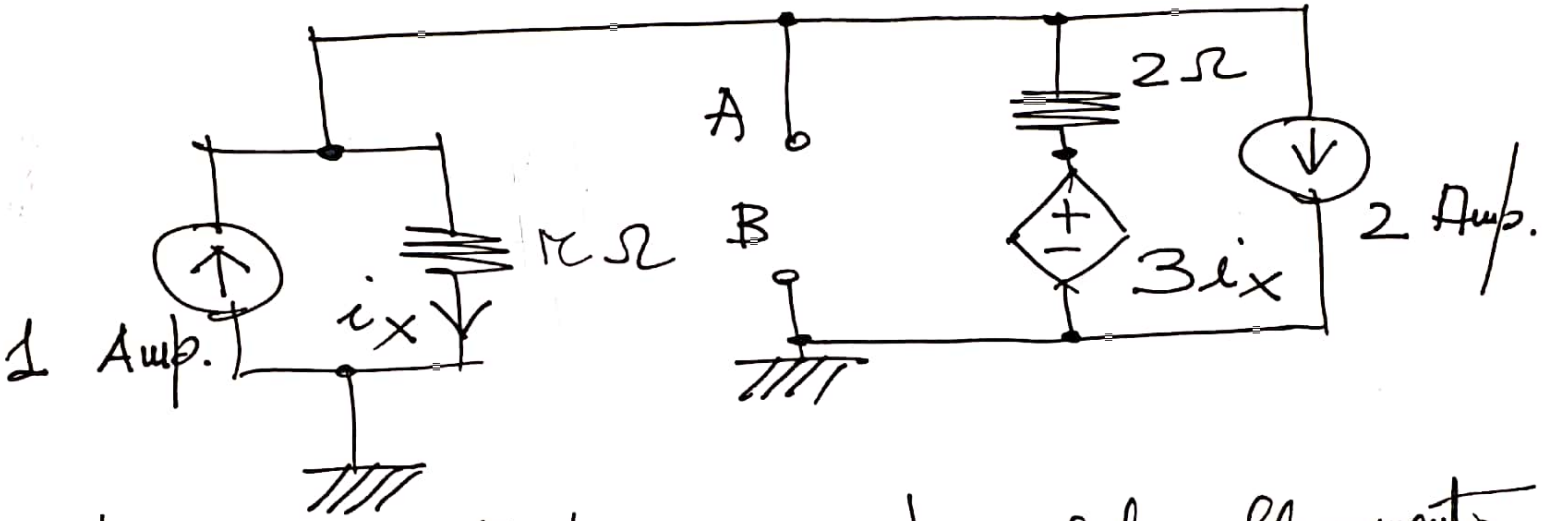
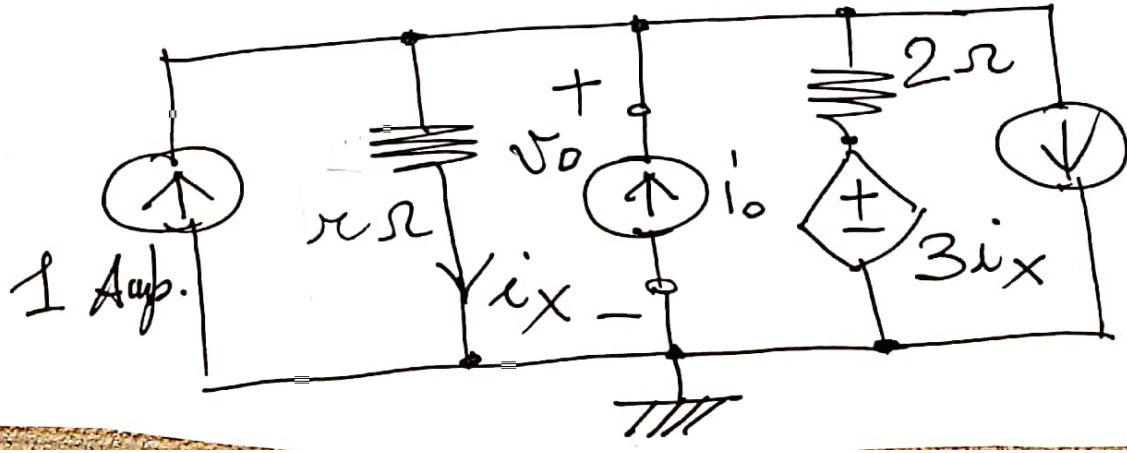
Esempio Determinare l'equivalente di Thevenin del bipolo A–B per $r \in \mathbb{R}$.



Soluzione. Ridisegno usando un solo collegamento di terra.



$g = \frac{1}{R}$ Pa Millmann

$$v_o = \frac{1 - 2 + \frac{3}{2} i_x + i_o}{g + \frac{1}{2}} = \frac{-1 + \frac{3}{2} i_x + i_o}{g + \frac{1}{2}}$$

$$\left(g + \frac{1}{2}\right) v_o = -1 + \frac{3}{2} i_x + i_o$$

$$i_x = g v_o$$

$$\left(g + \frac{1}{2}\right) v_o = -1 + \frac{3}{2} g v_o + i_o$$

$$\left(\frac{1}{2} - \frac{1}{2} g\right) v_o = -1 + i_o$$

$g \neq 1 \Rightarrow$

$$v_o = \underbrace{-\frac{1}{\frac{1}{2} - \frac{1}{2} g}}_{v_{eq}} + \underbrace{\frac{1}{\frac{1}{2} - \frac{1}{2} g}}_{R_{eq}} i_o$$

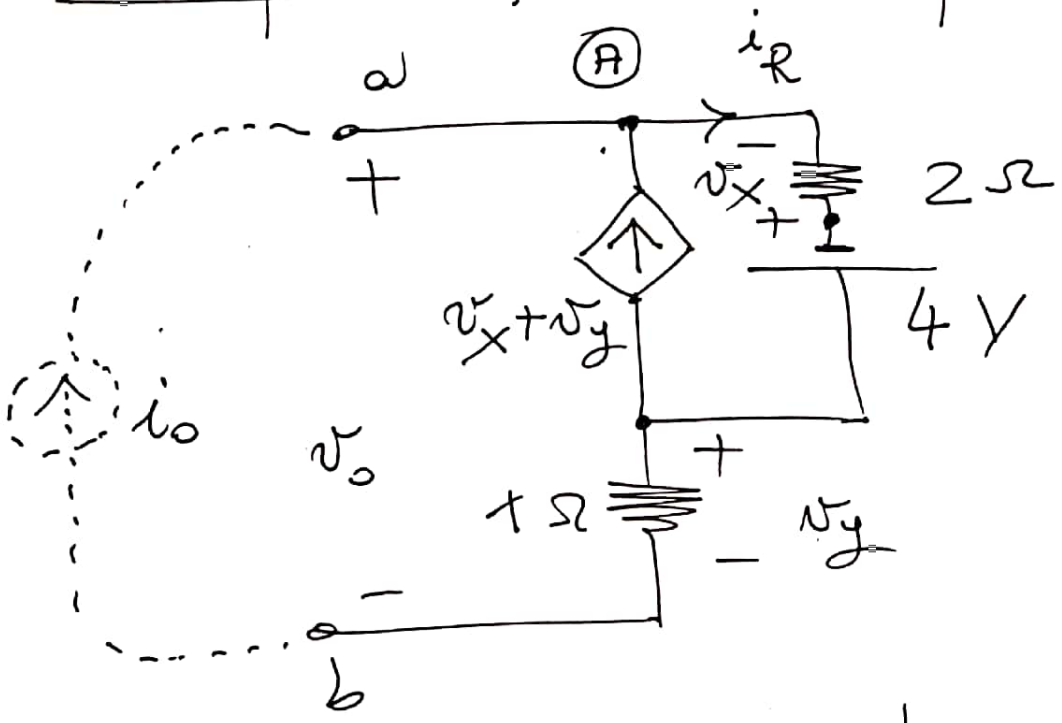
$g = 1$

$$0 = -1 + i_o \Rightarrow$$

$$i_o = 1 \Rightarrow$$

il bipolo non è controllabile in corrente.

Esempio 7. Thevenin bipolo ab



Soluzione: con metodo rapido...

$$\boxed{v_y = 1 \cdot i_o}$$

KI nodo (A):

$$i_o + v_x + v_y = i_R = -\frac{v_x}{2}$$

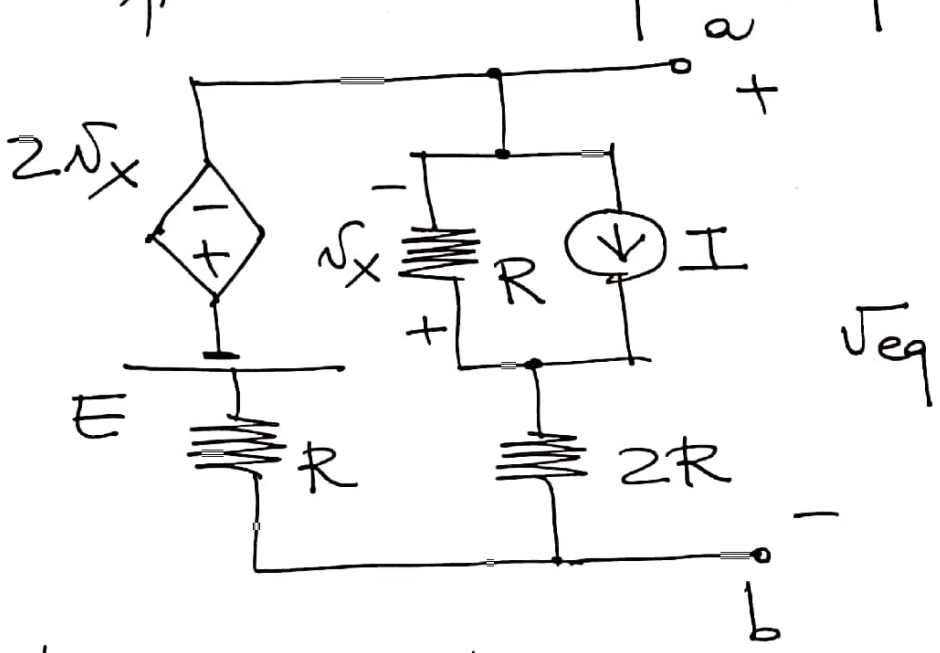
$$i_o + \frac{3}{2} v_x = -v_y = -i_o$$

$$\frac{3}{2} v_x = -2 i_o \Rightarrow \boxed{v_x = -\frac{4}{3} i_o}$$

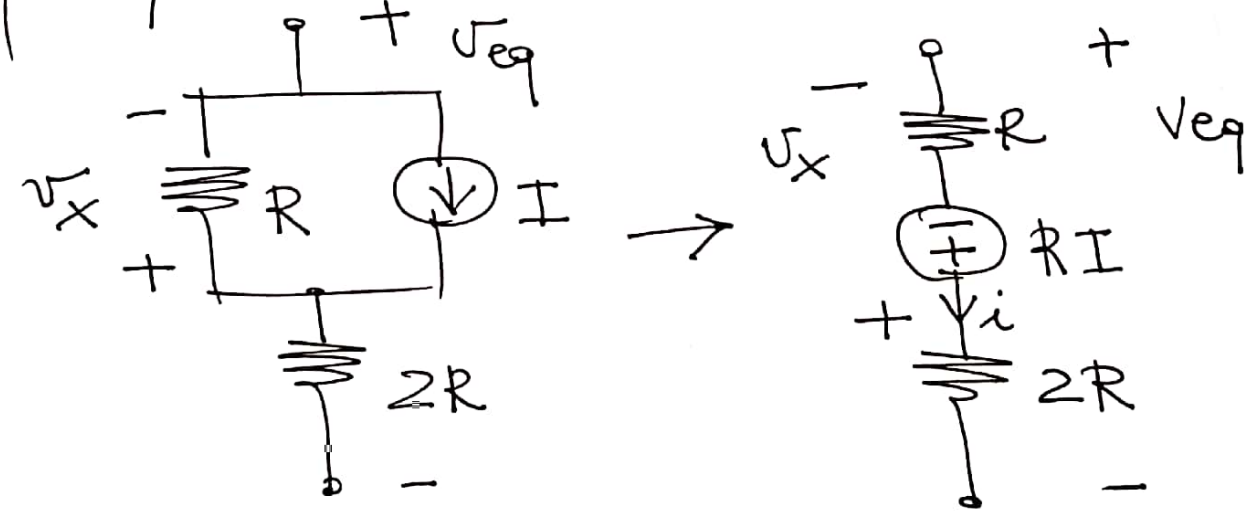
$$v_o = -v_x - 4 + v_y = \frac{4}{3} i_o - 4 + i_o$$

$$v_o = \underbrace{\frac{7}{3}}_{R_{eq}} i_o \underbrace{- 4}_{v_{eq}}$$

Esempio: Thevenin bipolo usando definizione di V_{eq} e R_{eq}



Soluzione: Determiniamo V_x

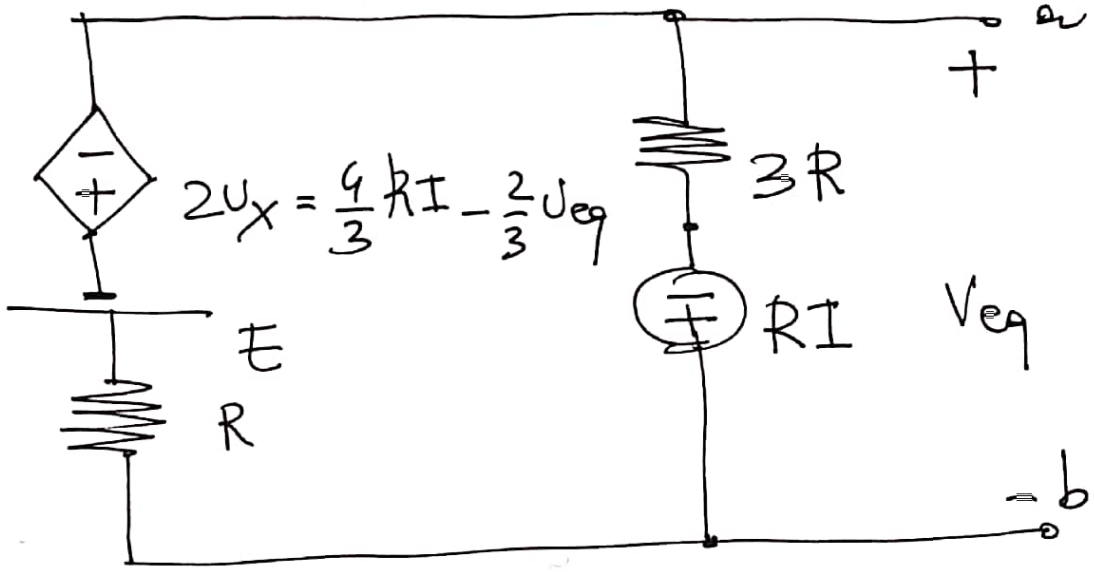


$$V_{eq} = Ri - RI + 2Ri = 3Ri - RI \Rightarrow$$

$$i = \frac{V_{eq} + RI}{3R}$$

$$V_x = -Ri + RI = -\frac{1}{3}V_{eq} - \frac{RI}{3} + RI$$

$$\boxed{V_x = \frac{2}{3}RI - \frac{1}{3}V_{eq}}$$



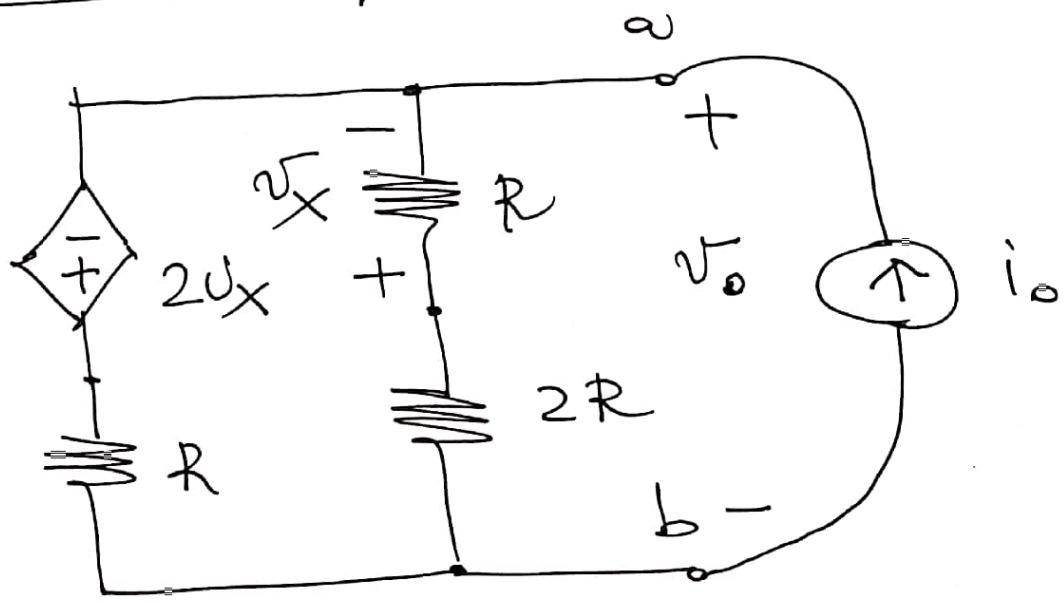
Millmann:

$$V_{eq} = \frac{-\dfrac{E + \frac{4}{3}RI - \frac{2}{3}V_{eq}}{R} - \dfrac{RI}{3R}}{\dfrac{1}{R} + \dfrac{1}{3R}}$$

.... risolvendo

$$V_{eq} = -\frac{3}{2}E - \frac{5}{2}RI.$$

Resistenza equivalente:



Millmann:

$$v_o = \frac{-\frac{2v_x}{R} + i_o}{\frac{1}{R} + \frac{1}{3R}} = -\frac{3}{2}v_x + \frac{3}{4}Ri_o$$

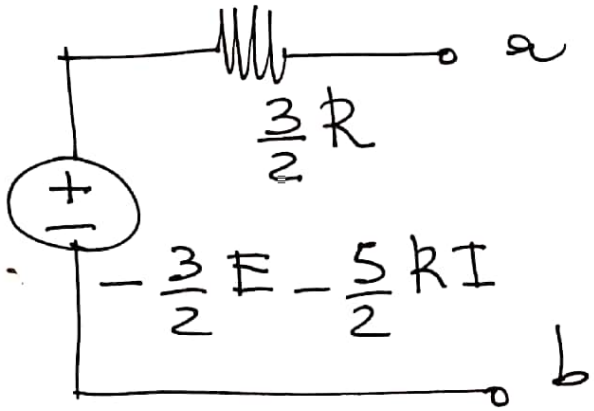
$$v_x = -v_o \frac{R}{3R} = -\frac{v_o}{3}$$

Sostituendo:

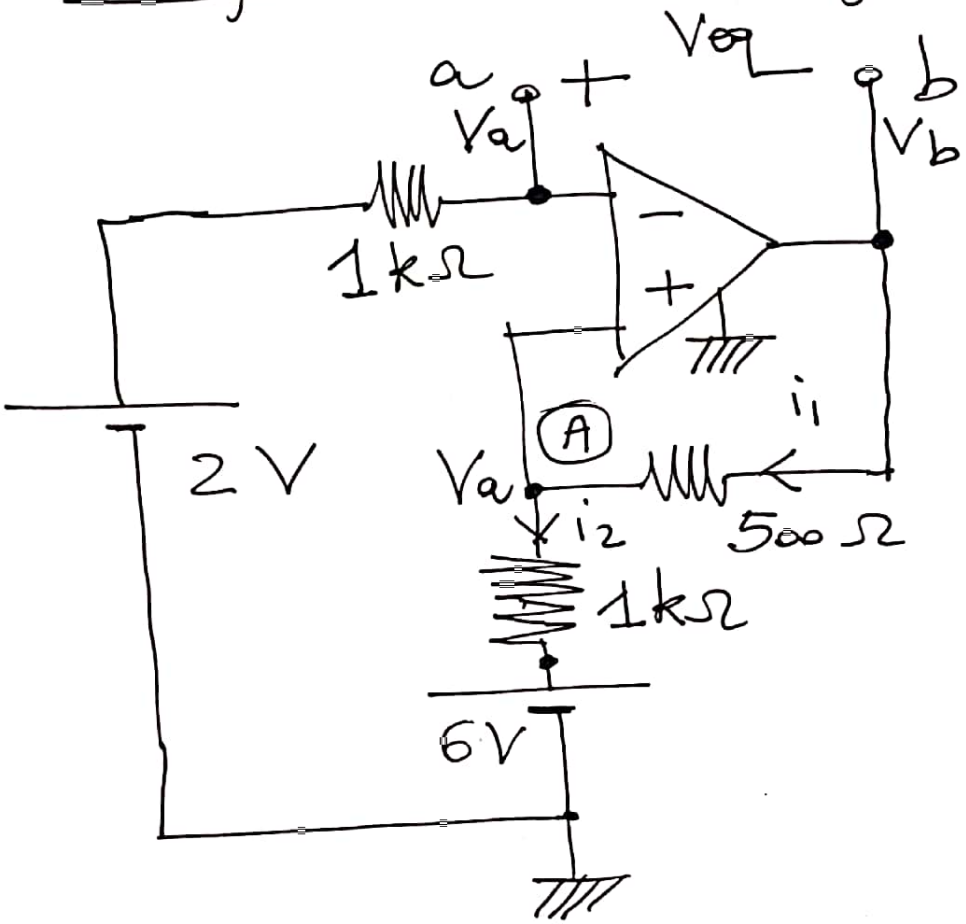
$$v_o = -\frac{3}{2}\left(-\frac{v_o}{3}\right) + \frac{3}{4}Ri_o = \frac{v_o}{2} + \frac{3}{4}Ri_o$$

$$v_o = \frac{3}{2}Ri_o \Rightarrow$$

$$R_{eq} = \frac{3}{2}R$$



Esempio ? Thevenin bipolo ab



Soluzione

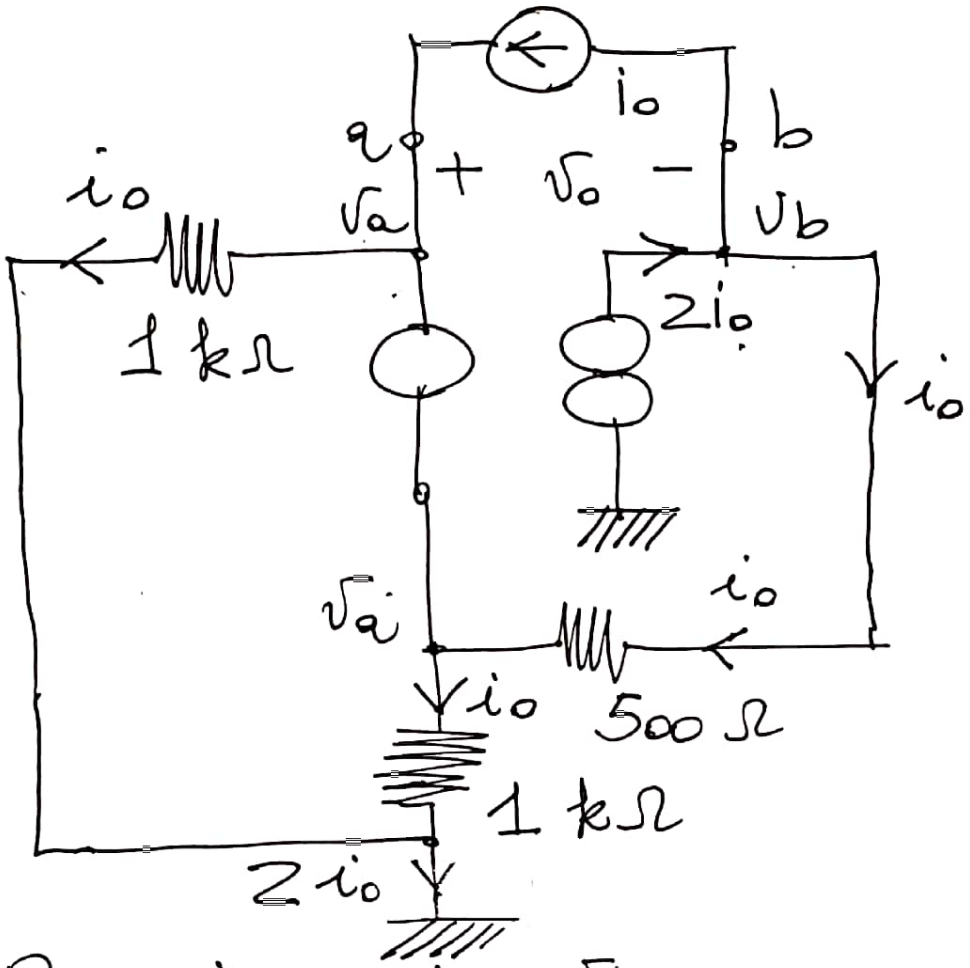
$$V_{eq} = V_a - V_b \; ; \; V_a = 2\,V$$

KI nodo (A) : $i_1 = i_2$

$$\frac{V_b - 2}{500} = \frac{2-6}{1000}$$

$$2V_b - 4 = -4 \Rightarrow V_b = 0 \Rightarrow$$

$$\boxed{V_{eq} = V_a - V_b = 2\,V}$$



$$R_{eq} = \frac{v_o}{i_o} = \frac{v_a - v_b}{i_o}$$

$$v_a = 1000\, i_o \quad ; \quad v_b = 1000\, i_o + 500\, i_o = 1500\, i_o$$

$$v_a - v_b = -500\, i_o \Rightarrow$$

$$R_{eq} = \frac{v_o}{i_o} = -500\ \Omega.$$