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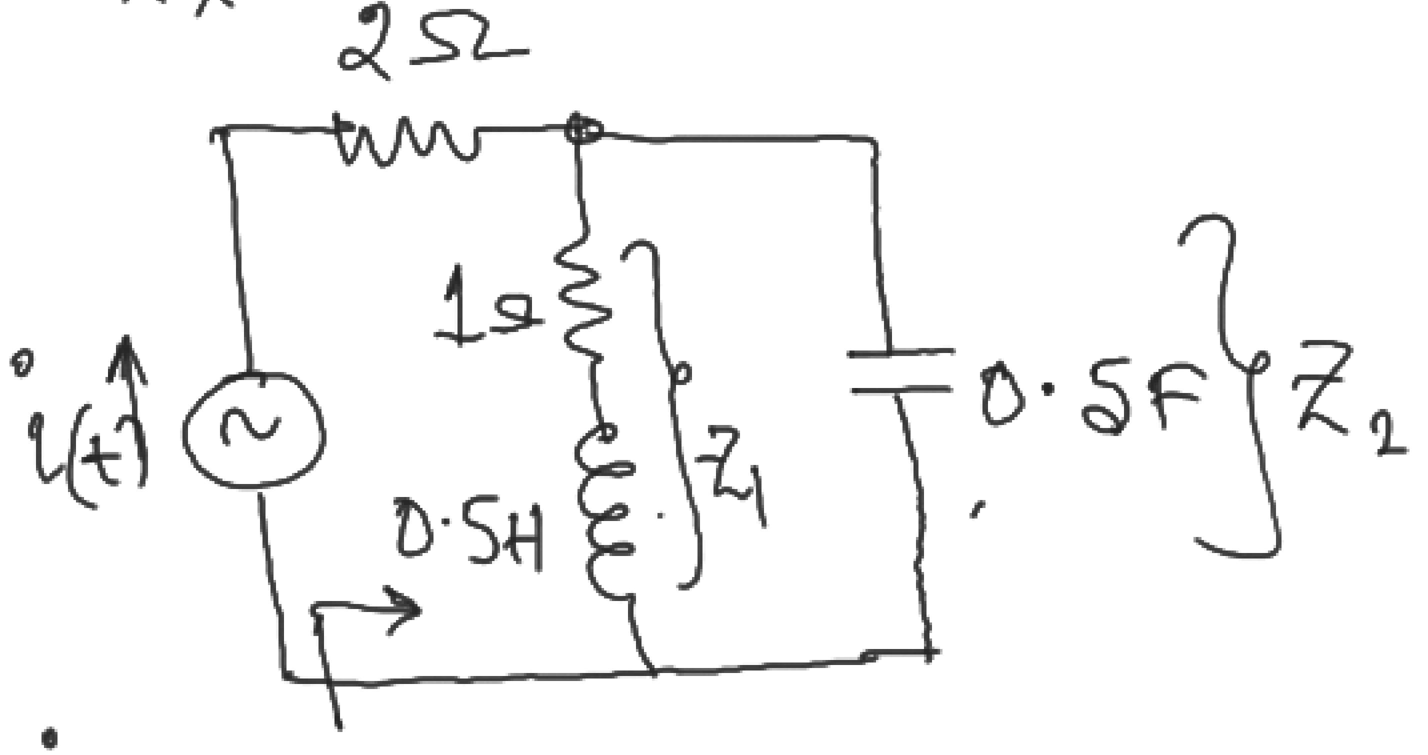


$Z_1 = 1 + j\omega L = 1 + j \times 2 \times 0.5 = 1 + j$

$Z_2 = \frac{1}{j\omega C} = -j$

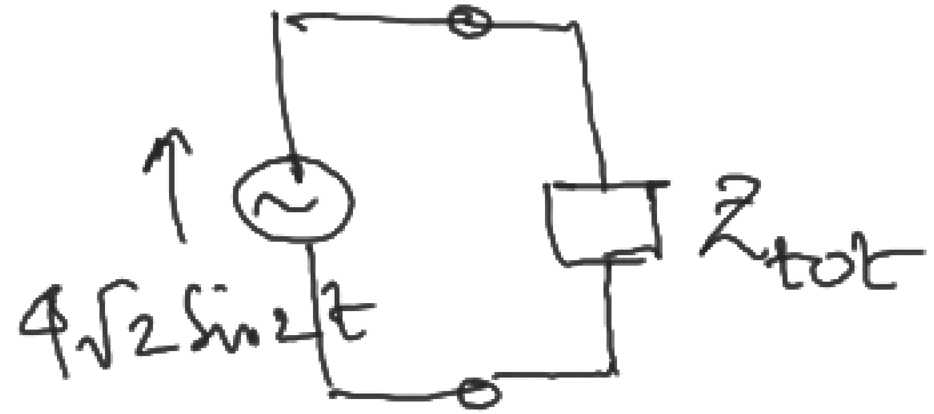
total impedance $= 2 + Z_1 \| Z_2$

$Z_{tot} = (3 - j)$ ohm.

$i(t) = 4\sqrt{2} \sin 2t$

$4\sqrt{2}$ → peak amplitude

2 → angular frequency.



Find out the impedance faced by the source & power dissipation.

$P = I_{r.m.s}^2 \, Re(Z)$.

$= \left(\frac{4\sqrt{2}}{\sqrt{2}}\right)^2 \cdot 3 = 48W.$

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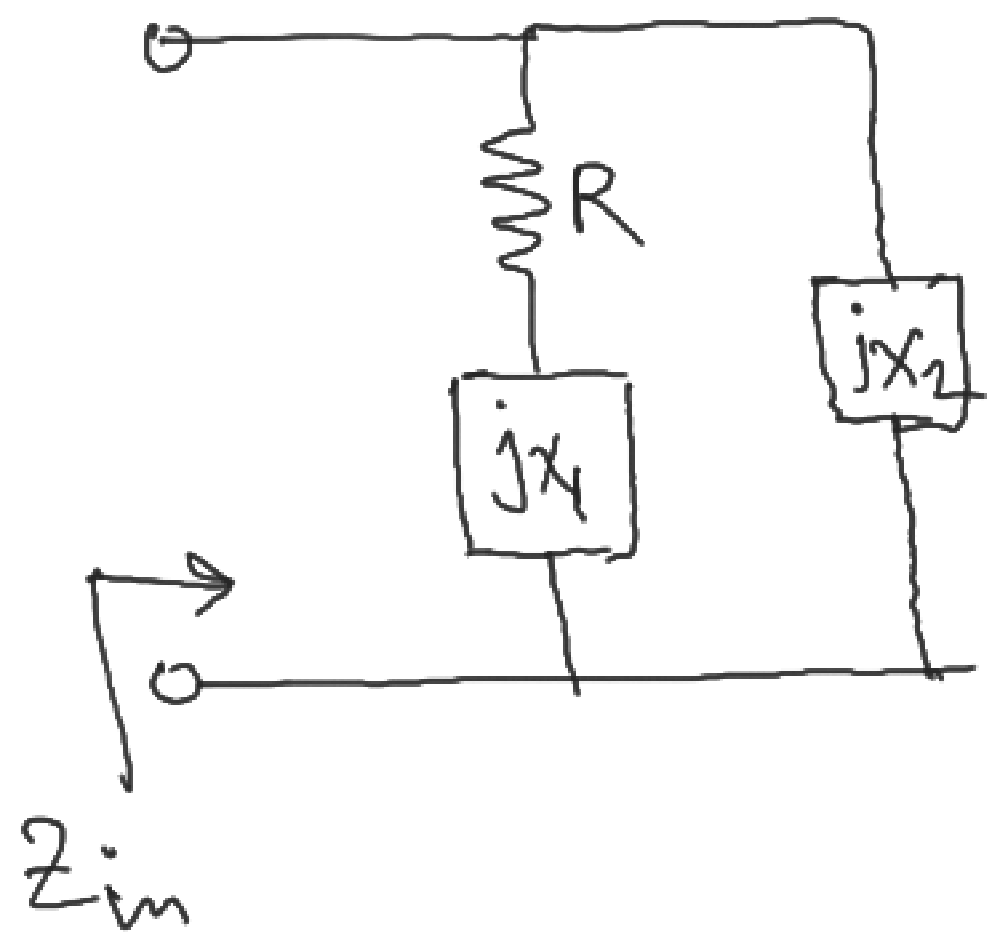

$$\Rightarrow Z_{in} = Z_1 \| Z_2$$

where $Z_1 = R + jX_2$ & $Z_2 = jX_2$.

$$Z_{in} = \frac{(R + jX_1)\, jX_2}{R + j(X_1 + X_2)}$$

$$= \frac{-X_1X_2 + jX_2R}{R + j(X_1 + X_2)}$$

Show that the input impedance Z_{in} will be independent of 'R' if $\underline{X_2 = -2X_1}$

$$|Z_{in}| = \frac{X_2\sqrt{X_1^2 + R^2}}{\sqrt{R^2 + (X_1 + X_2)^2}}$$

if Z_{in} is independent of 'R'

$$\sqrt{X_1^2 + R^2} = \sqrt{R^2 + (X_1 + X_2)^2} \quad \text{or} \quad \boxed{2X_1 = -X_2}$$

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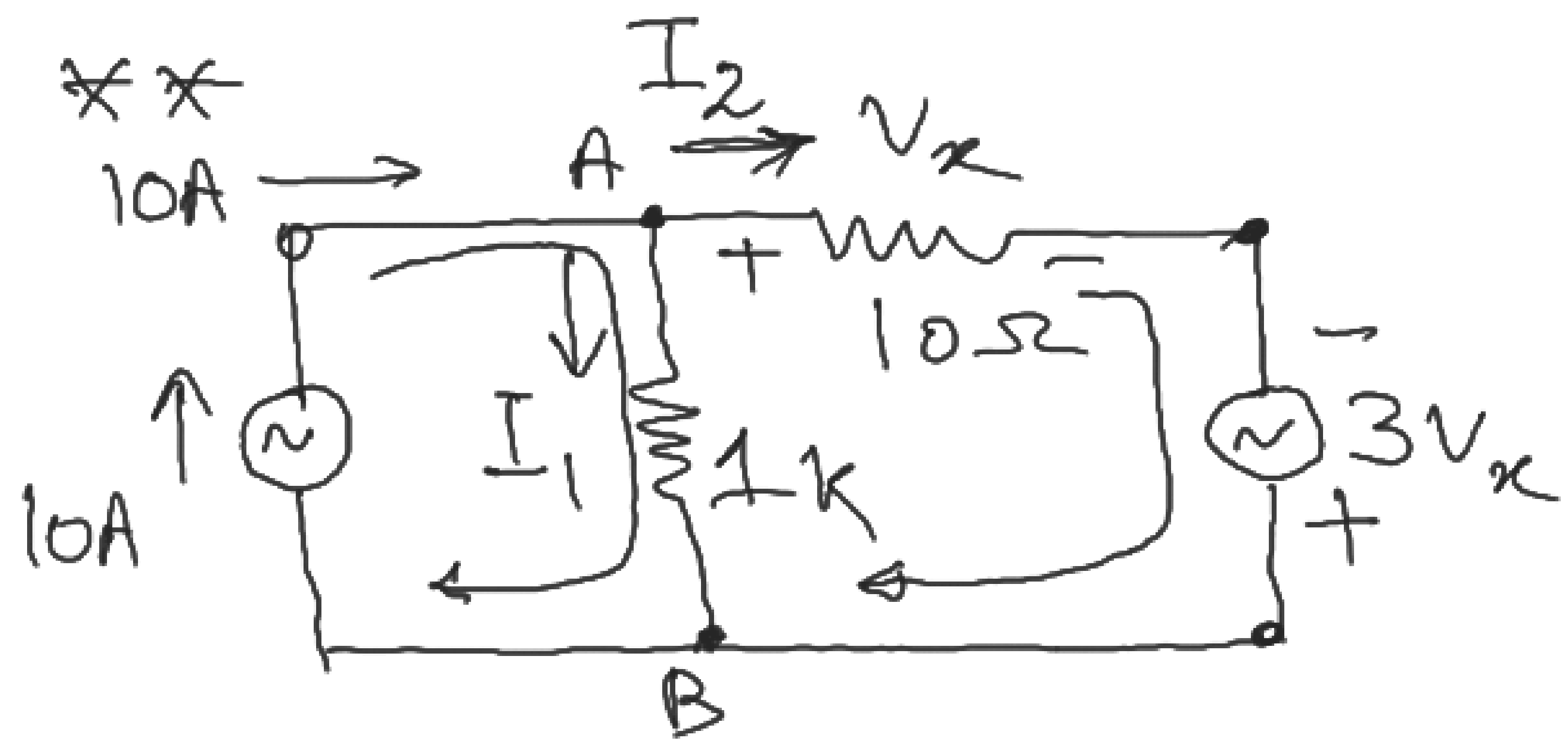


Calculate the power dissipation.

$\Rightarrow$

$$I_1 + I_2 = 10 \text{ ......(i)}$$

$$\left.\begin{aligned} V_{AB} &= 1000 I_1 \\ V_{AB} &= 10 I_2 - 3V_x \end{aligned}\right\} \boxed{1000 I_1 = 10 I_2 - 3V_x}$$

$$\boxed{V_x = 10 I_2}$$

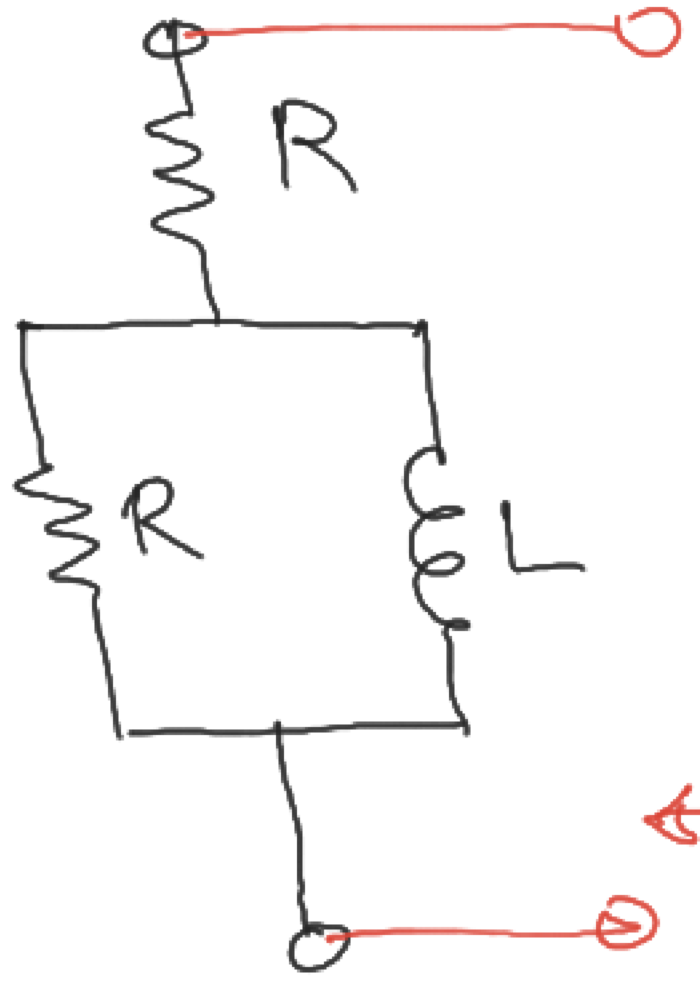
$$\left.\begin{aligned} 1000 I_1 &= 10 I_2 - 30 I_2 \\ I_2 &= -50 I_1 \end{aligned}\right\}$$

$$\left.\begin{aligned} I_1 + I_2 &= 10 \\ I_2 &= -50 I_1 \end{aligned}\right\} \begin{aligned} I_1 &= -\frac{10}{49} A. \\ I_2 &= \frac{500}{49} A. \end{aligned}$$

$$\boxed{P_{dissipated} = 1082.8 \text{ Watt}}$$

**

Find out the Q-factor of the circuit shown below.



$$\Rightarrow \quad Z = (\text{Real}) + j\,(\text{reactance}).$$

**

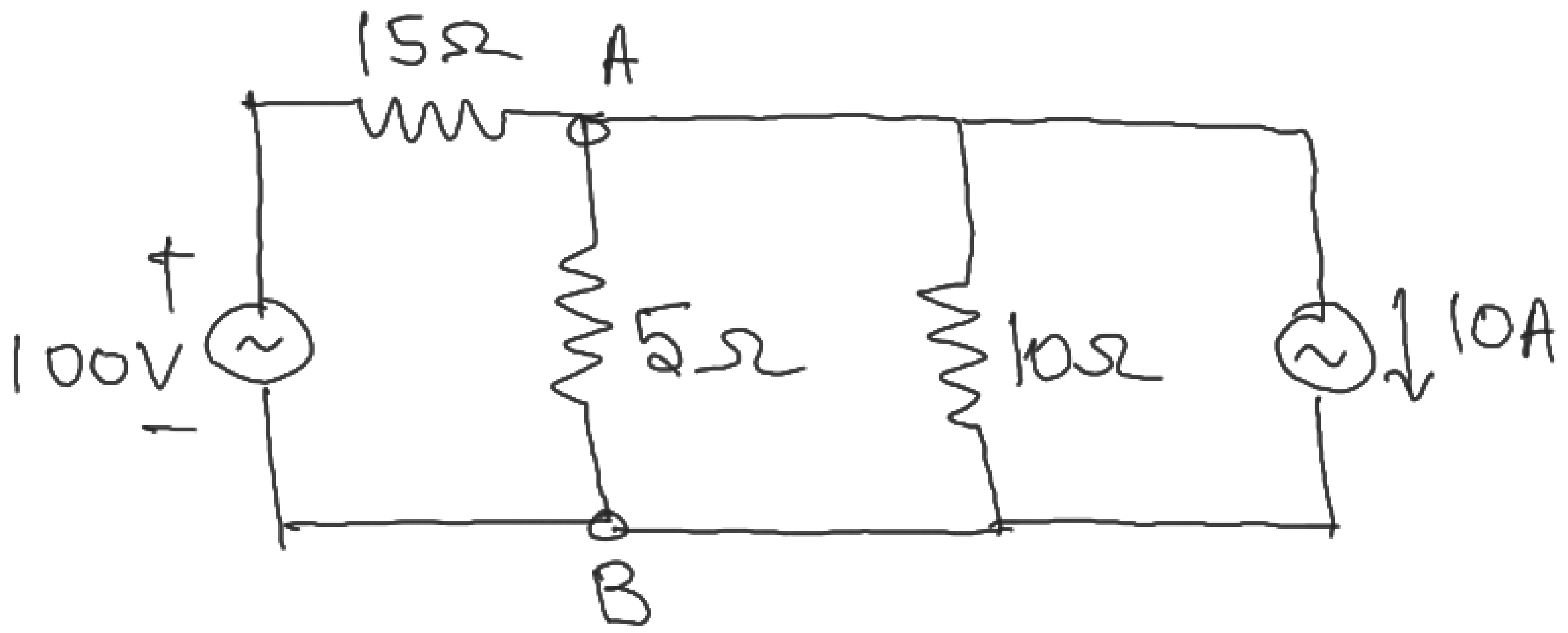
$$\boxed{Q = \frac{|\text{Reactance}|}{|\text{Real}|}}$$

$$Z = R + (R \,\|\, j\omega L) = \frac{R + j\omega L R(R - j\omega L)}{R^2 + \omega^2 L^2}$$

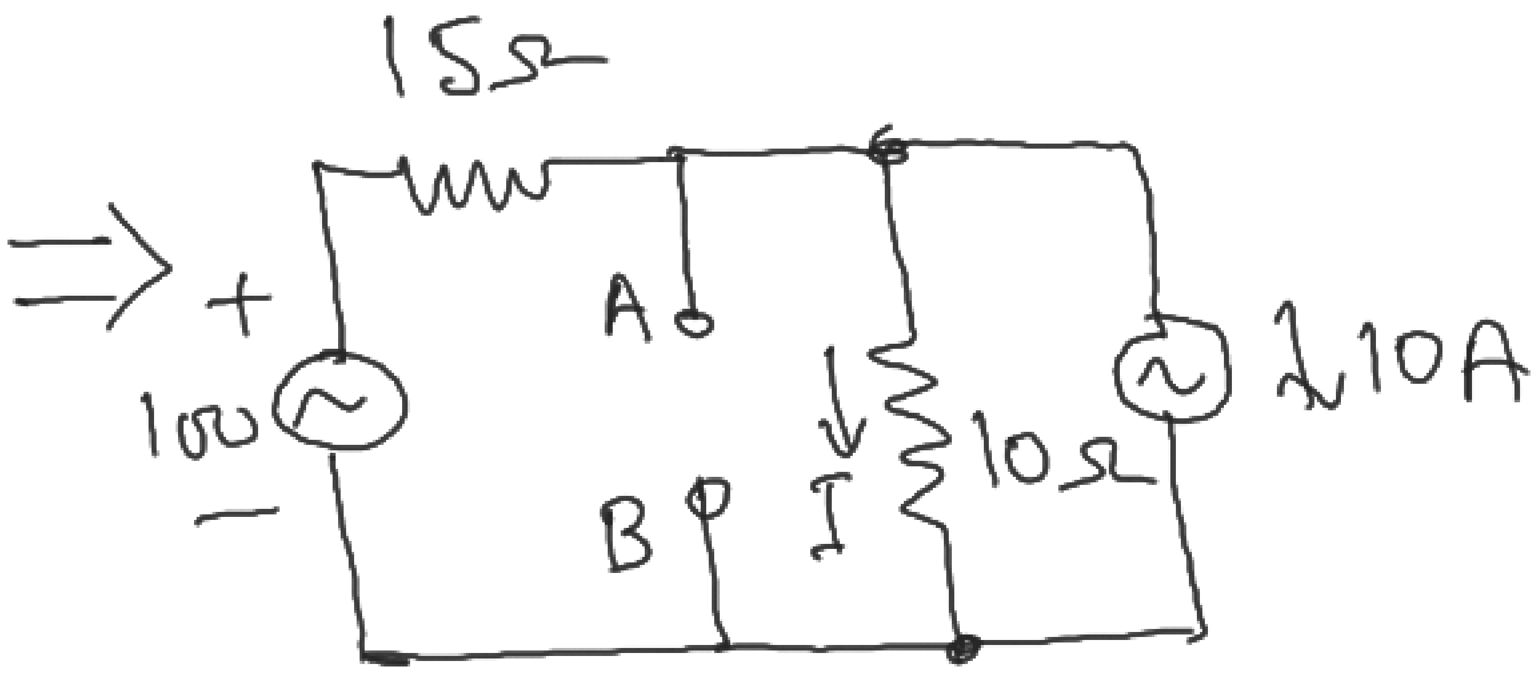
$$Z = R + \frac{\omega^2 L^2 R}{R^2 + \omega^2 L^2} + j\,\frac{\omega L R^2}{R^2 + \omega^2 L^2}.$$

$$\boxed{Q = \frac{\omega L R^2}{R^3 + 2\omega^2 L^2 R} = \frac{\omega L R}{R^2 + 2\omega^2 L^2}}$$

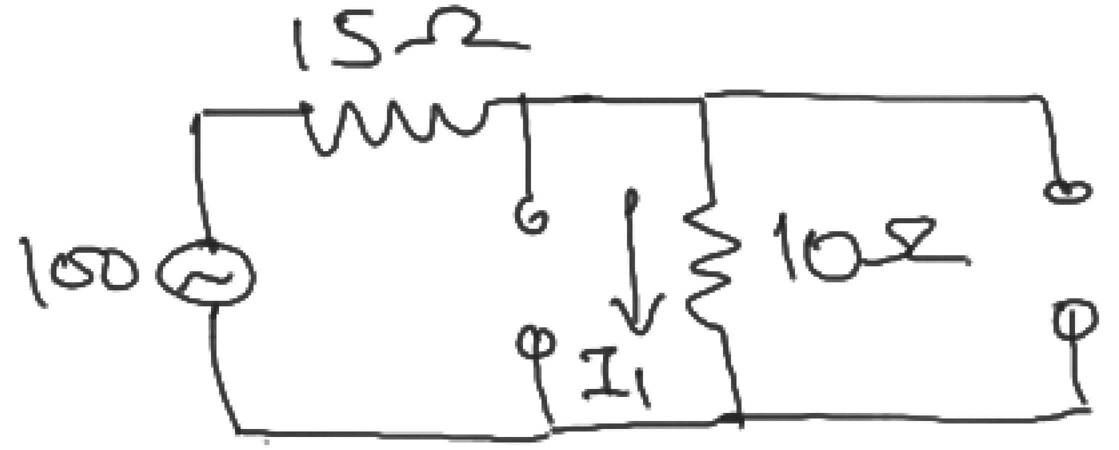
Ex



$\Rightarrow$

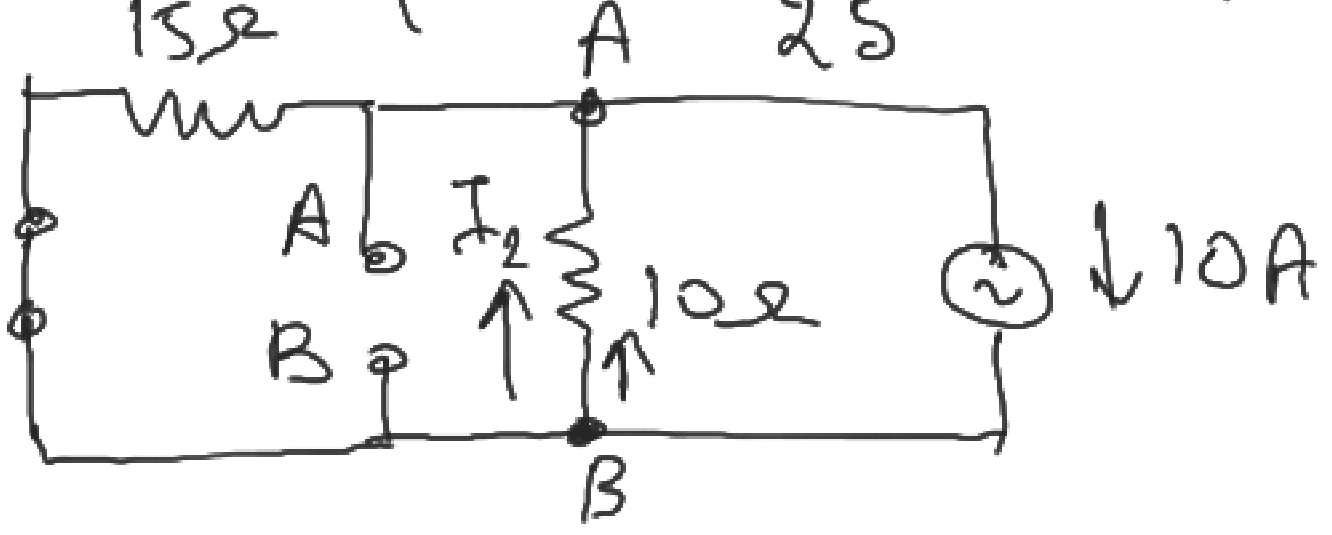


Find out the current flowing through the 5Ω resistance.



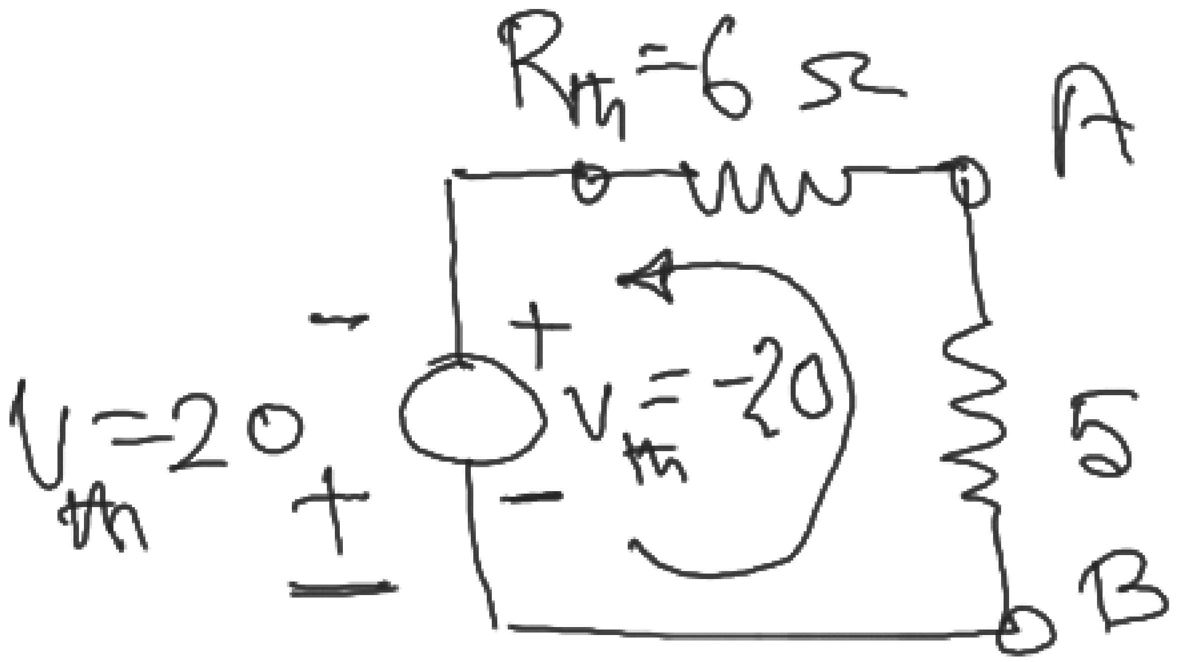
$$R_{Th} = \frac{15\times 10}{15+10} = 6\Omega$$

$$I_1 = \frac{100}{25} = 4A$$



$$\boxed{I = I_1 - I_2 = -2A}$$

$$I_2 = \overset{2}{\cancel{10}} \times \frac{\overset{3}{\cancel{15}}}{\underset{\cancel{5}}{\cancel{25}}} = 6A$$



$$\boxed{I = \frac{20}{11} A.}$$

$$\left.\begin{aligned} I_{AB} &= -\frac{20}{11} A \\ I_{BA} &= +\frac{20}{11} A. \end{aligned}\right\}.$$

* "Fundamentals of electric circuits" — M. N. O. Sadiku.

* "Network analysis" — M. E. Van Valkenburg.

* "Fundamentals of electric circuit Theory" — D. Chattopadhyay & P. C. Rakshit.

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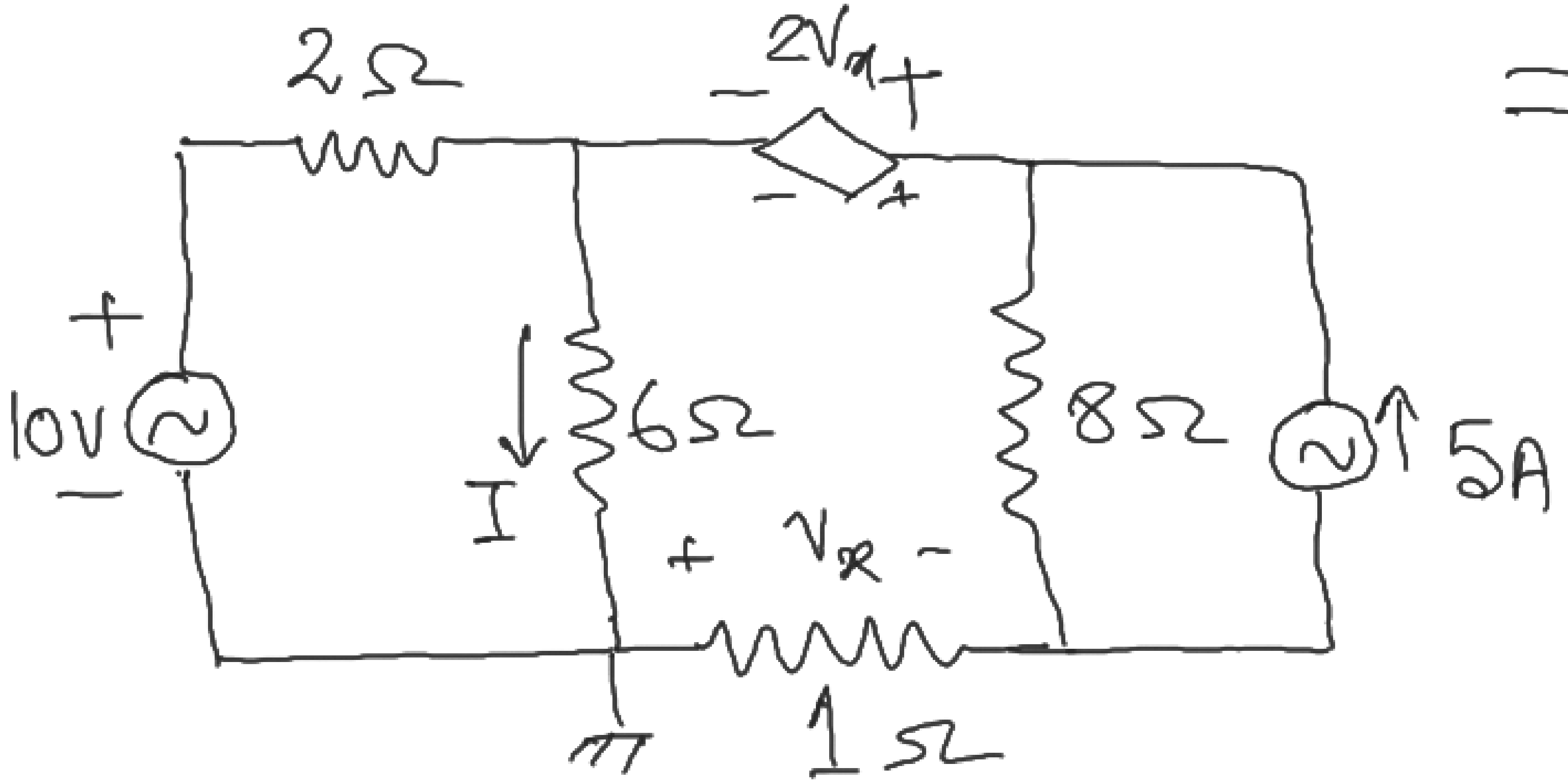
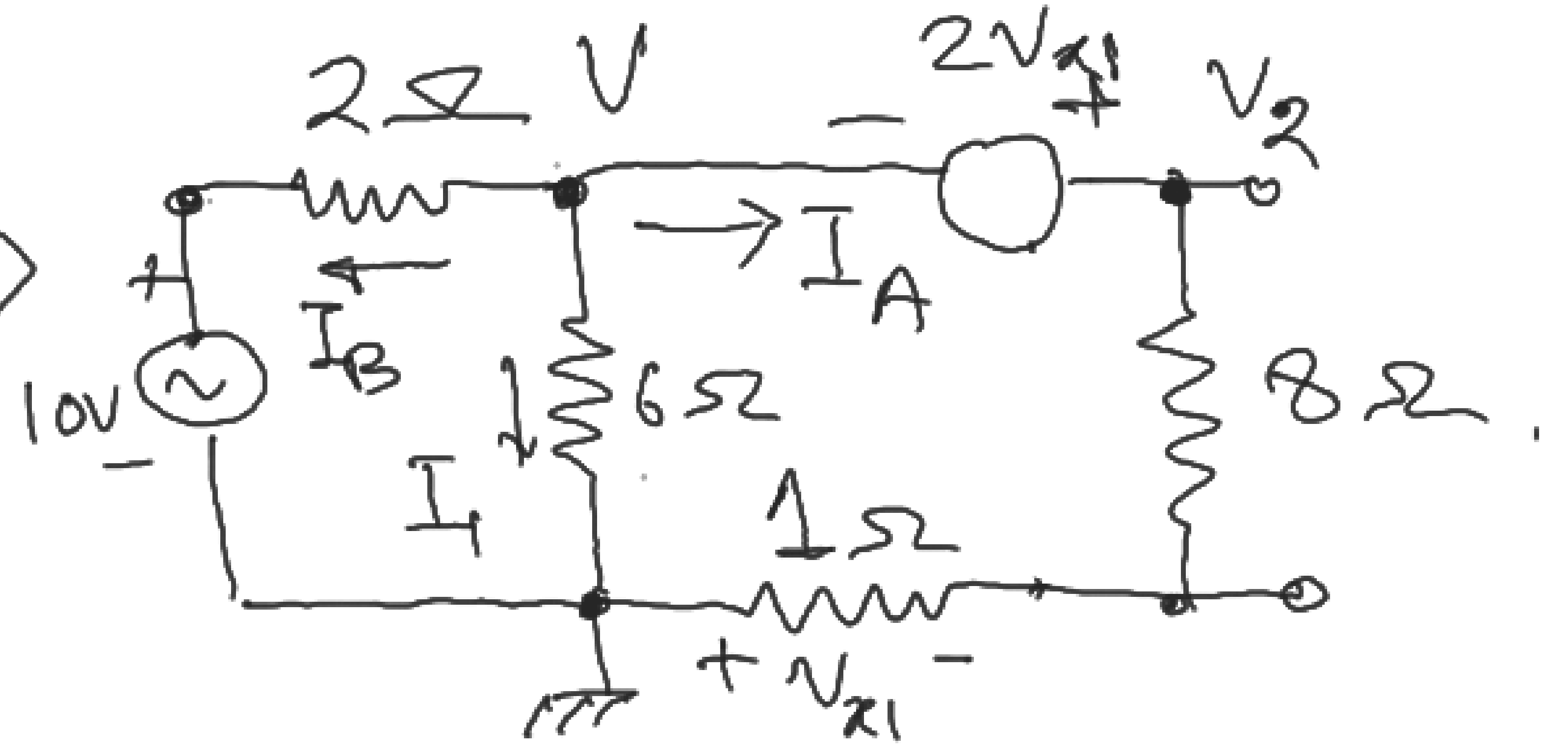


What is the value of I ??

$$\boxed{V_2 = \frac{9}{11} V}$$

$$\boxed{I_A = \frac{V}{11}}.$$

⇒



$$\boxed{I_A + I_1 + I_B = 0} \quad \ldots\ldots (i)$$

$$I_B = \frac{V-10}{2}.$$

$$I_A = \frac{V_2}{8+1} = \frac{V_2}{9}$$

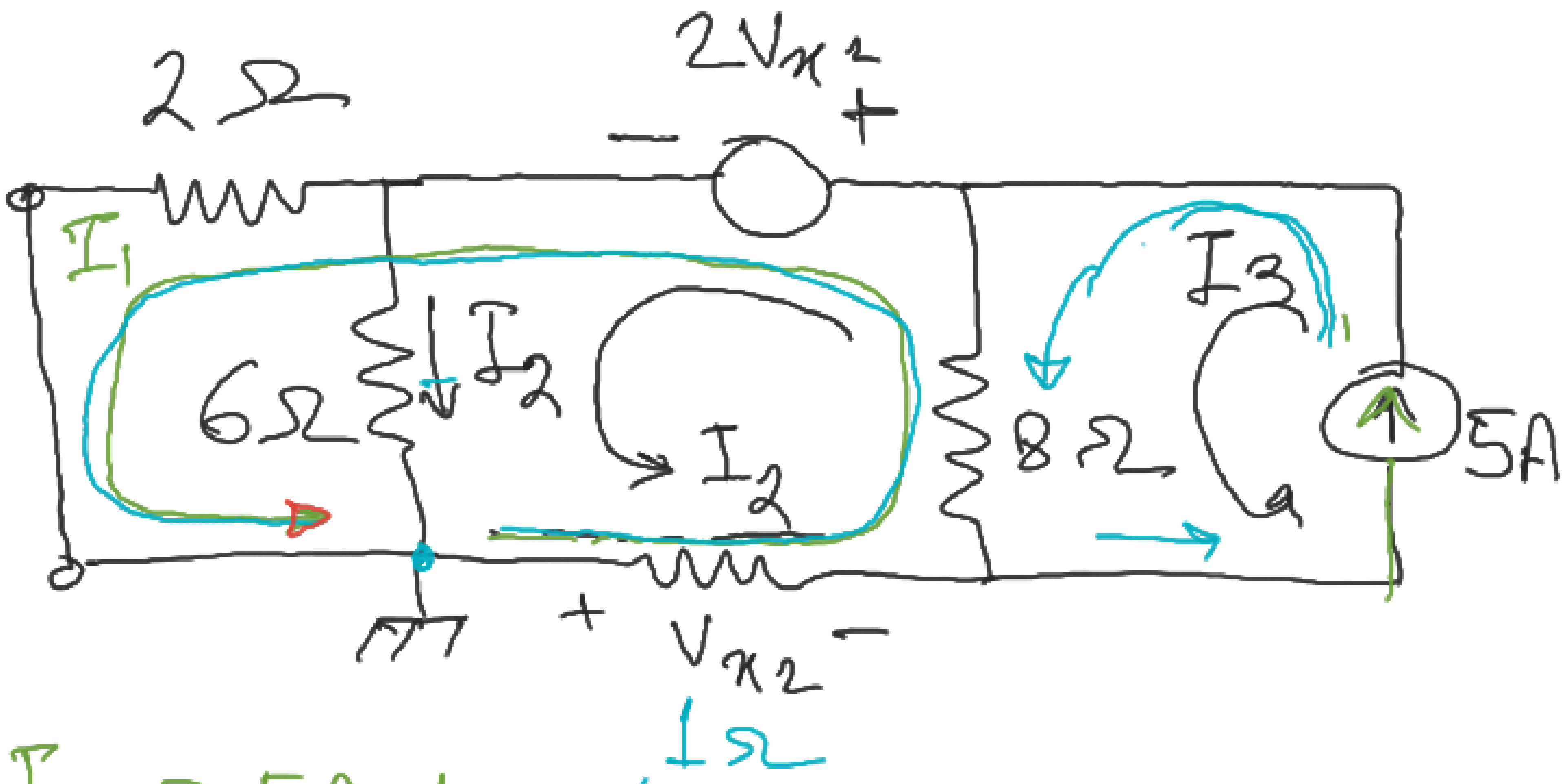
$$V_{x1} = -\frac{V_2}{9}\times 1 \quad \& \quad V_2 - V = 2V_{x1}$$

$$\boxed{V = V_2 - 2V_{x1}} \qquad \boxed{V_2 = 2V_x + V}$$

$$v\left(\frac{1}{2}+\frac{1}{6}+\frac{1}{11}\right)=5$$

$$V = 6.6\ \text{Volt}.$$

$$\boxed{I_1 = 1.1A}$$



$I_3 = 5\text{Amp}.$

$V_{x_2} = (I_1+I_2)\times 1$

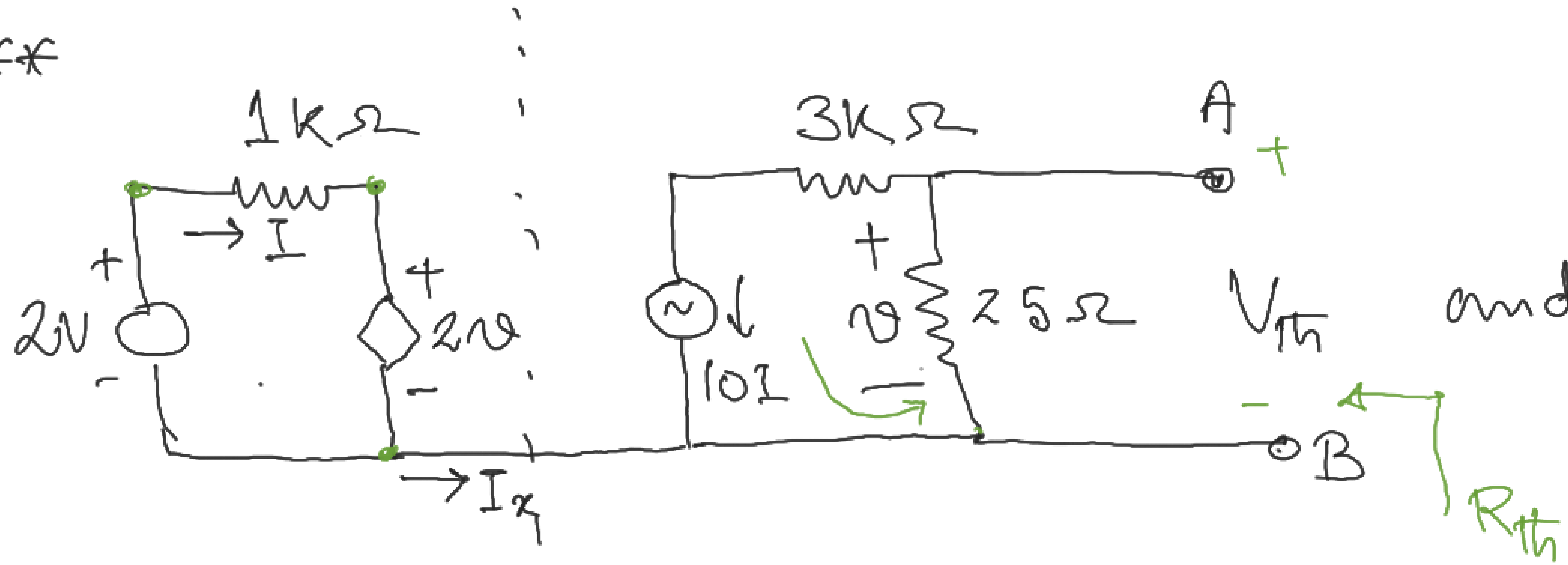
$$(I_1+I_2) + (I_1+I_2-I_3)8 + 2V_x + 2I_1 = 0$$

$$\boxed{I_2 = 0.8A.}$$

Total current through 6Ω resistance is

$I = 0.8+1.1 = 1.9A$

**



V_{th} and R_{th}.

What is I_x value?

Find out Thevenin equivalent at terminal A-B.

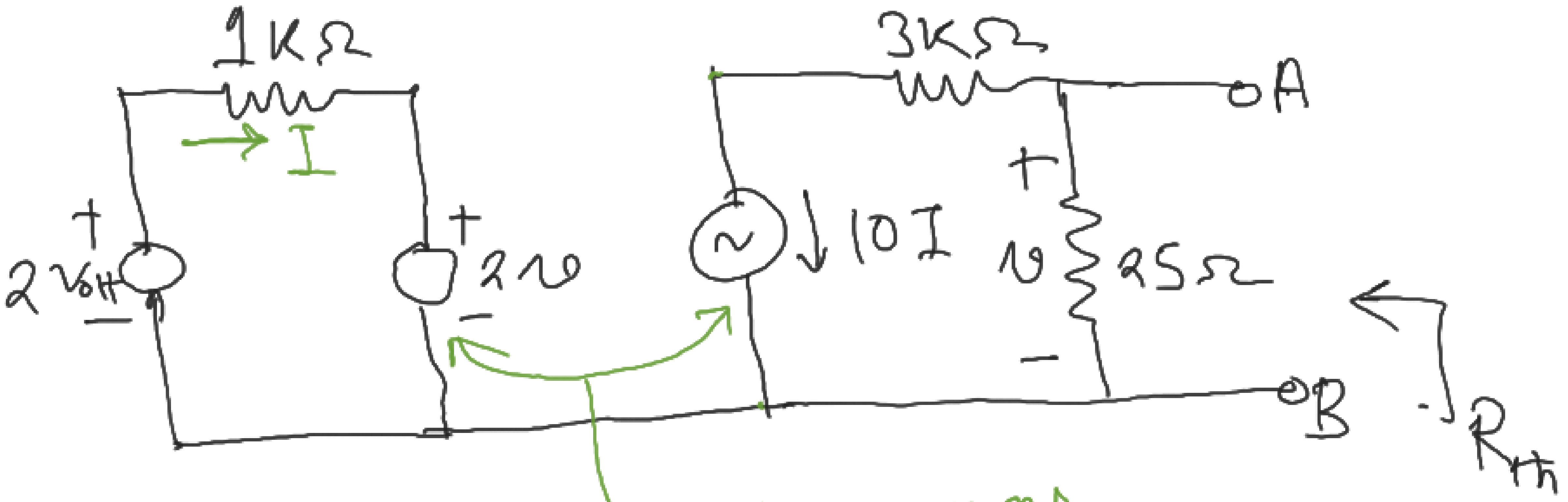
⇒ $I_x = 0$ as there is no complete path for I_x.

$V_{th} = -25 \times 10I = -250I.$

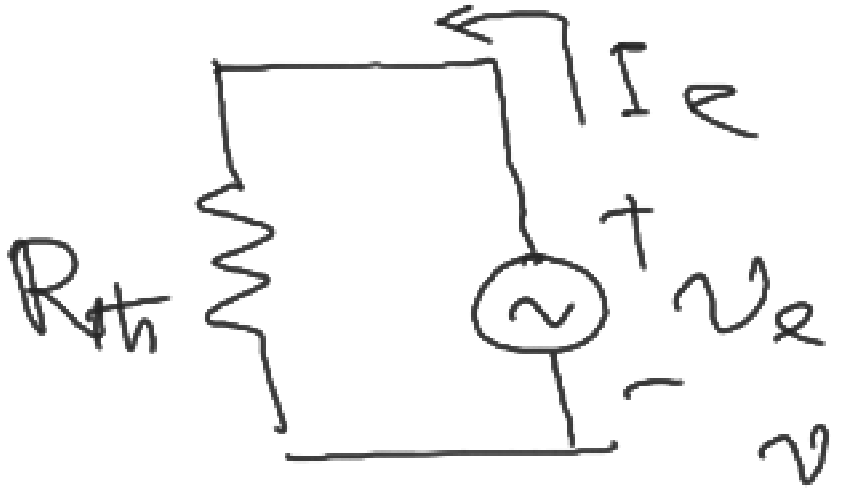
$\upsilon = -250I \quad \text{--- (i)}$

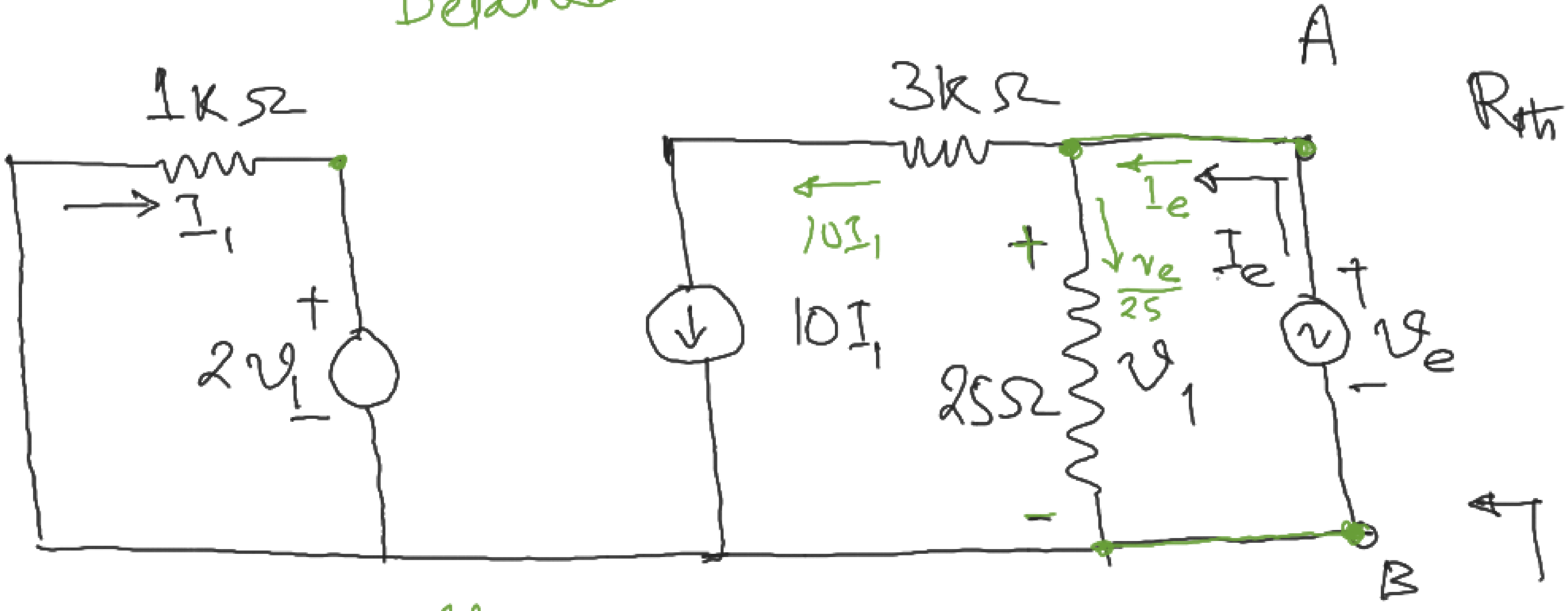
$I = \dfrac{2-2\upsilon}{1000} \quad \text{--- (ii)}$

From (i) and (ii) ⟹ $\boxed{\upsilon = V_{th} = -1V}$



Dependent sources.





$$R_{th} = \frac{v_e}{I_e}$$

$$\boxed{v_1 = v_e}$$

$$I_e = \frac{v_e}{25} + 10 I_1 \quad \cdots \text{(iii)}$$

$$\boxed{I_1 = -\frac{2 v_e}{1000}} \quad \cdots \text{(iv)}$$

$$I_1 = -\frac{2 v_1}{1000}$$

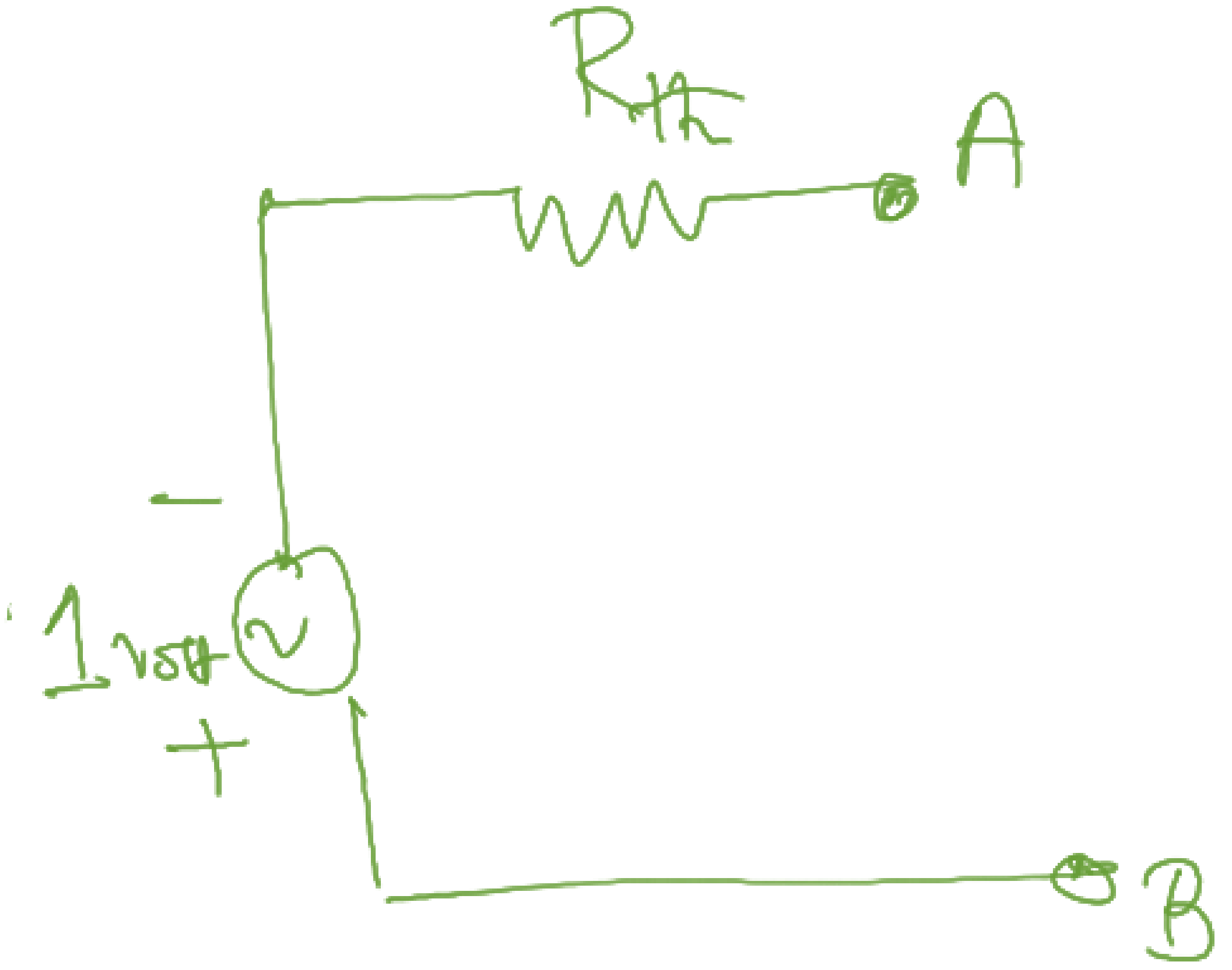
From (iii) & (iv).

$$I_e = \frac{V_e}{25} + 10 I_1 \qquad I_1 = -\frac{2V_e}{1000}.$$

$$I_e = \frac{V_e}{25} - \frac{2V_e}{100}$$

or $I_e = \dfrac{V_e}{50}$.

$$\boxed{\frac{V_e}{I_e} = R_{th} = 50\,\Omega.}$$



$$\left.\begin{aligned} V_{th} &= -1 \text{ volt} \\ R_{th} &= 50\,\Omega. \end{aligned}\right\}$$