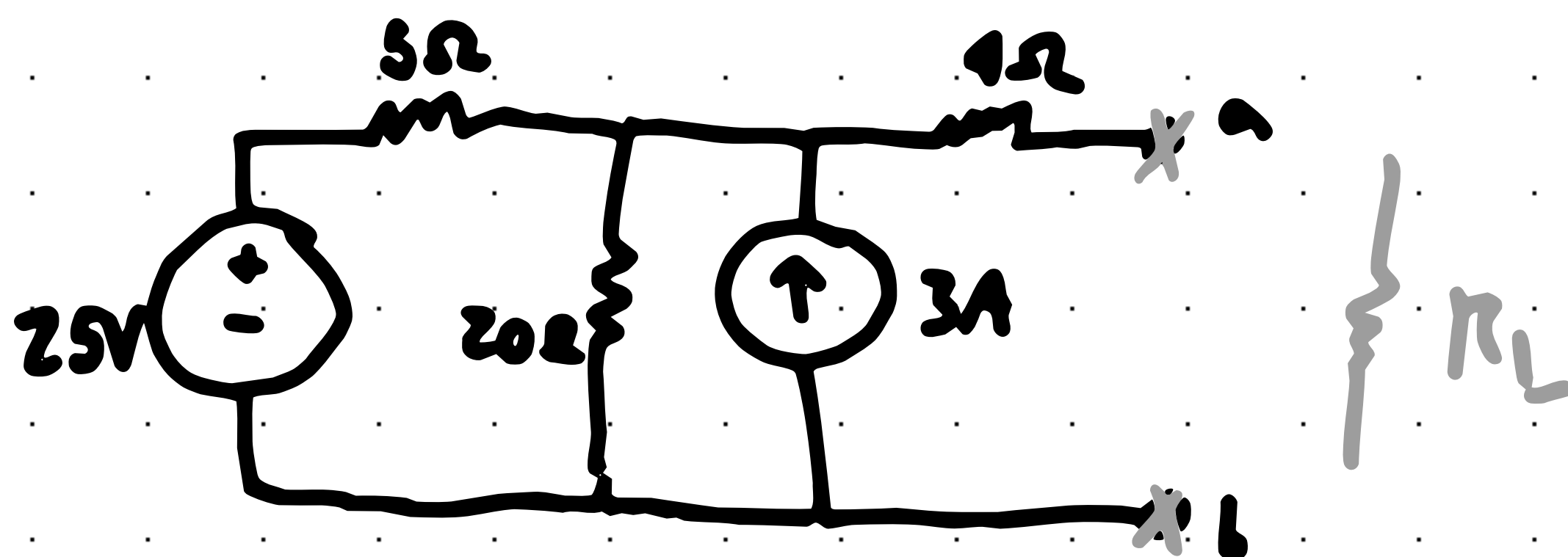


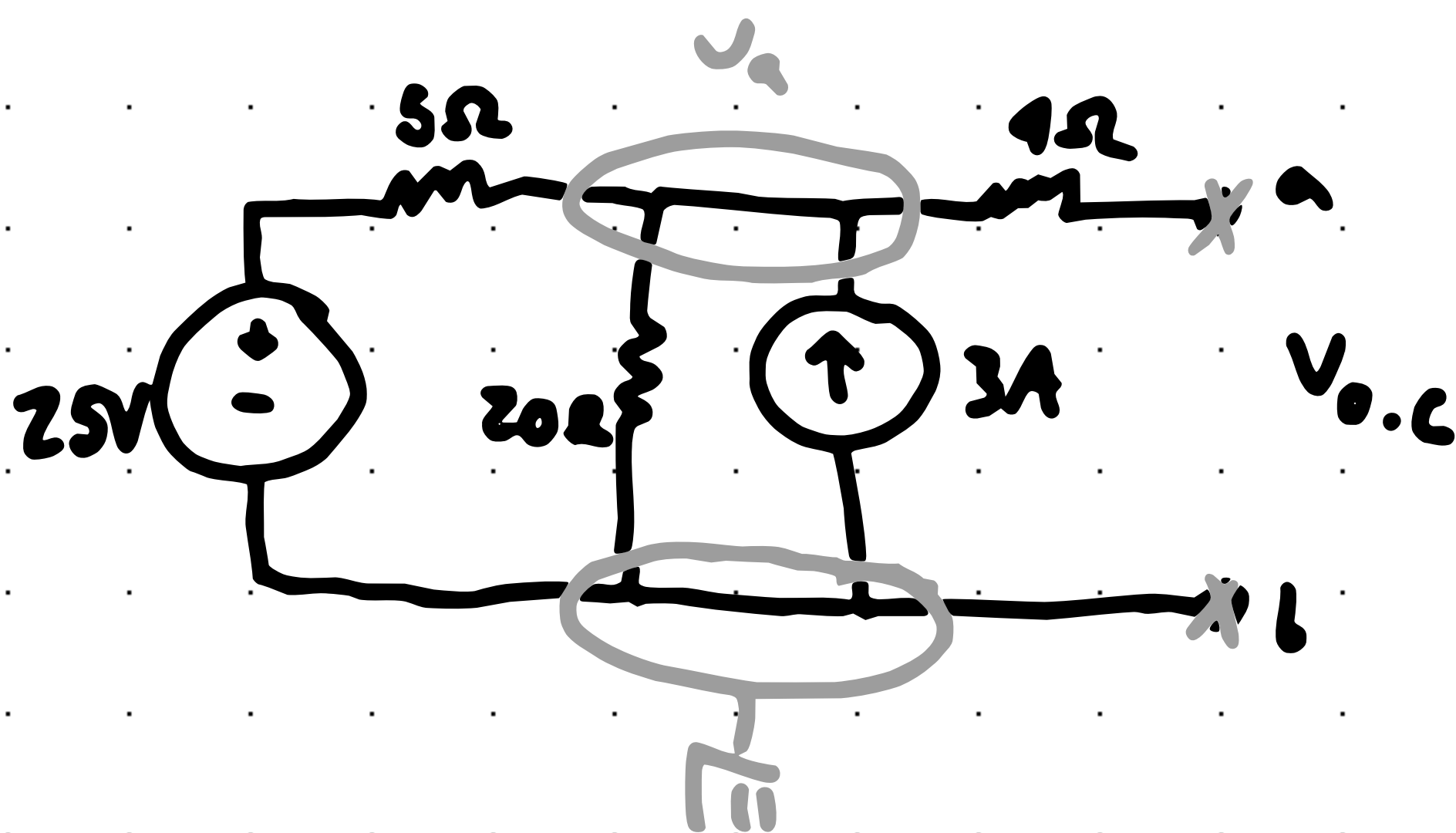
# Thevenin and Norton's equivalents problem

Ex. Find Thevenin and Norton equivalent between a and b for the following circuit



Calculate the value of  $R_L$  for max power and max power

Soln  $V_{th}$

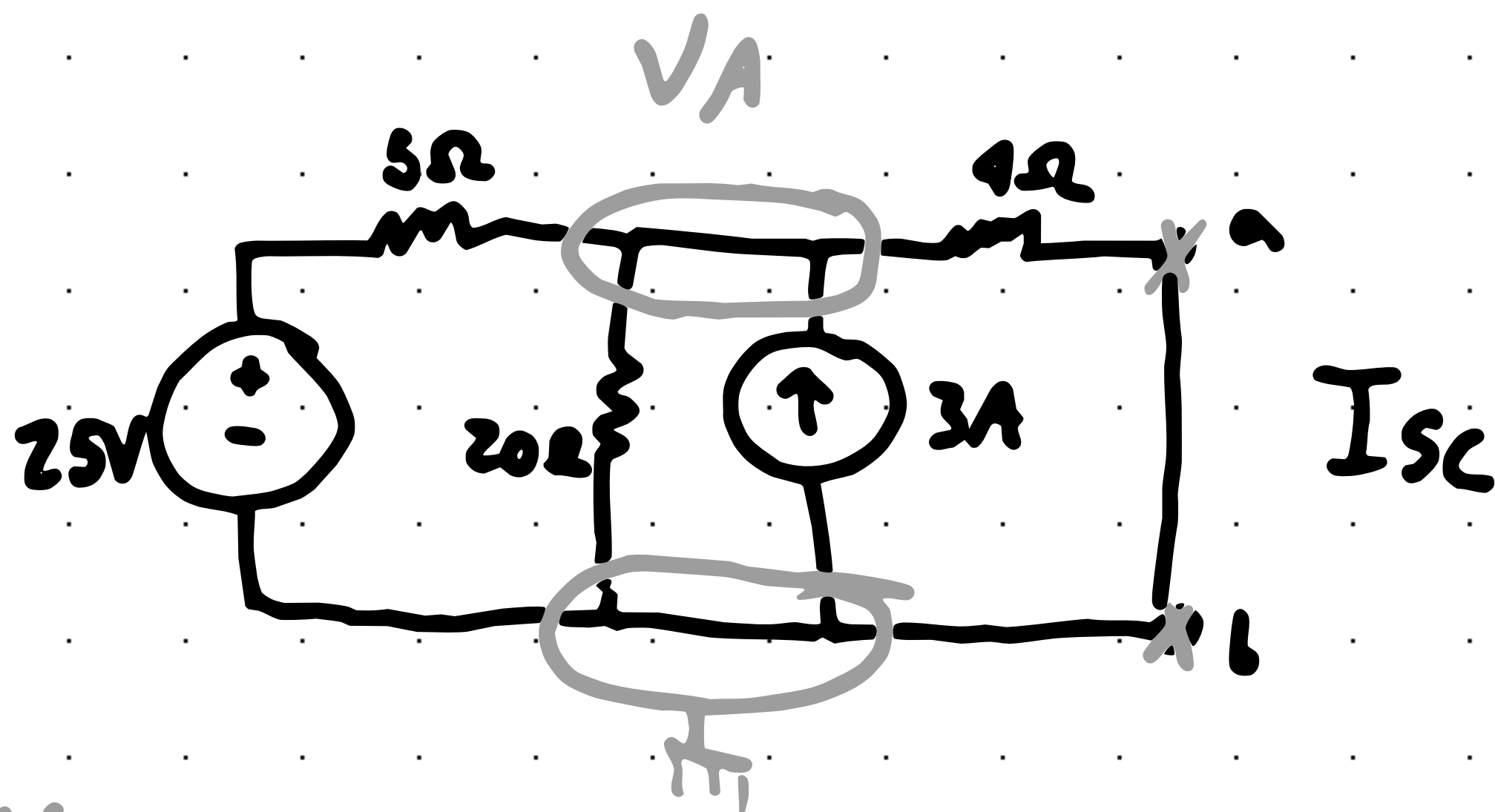


$$\frac{V_a - 25}{5} + \frac{V_a}{20} - 3 = 0$$

$$V_a = 32V$$

$$V_{o.c} = V_a = V_{TH} = 32V$$

To Calculate  $I_N$



$$I_{sc} = \frac{V_A}{4}$$

$$\frac{V_A - 25}{5} + \frac{V_A}{20} + (-3) + \frac{V_A}{4} = 0 \quad V_A = 16V$$

$$I_{sc} = \frac{16}{4} = 4A$$

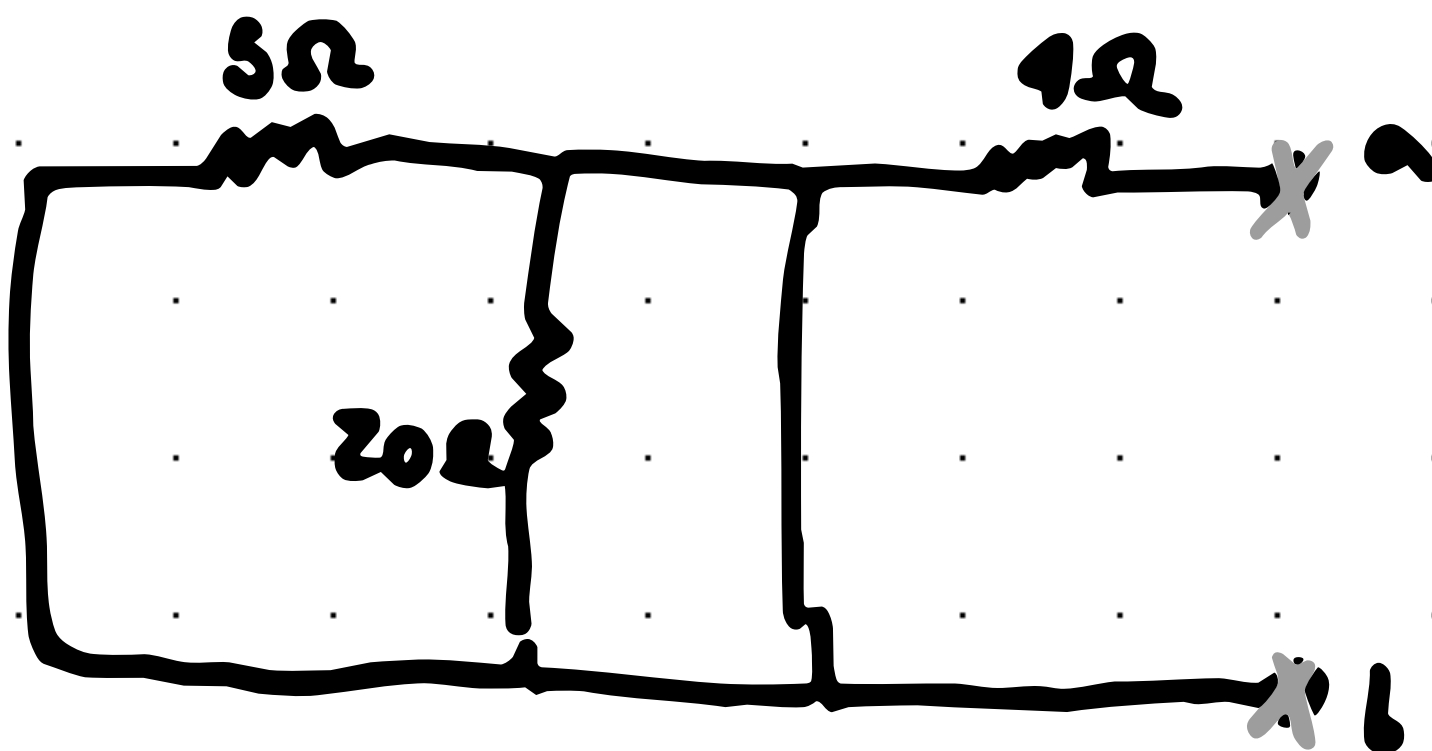
$$I_N = I_{sc} = 4A$$

Calculating  $R_{TH}$

$$R_{TH} = \frac{V_{TH}}{I_N} = \frac{32}{4} = 8\Omega$$

## Another Method for $R_{Th}$

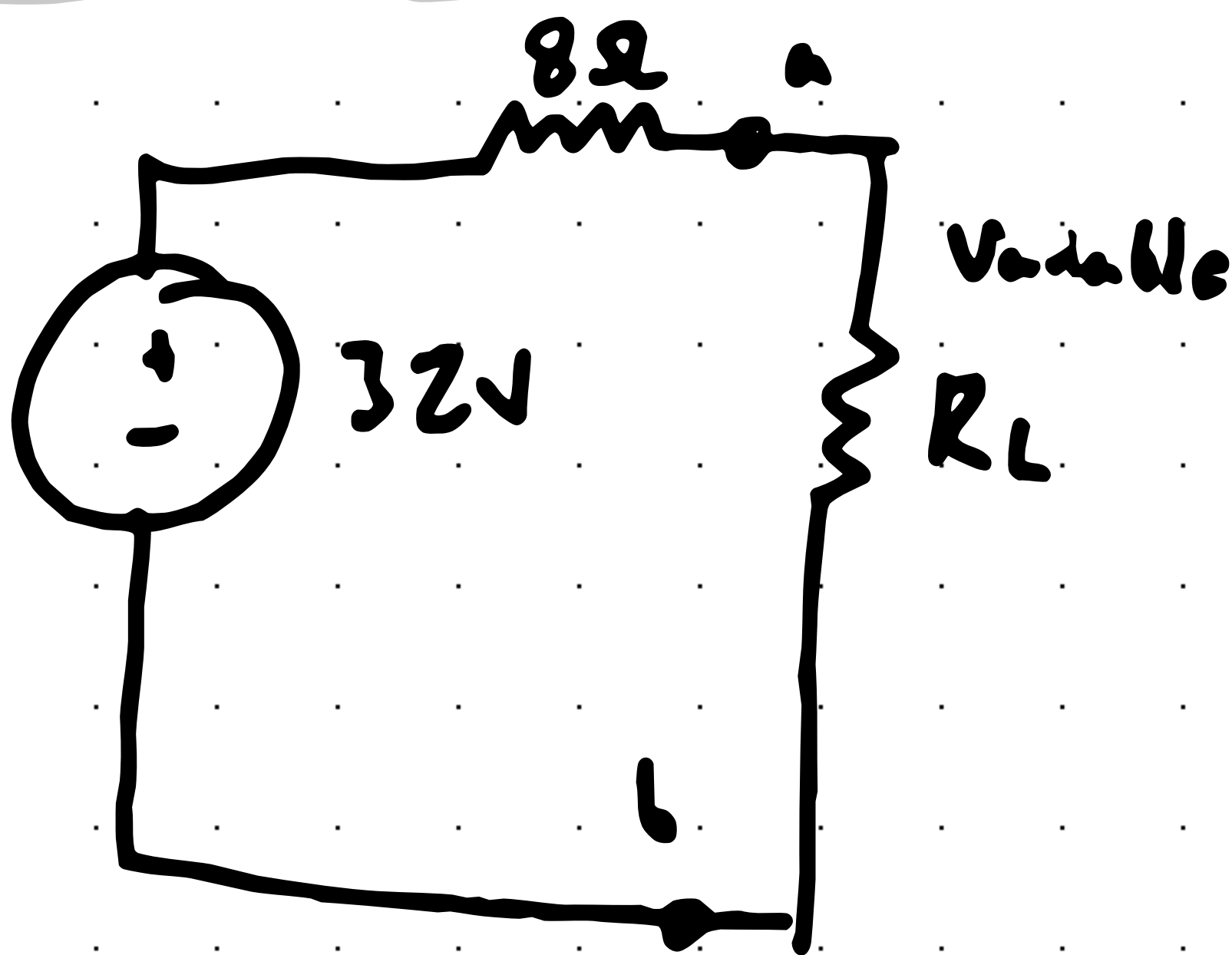
Remove  
Independent  
Sources



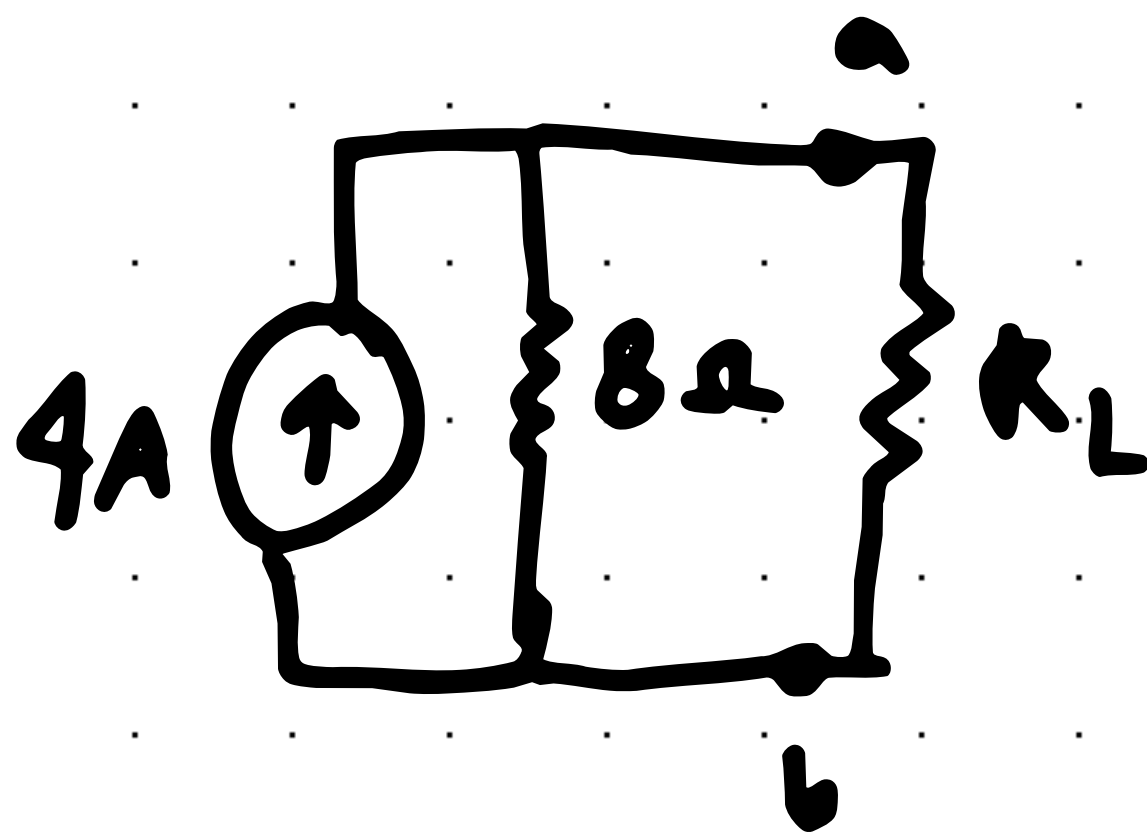
$$R_{eq} = 5 // 20 + 4$$

$$R_{eq} = 8\Omega$$

## Thevenin Equivalent



## Norton Equivalent

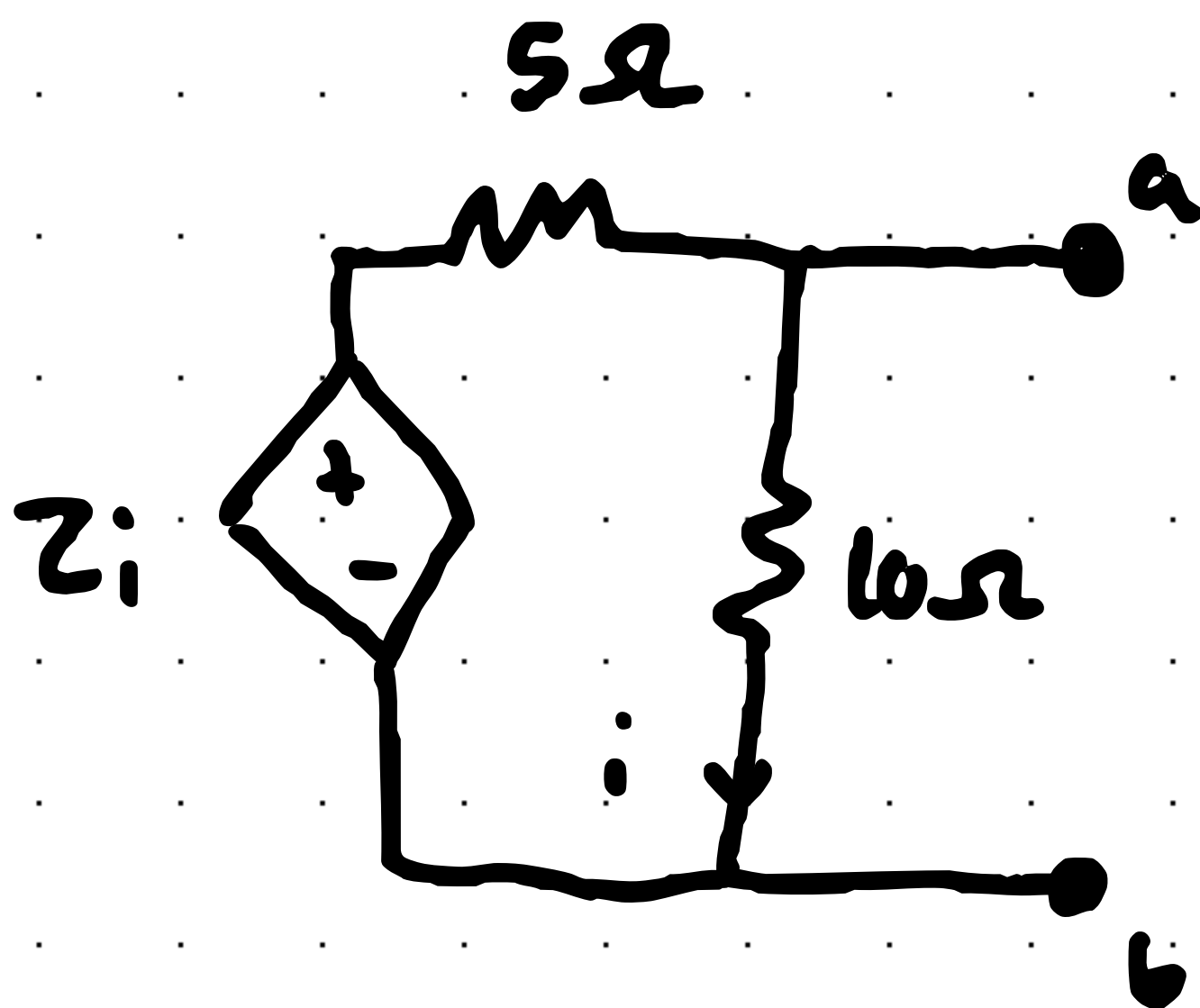


For Max Power

$$R_L = R_{Th} = 8\Omega$$

$$P_{RL} = I^2 R = \left( \frac{32}{8+8} \right)^2 8 \text{ watts}$$

Example 2 Find Thevenin and Norton equivalents between a and b.



SOL

To Calculate  $V_{TH}$

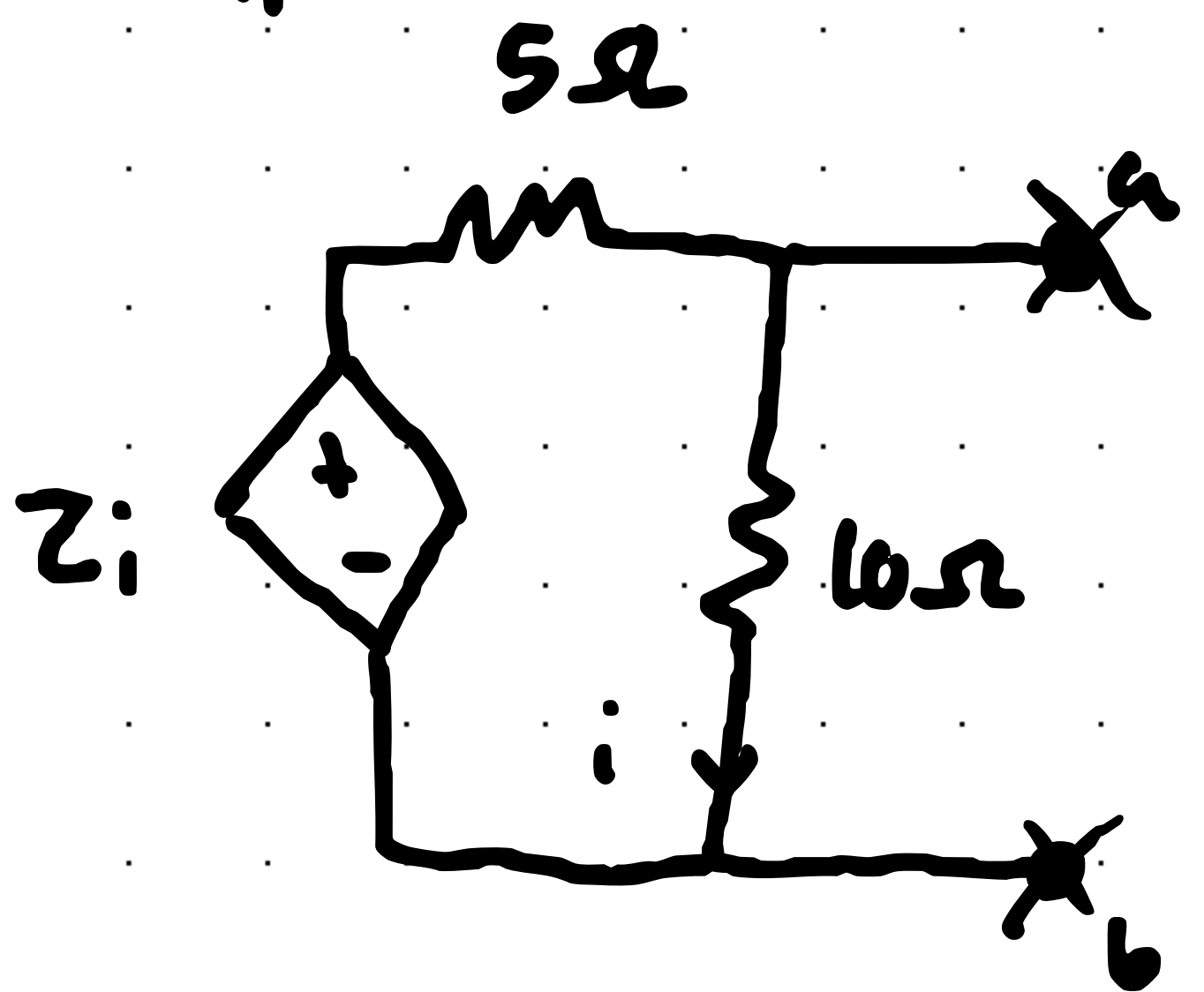
$$V_{o.c} = 10i$$

$$\sum V = 0$$

loop ①

$$Z_i - 5i - 10i = 0$$

$$-13i = 0$$



$i = 0?$

What?

How does this

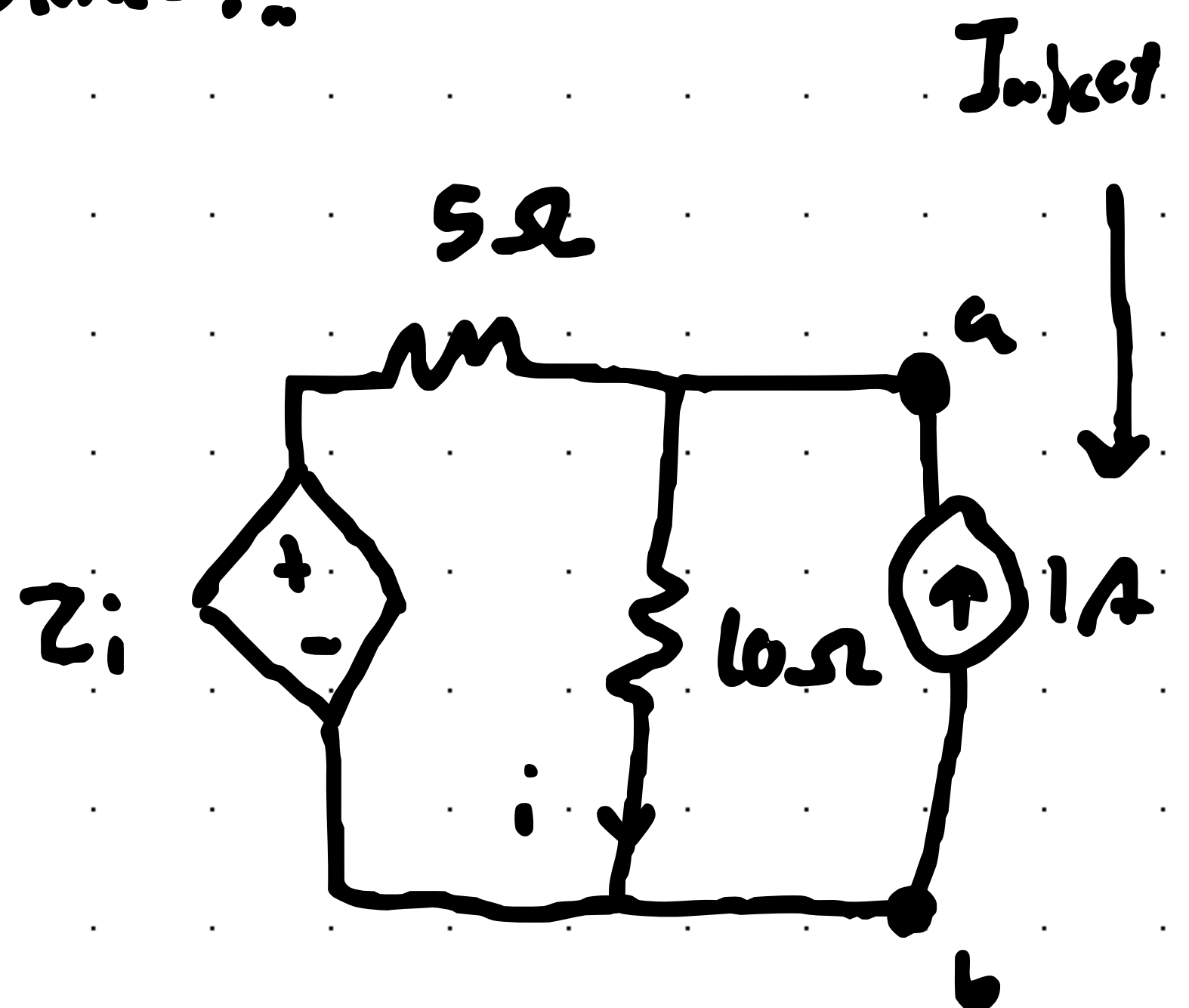
make sense?

Well, There are no independent sources here...

Since there are no independent sources, I should be expecting that current is equal to zero...

So, Method one doesn't really work does it?

$$R_{TH} = \frac{0}{0} = \text{undefined} \dots$$



To Calculate  $R_N = R_{TH}$

$$\sum I = 0$$

Node ①

$$\frac{V_1 - z_i}{5} + \frac{V_1}{10} + (-1) = 0$$

$$i = \frac{V_1}{10}$$

$$\frac{V_1 - 2\left(\frac{V_1}{10}\right)}{5} + \frac{V_1}{10} + (-1) = 0$$

$$V_1 = 3.85$$

$$R_{TH} = R_N = \frac{V_1}{i} = \boxed{3.85\Omega}$$