

# Tutorial 3 Solutions

ECED2000

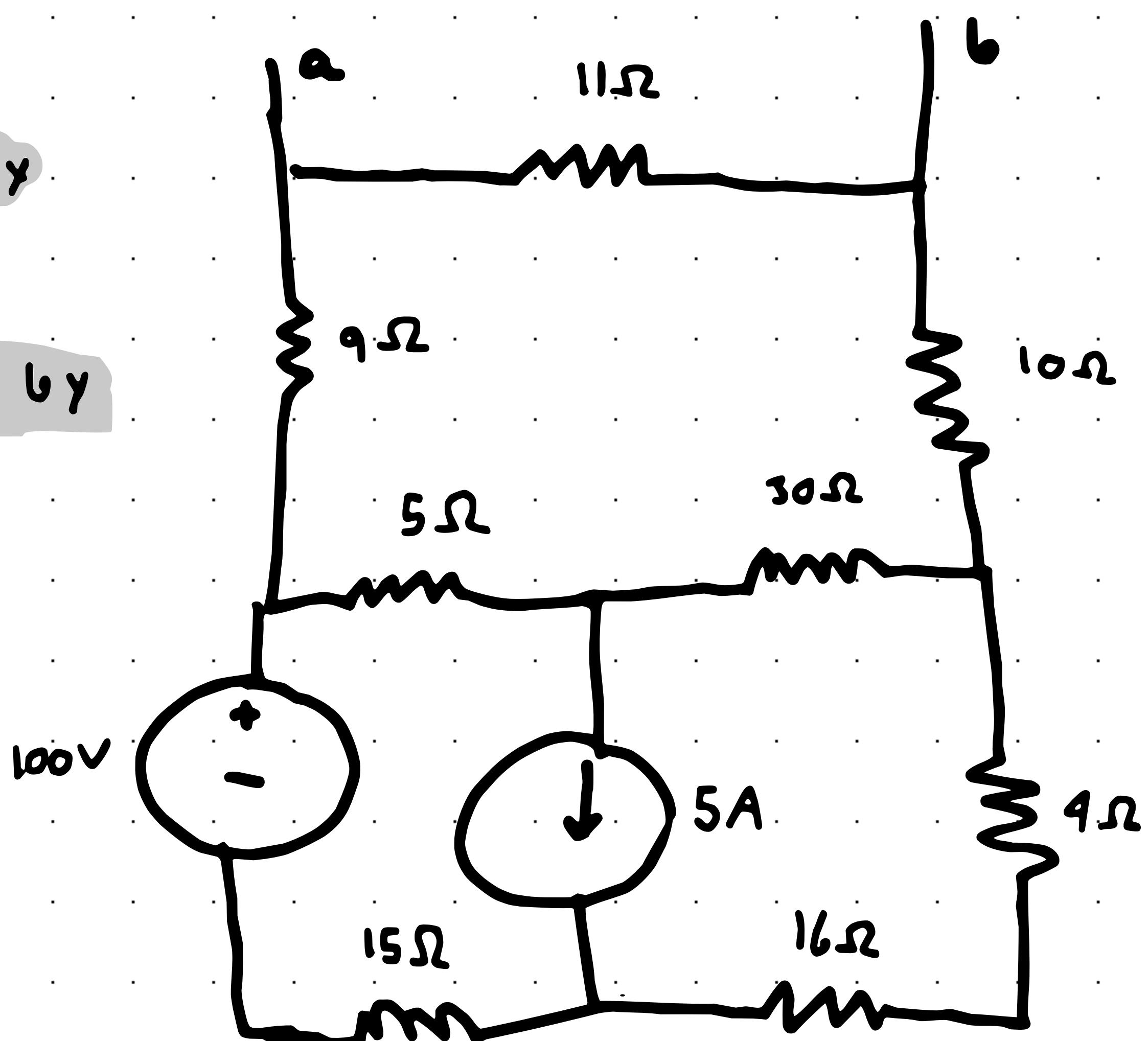
Problem ①

Substitute Voltage Source by  
Short Circuit

Substitute Current Source by  
Open Circuit

S.I. voltage in O.C.

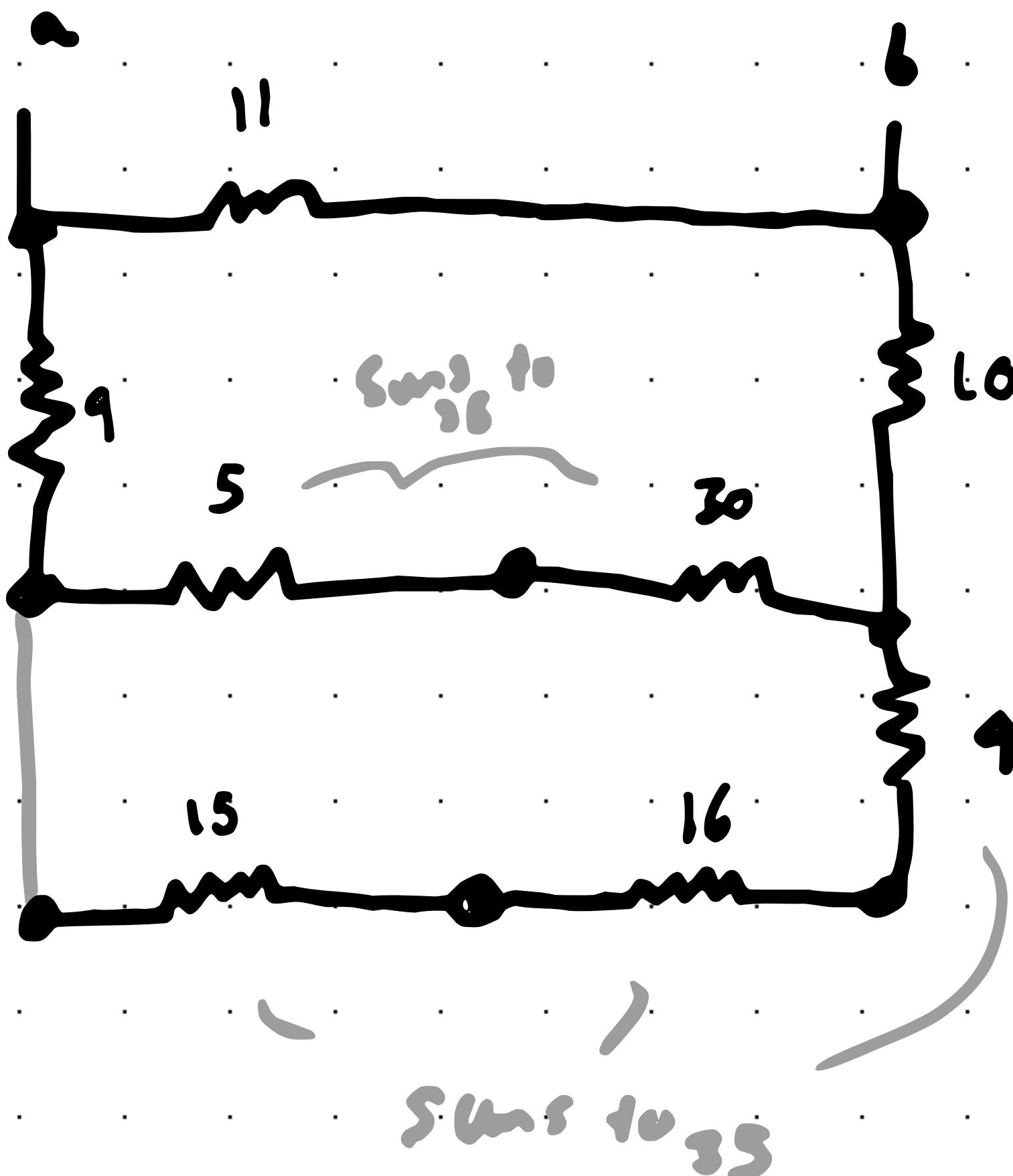
S.I. current in S.C.

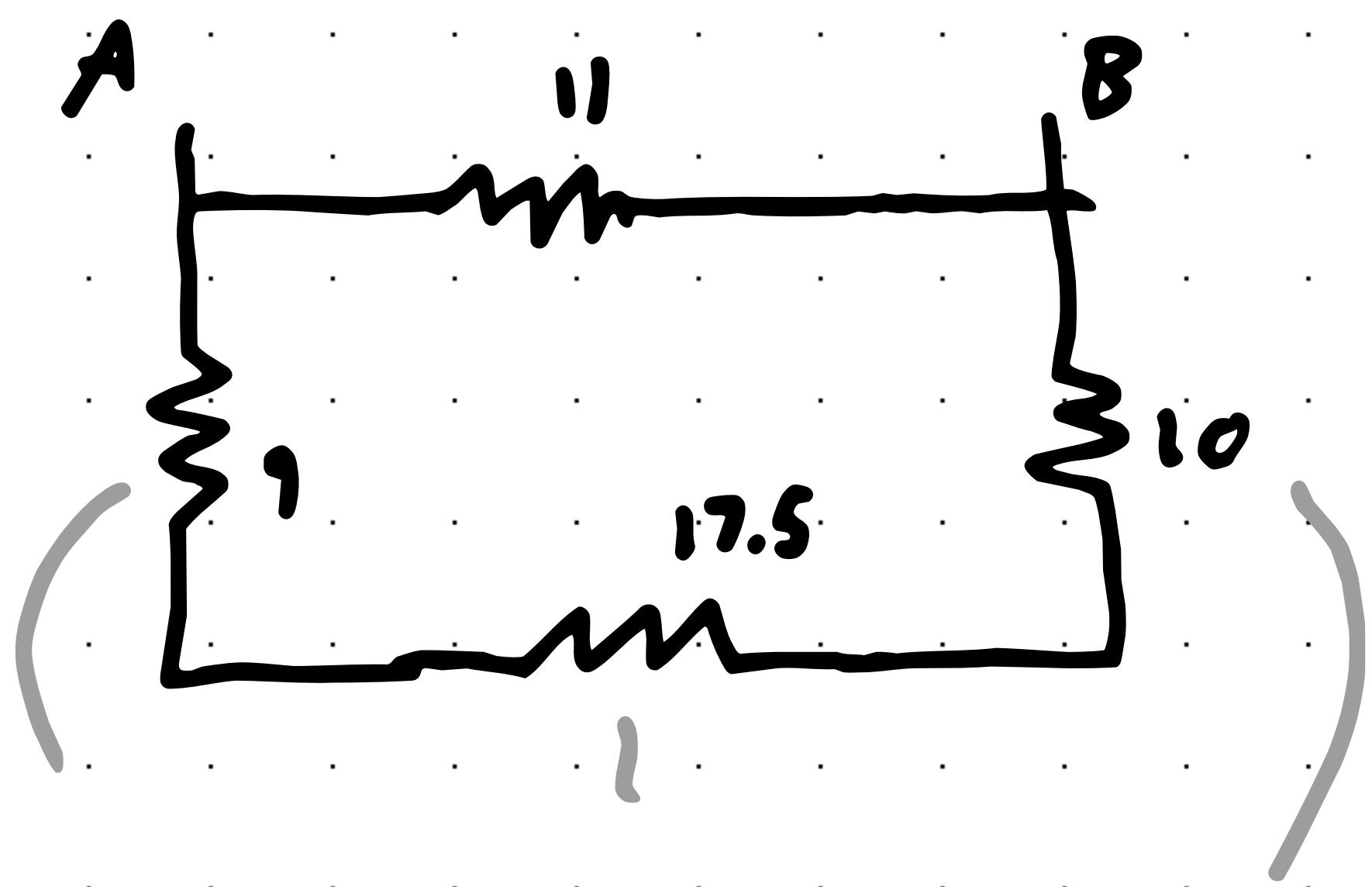


Reduced Circuit

Find total resistance in  
between A and B

$$35/35 = \frac{35(35)}{35+35} = 17.5\Omega$$



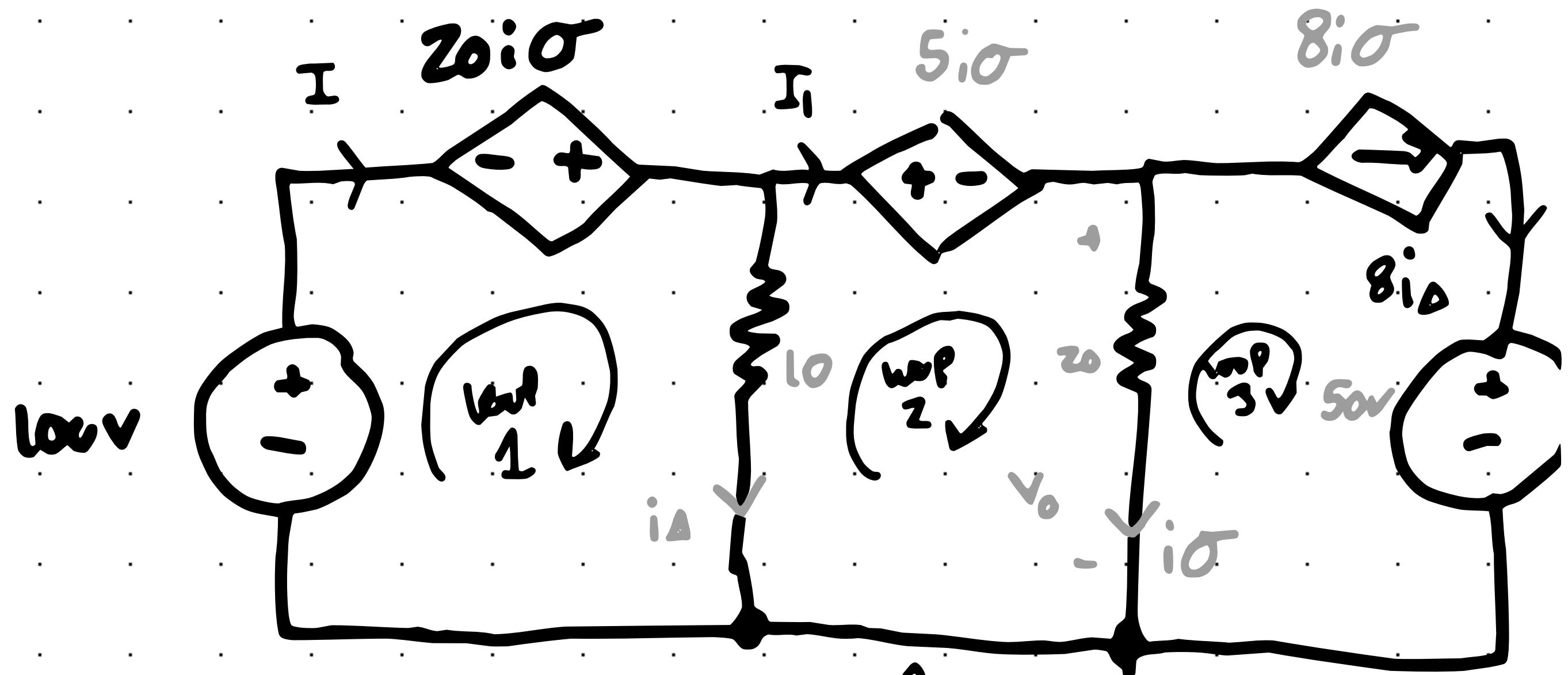


$5\text{V}_\text{DC} + 36.5\Omega$

$36.5$  in parallel with  $11$

$$11 \parallel 36.5 = \frac{11(36.5)}{11 + 36.5} = 8.48\Omega$$

## Problem 2



a)

Show  $\sum P_{\text{par}} = \sum P_{\text{abs}}$

New Concept!

If there are two nodes,  
with nothing but a wire  
in between, they can  
be considered the same  
node.

## Solution

$$\sum V = 100 + 20i_\sigma - 10i_\Delta = 0$$

loop 1

$$\sum V = 10i_\Delta - 5i_\sigma - 20i_\sigma = 0$$

loop 2

We have enough to solve!

$$10i_\Delta = 25i_\sigma, \quad i_\Delta = \frac{25}{10}i_\sigma$$

$$100 + 20i_\sigma - 10\left(\frac{25}{10}i_\sigma\right) = 0,$$

$$i_\sigma = \frac{100}{5} = 20A$$

$$i_\Delta = \left(\frac{25}{10}\right)20 = 50A$$

$$V_0 = 20i_\sigma = 20(20) = 400V$$

$$\sum_{V=0} 20i_0 - V_1 - 50 = 0$$

loop 1

$$20i_0 - V_1 - 50 = 0$$

$$V_1 = 350$$

$$400 - V_1 - 50 = 0$$

$$\sum I = 0 \quad I_1 - i_0 - 8i_\Delta = 0$$

Node ②

$$\begin{matrix} 1 \\ 1 \\ 20 \\ 50 \end{matrix}$$

$$I_1 = 420 A$$

$$\sum I = 0 \quad I - I_\Delta - I_1 = 0$$

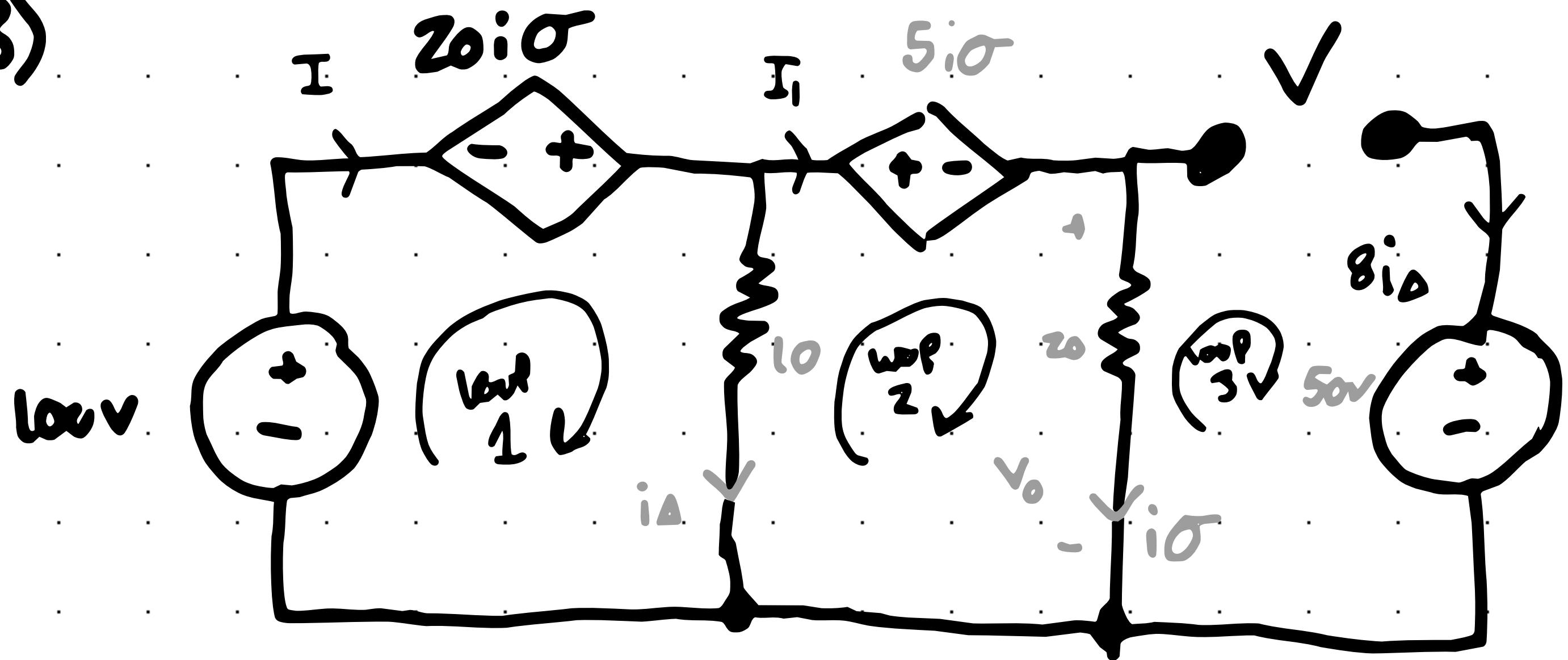
$$\begin{matrix} 1 \\ 1 \\ 50A \\ 420A \end{matrix}$$

$$I = 420 A$$

$\sum P_{\text{gen}} = \sum \text{All Power across the circuit}$

$\sum P_{\text{abs}} = \sum \text{All Power}$

Part B)



Calculate  $i_d$ ,  $i_o$ ,  $V_o$  and  $V$

From Part A) ...

$$i_o = 20A, i_o = 50A$$

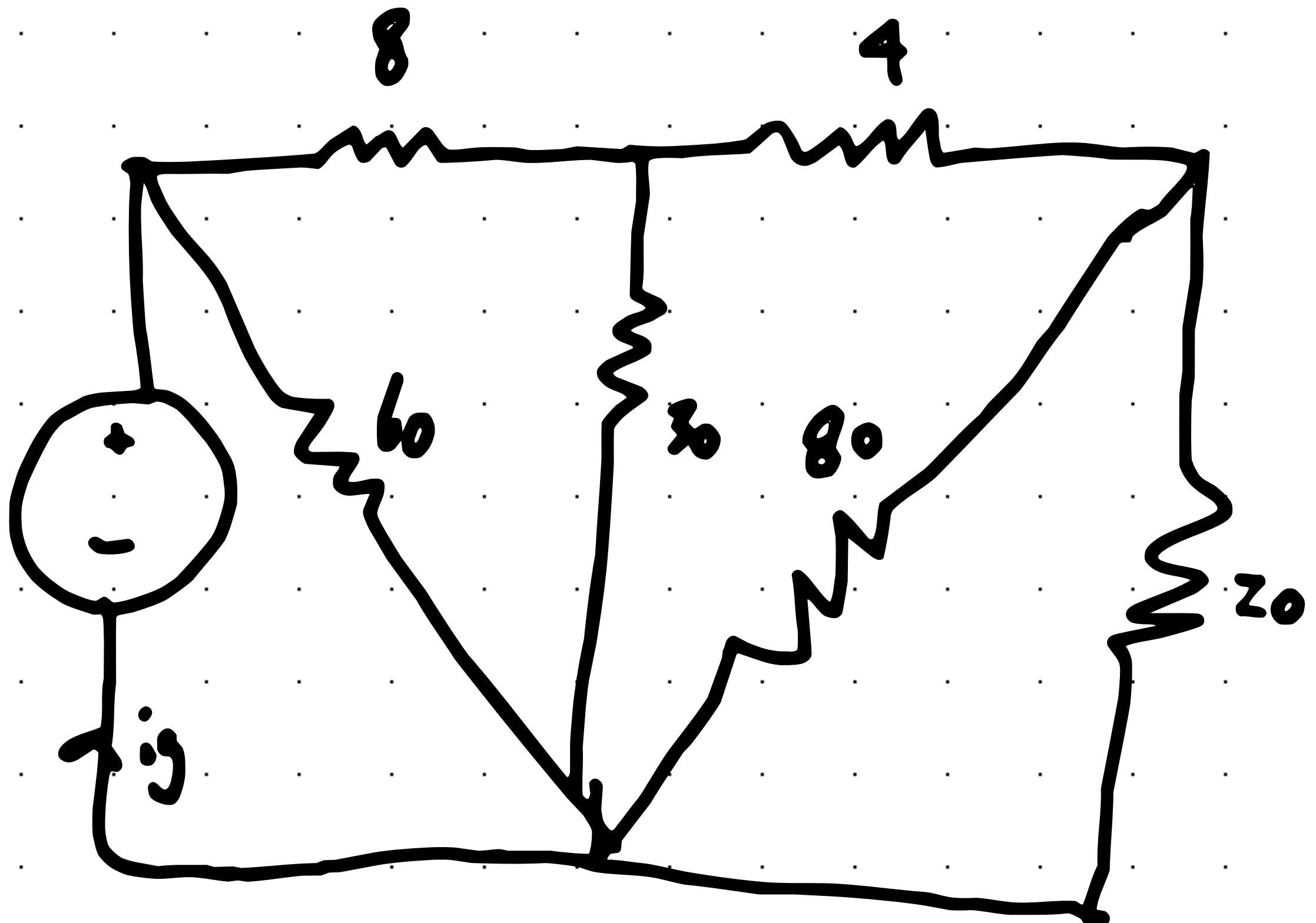
$$\sum_{\text{loop } 3} V = 0$$

$$20i_o - V - 50 = 0$$

$$V = 20i_o - 50 = \underline{\underline{350V}}$$

## Problem 3

Calculate the total resistance  $30\Omega$   
seen by source  
and  $i_g$



Solution

(Par)

$$80//20 = \frac{80(20)}{80+20} = 16\Omega$$

(Series)

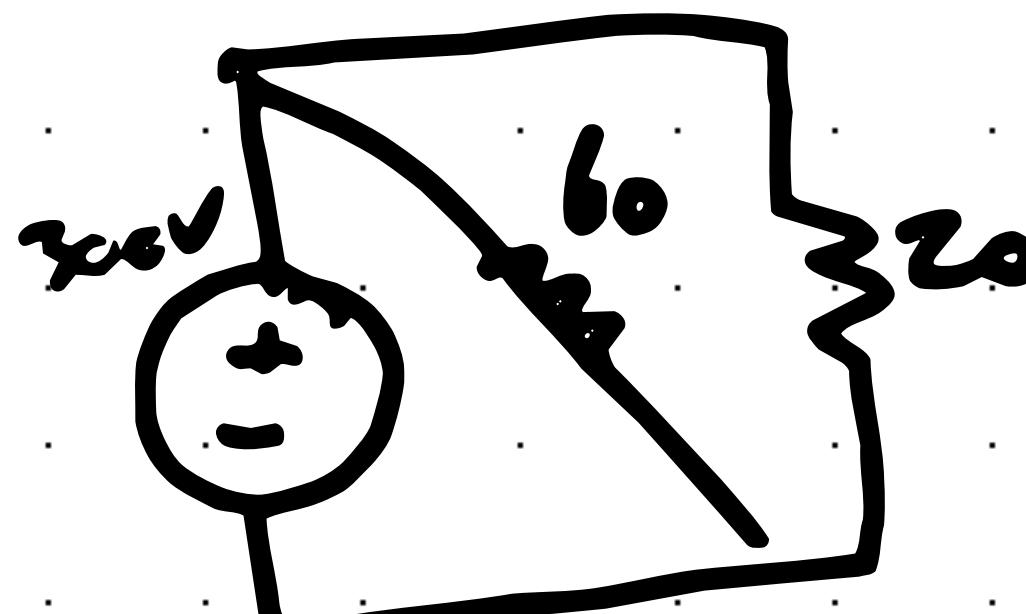
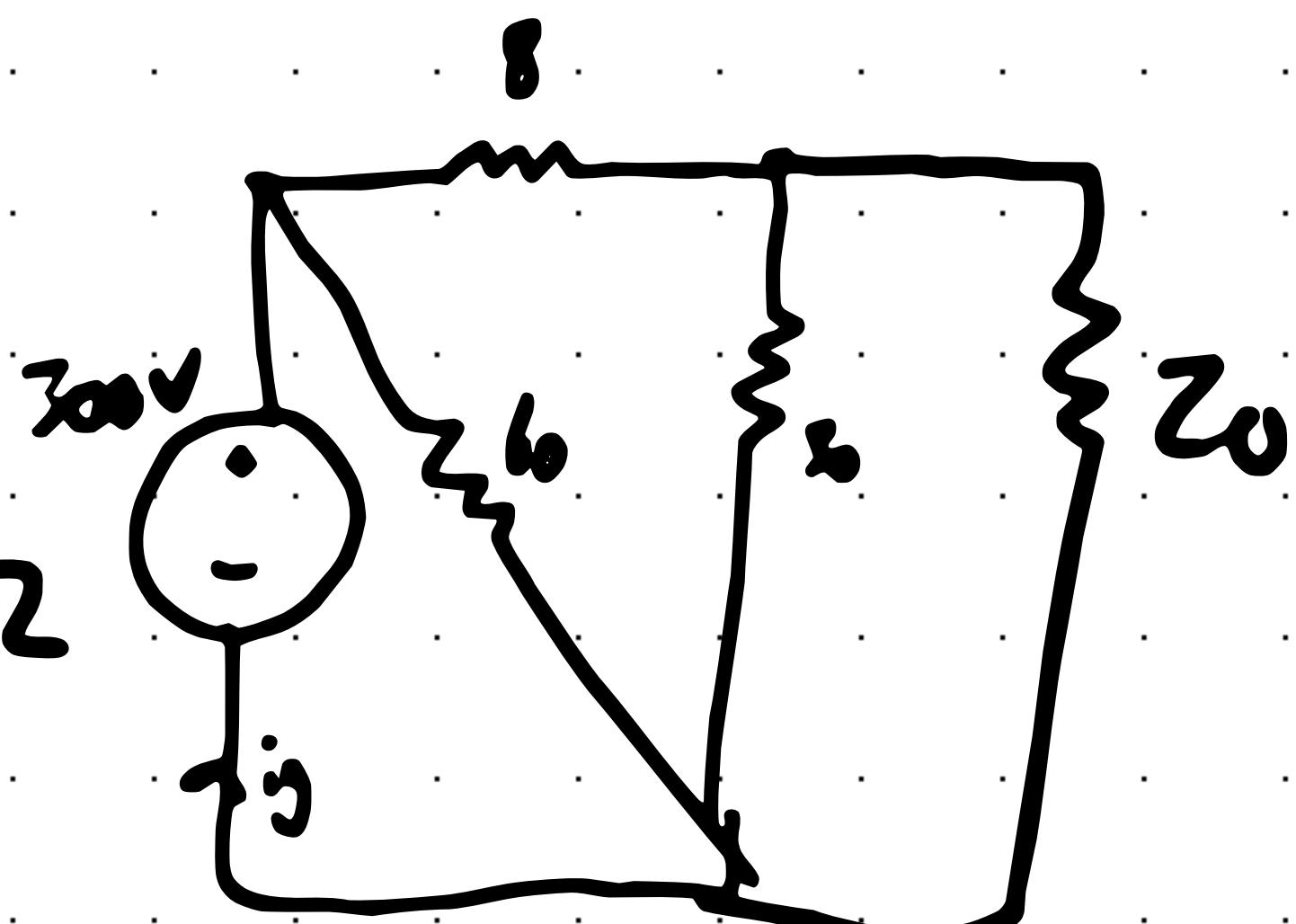
$$16+4=20$$

(Par)

$$20//30 = \frac{20(30)}{20+30} = 12\Omega$$

(Series)

$$8+12=20\Omega$$

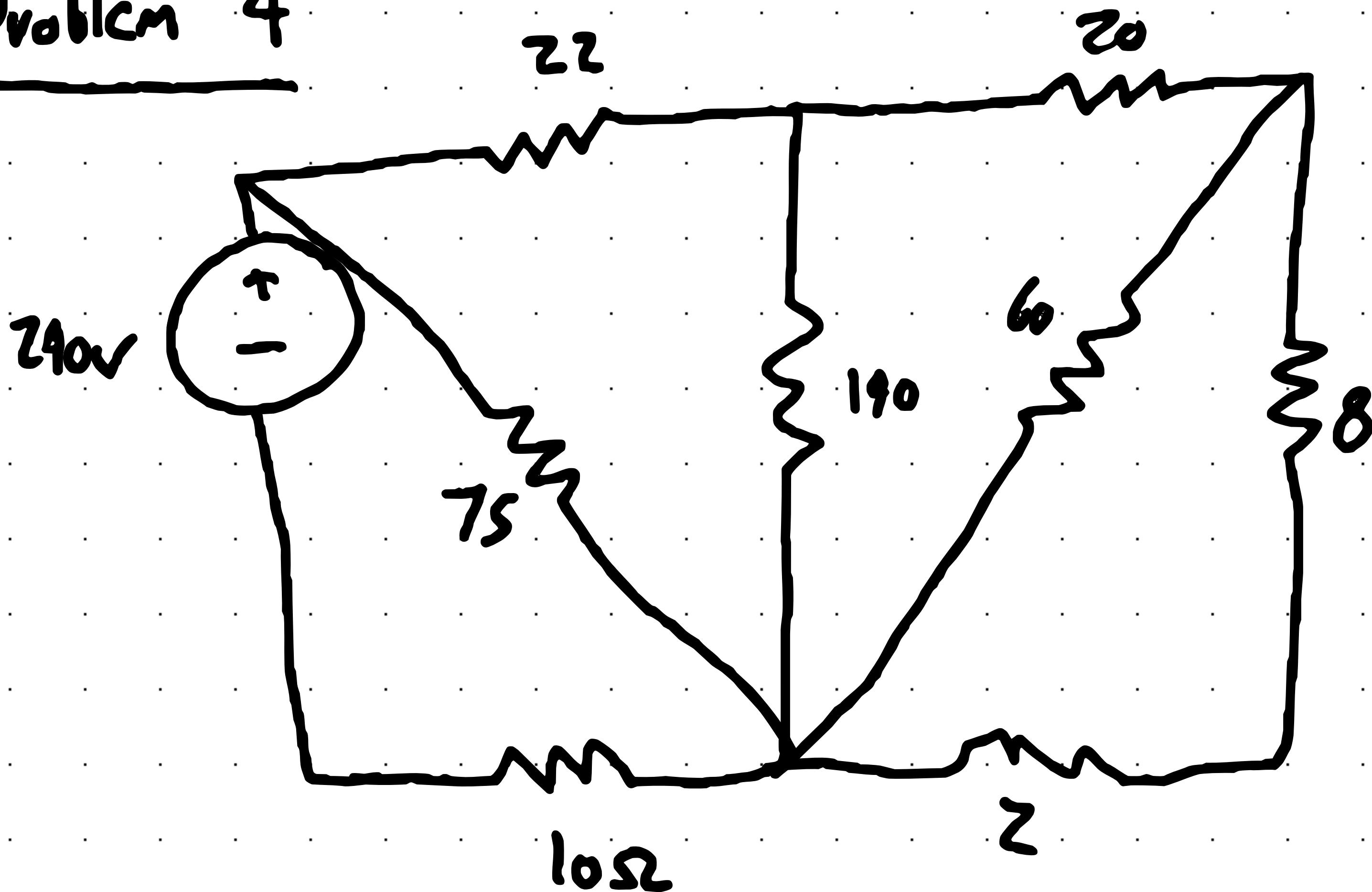


$$R_{tot} = 20//60$$

$$= \frac{20(60)}{20+60} = 15\Omega$$

$$i_g = \frac{30}{15} = 20A$$

## Problem 4



Calculate  $i_o$  and power dissipated in  $10\Omega$

$$2+8=10$$

$$60//10 = \frac{60(10)}{60+10} = 15\Omega$$

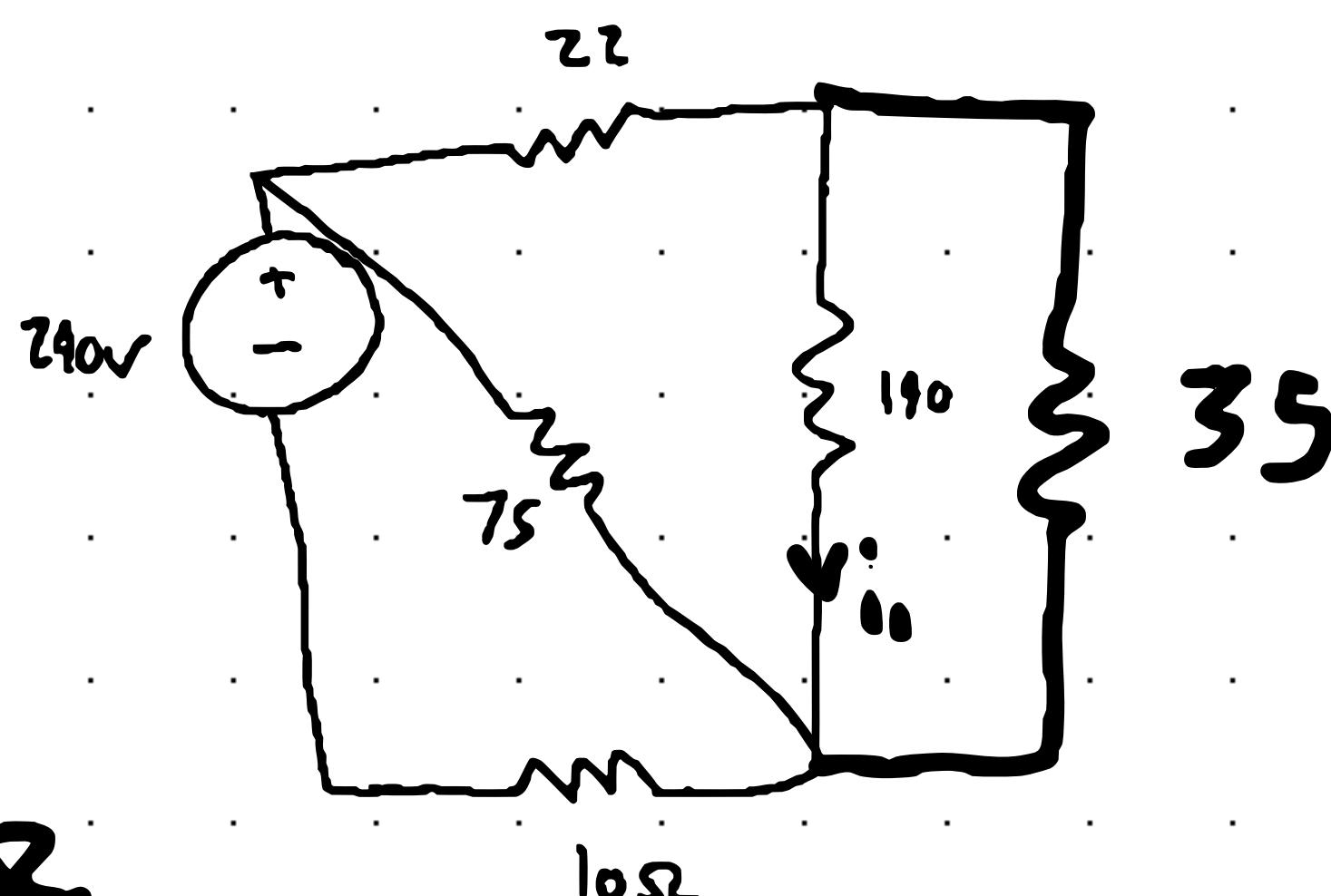
$$15+20=35$$

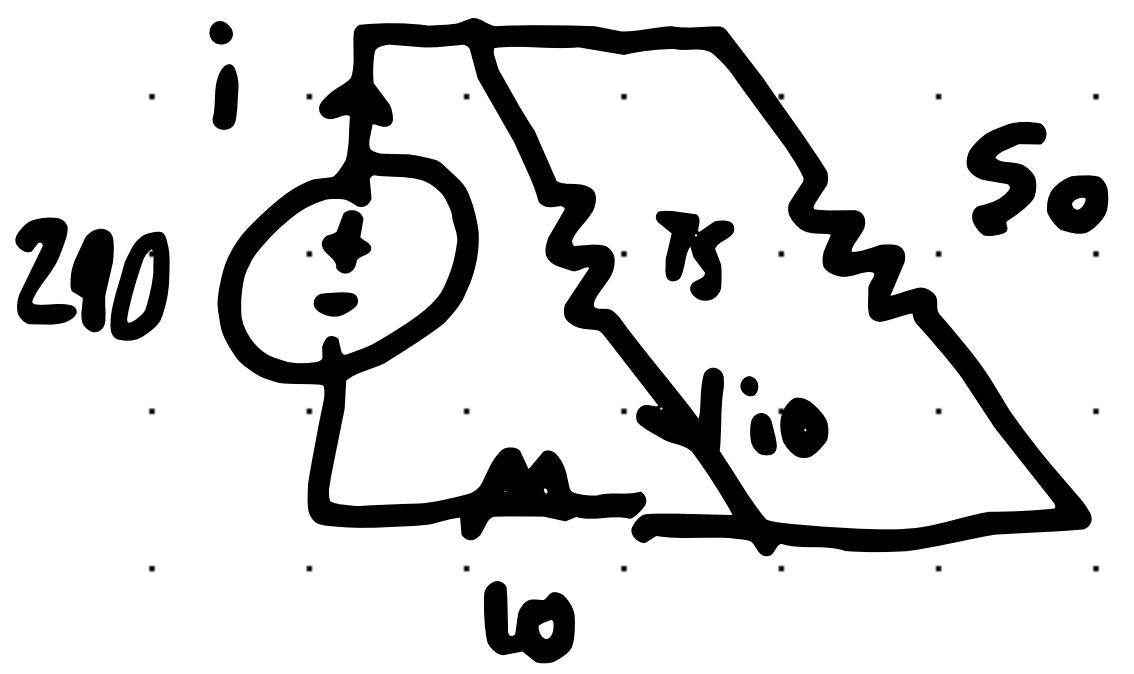
$$140//35$$

$$\frac{140(35)}{140+35} = 28\Omega$$

Series

$$22+28=50\Omega$$



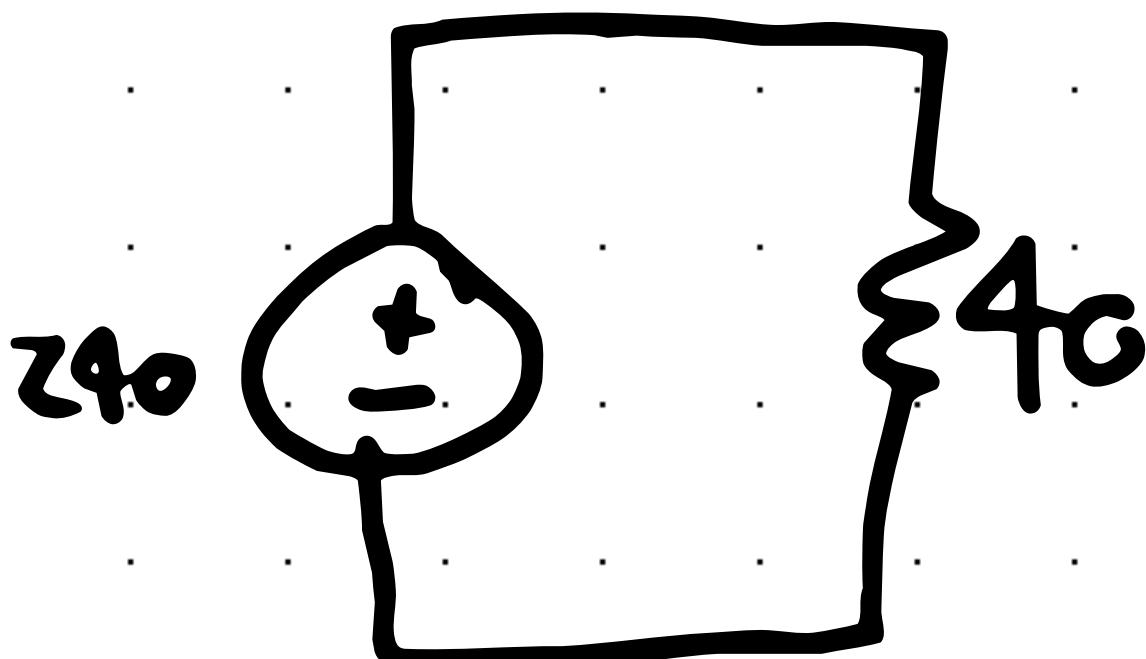


$$S_0 // 75$$

$$\frac{75(S_0)}{75 + S_0} = 30$$

R<sub>total</sub>

$$30 + 6 = 40$$

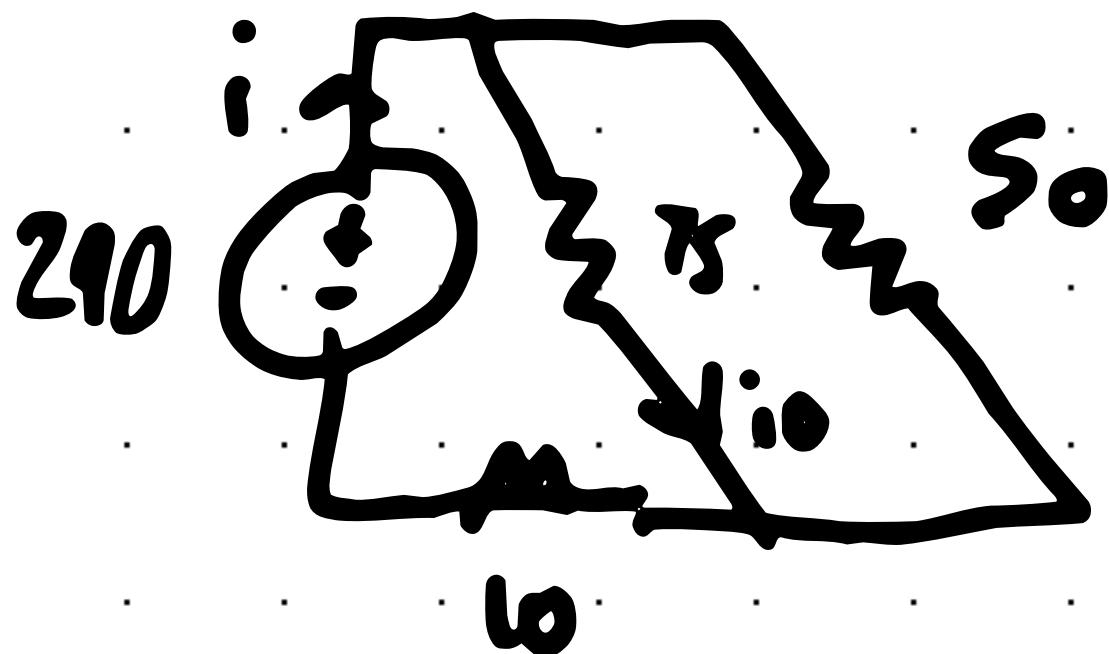


$$V = IR$$

$$240 = I(40)$$

$$I = \frac{240}{40} = 6A$$

Current Divider



$$I_0 = i \left( \frac{S_0}{S_0 + 75} \right) = 2.4A$$

$$I_2 = i \left( \frac{75}{S_0 + 75} \right) = 3.6A$$