

Tutorial 3 Solutions

ECED2000

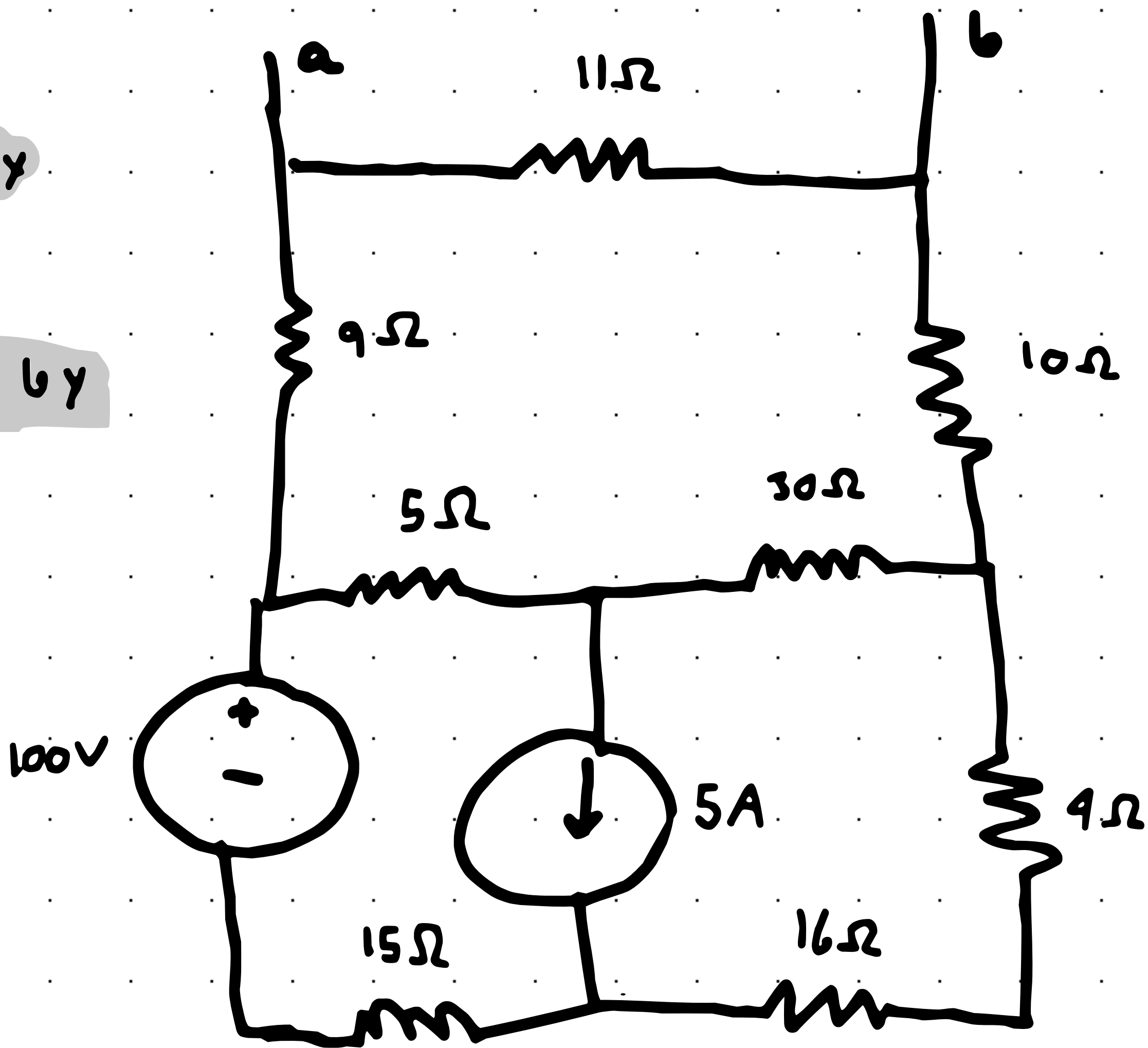
Problem ①

Substitute Voltage Source by
Short Circuit

Substitute Current Source by
Open Circuit

Still voltage in
O.C.

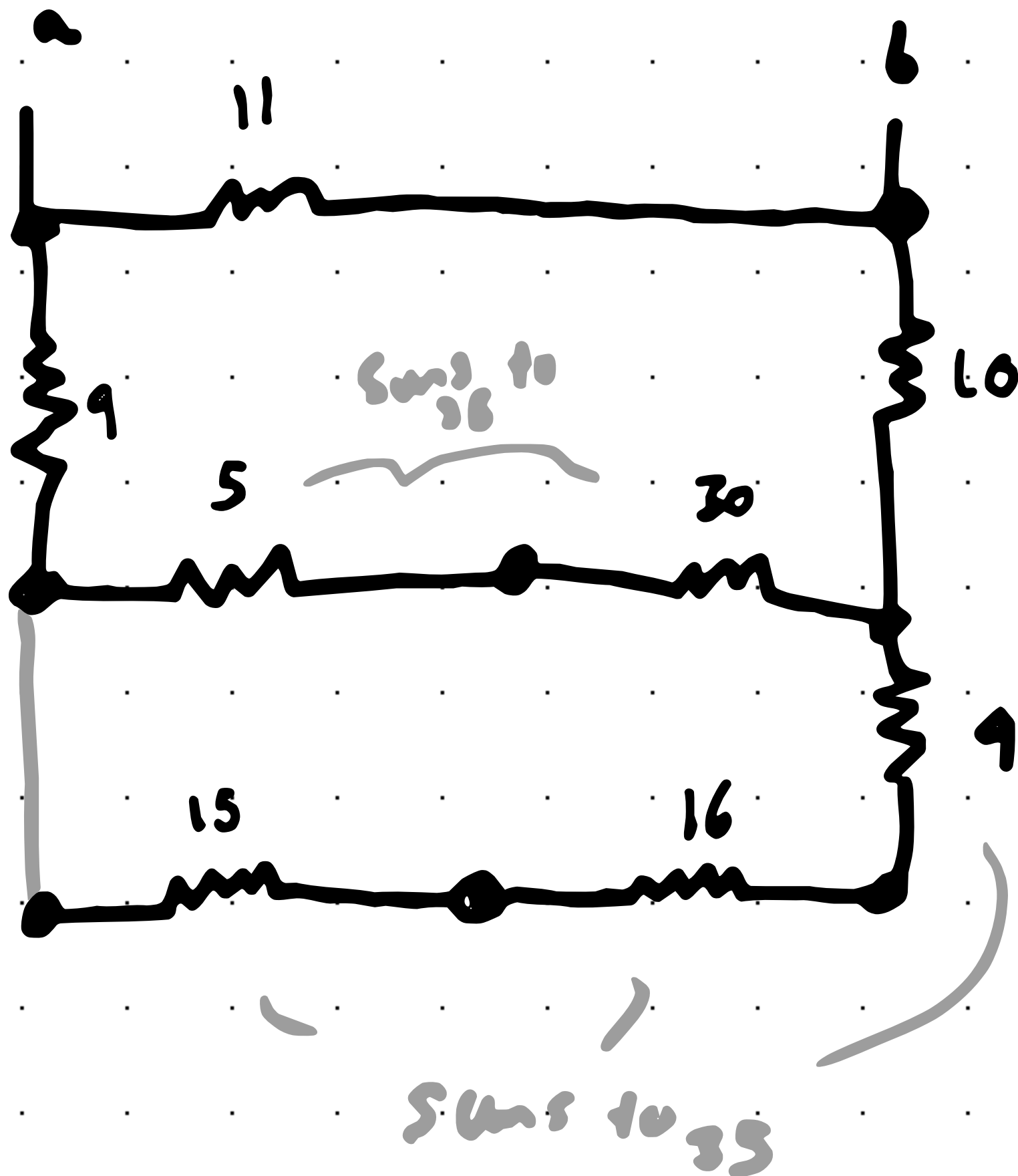
Still current in
S.C.

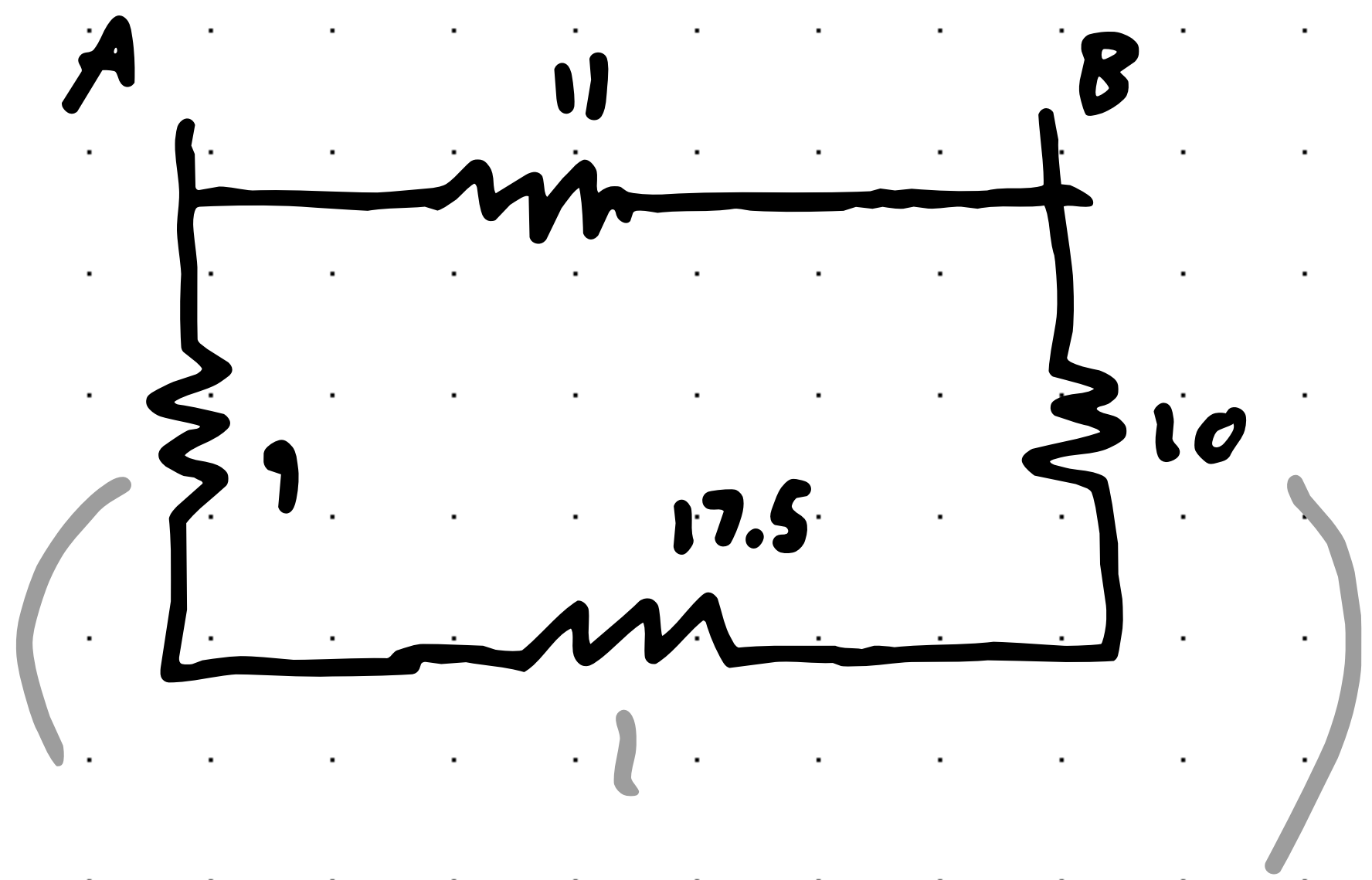


Reduce Circuit

Find total resistance in
between A and B

$$35/35 = \frac{35 \times 35}{35 + 35} = 17.5 \Omega$$



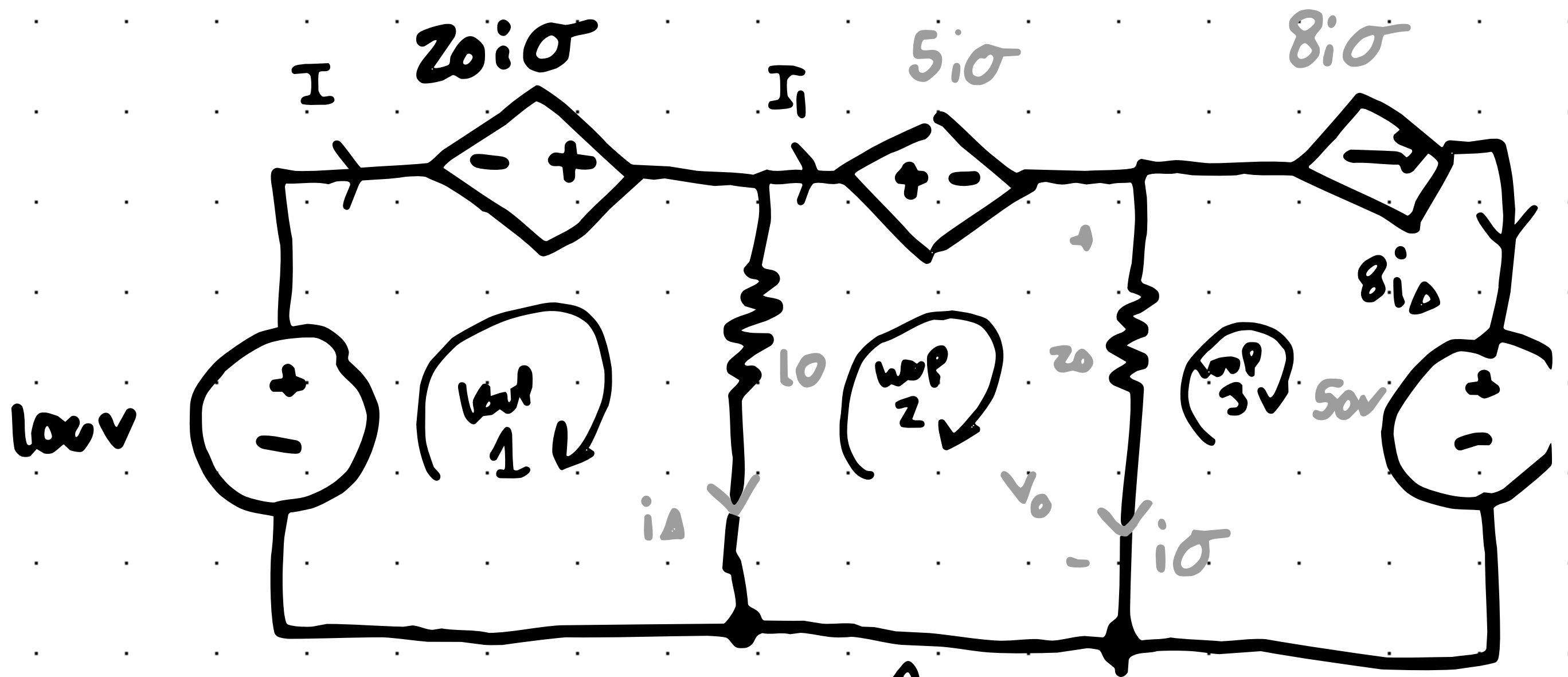


Sum = 36.5 Ω

36.5 in parallel with 11

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

Problem 2



a) Show $\sum P_{dev} = \sum P_{abs}$

New Concept!

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

Solution

$$\sum_{\text{loop 1}} V = 100 + 20i_{\sigma} - 10i_{\Delta} = 0$$

$$\sum_{\text{loop 2}} V = 10i_{\Delta} - 5i_{\sigma} - 20i_{\sigma} = 0$$

We have chosen to solve!

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

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

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

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

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

$$\sum V = 0$$

loop 1

$$20i_{\sigma} - V_1 - 50 = 0$$

20(2A)

$$400 - V_1 - 50 = 0$$

$$V_1 = 350$$

$$\sum I = 0$$

Node 2

$$I_1 - i_{\sigma} - 8i_{\Delta} = 0$$

\uparrow \uparrow
20 30

$$I_1 = 420 \text{ A}$$

$$\sum I = 0$$

$$I - I_{\Delta} - I_1 = 0$$

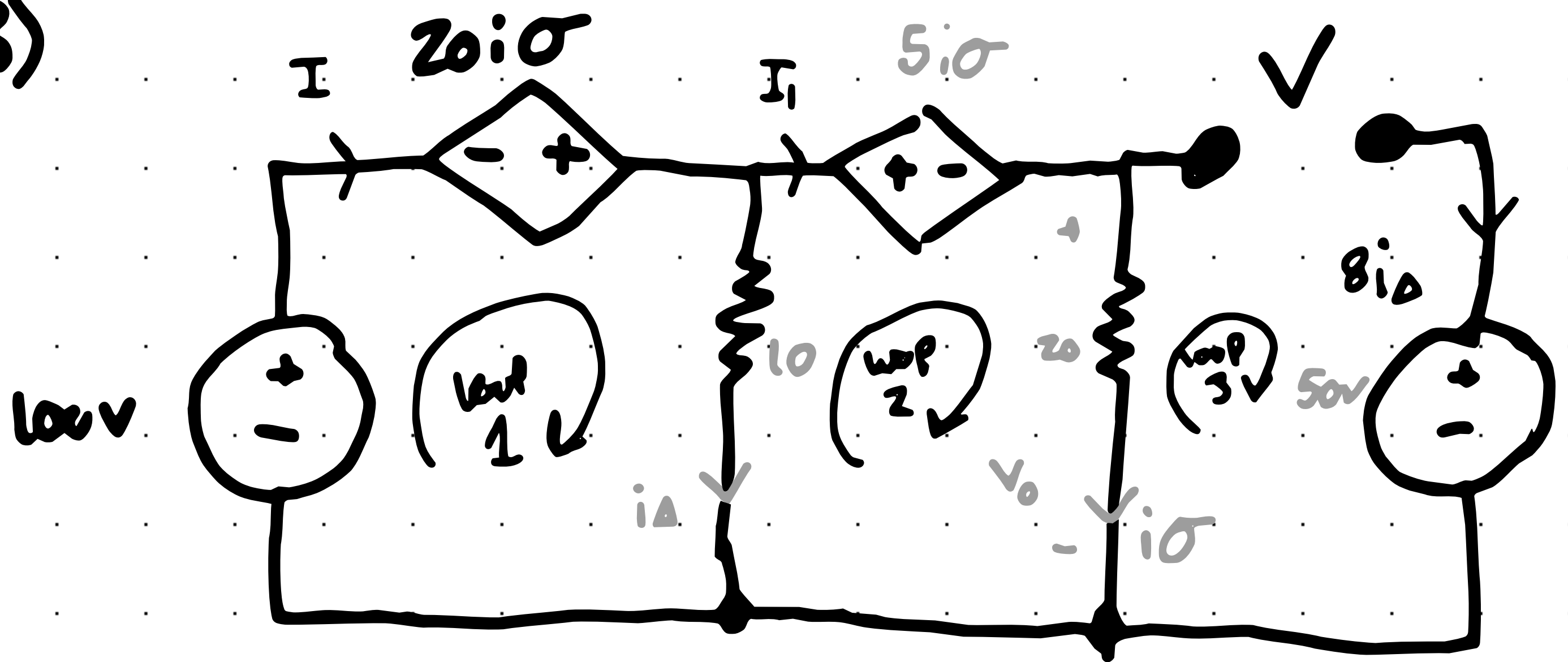
\uparrow \uparrow
50A 420A

$$I = 470 \text{ A}$$

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

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

Part (B)



Calculate $i\Delta$, $i\sigma$, V_0 and V

From part A).... $i\Delta = 20A$, $i\sigma = 50A$

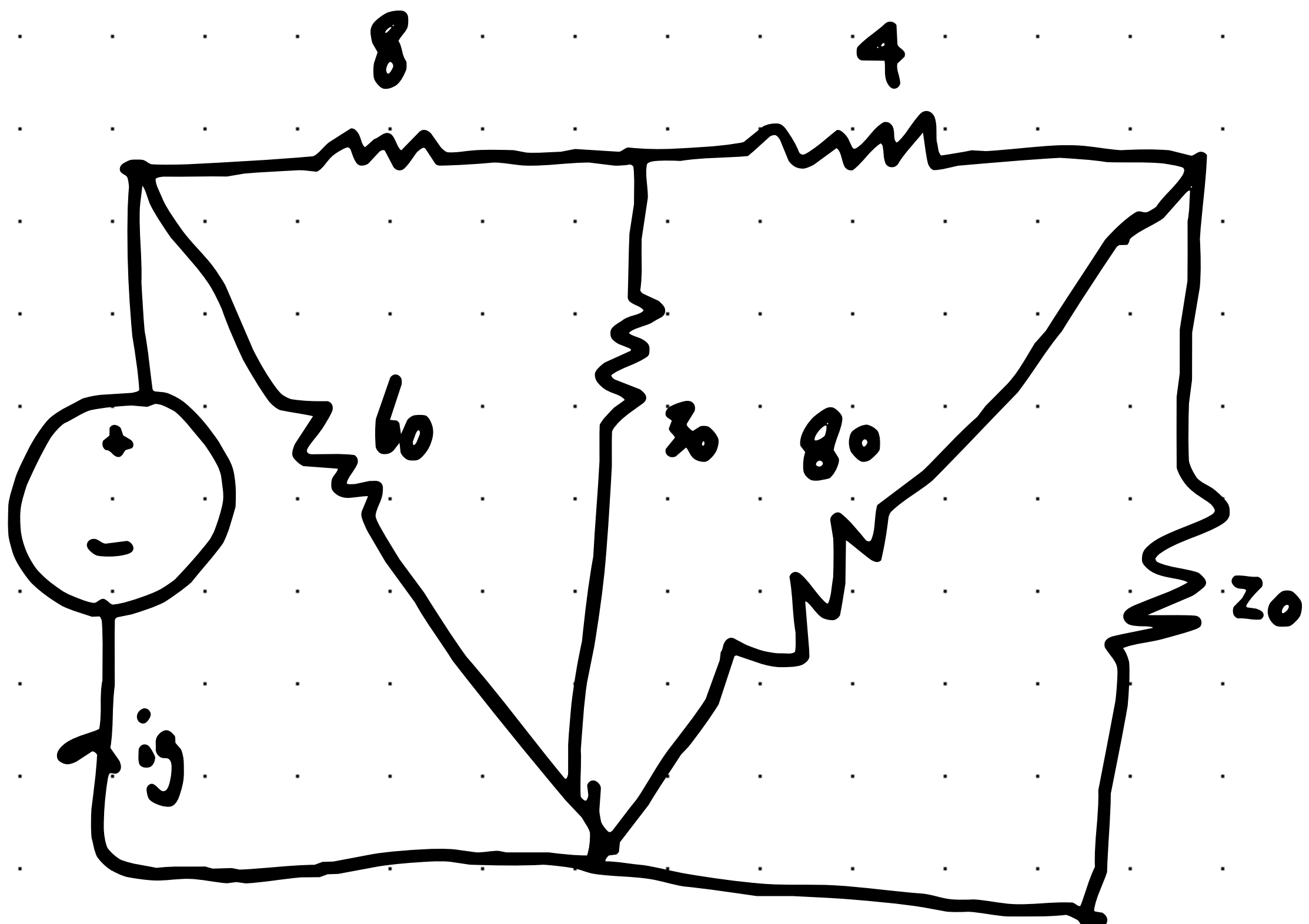
$$\sum_{\text{loop}_3} V = 0$$

$$20i\sigma - V - 50 = 0$$

$$V = 20i\sigma - 50 = \underline{\underline{350V}}$$

Problem 3

Calculate the total resistance R_{eq} seen by source and i_g



Solution

Para

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

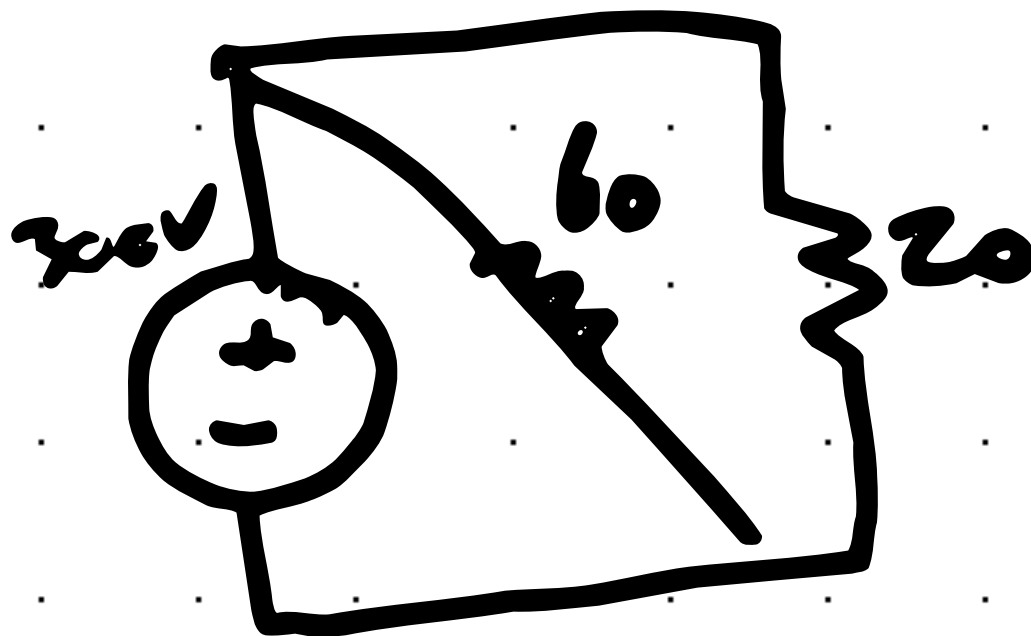
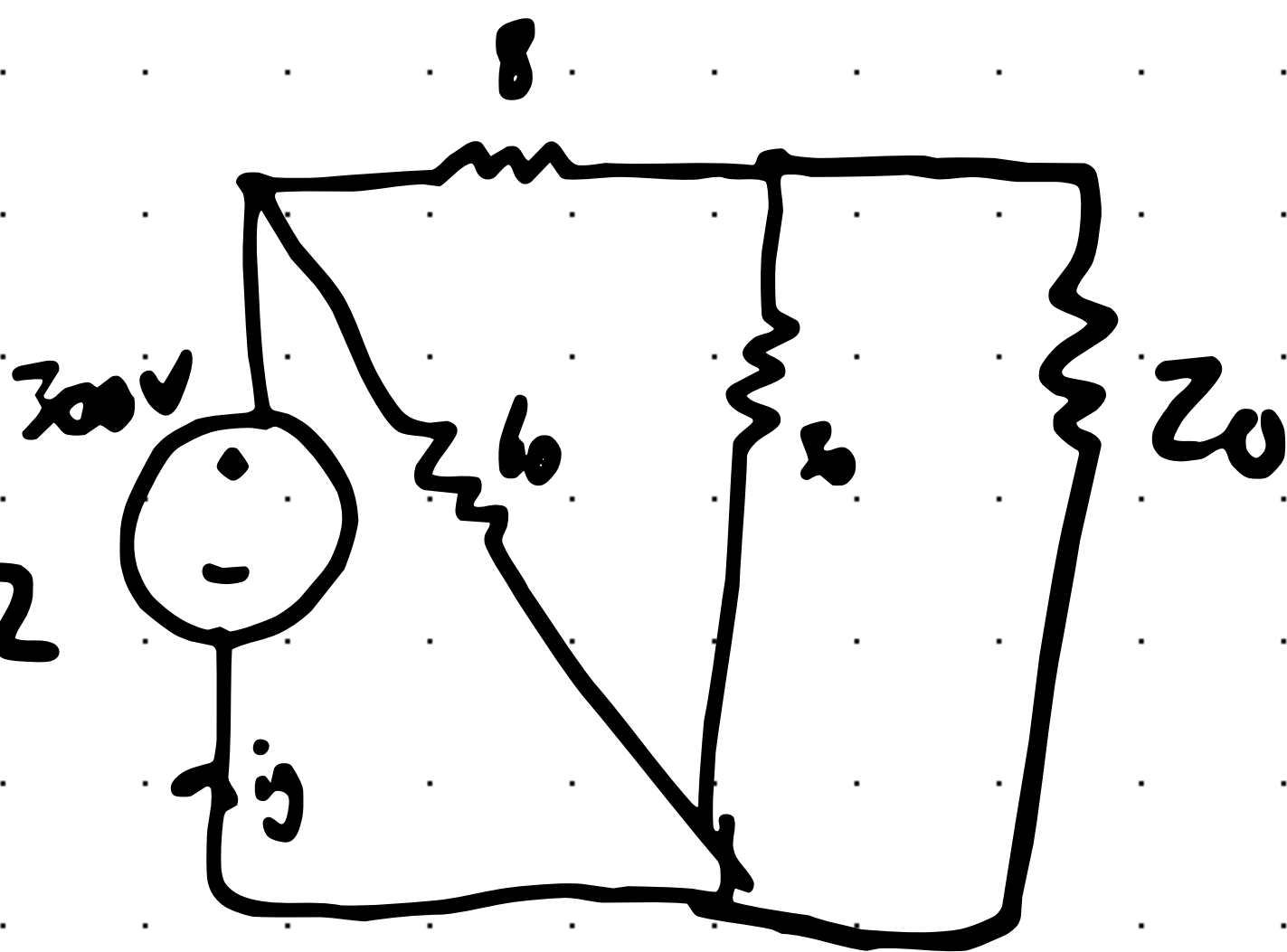
$$16 + 4 = 20$$

Para

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

Series

$$8 + 12 = 20\Omega$$

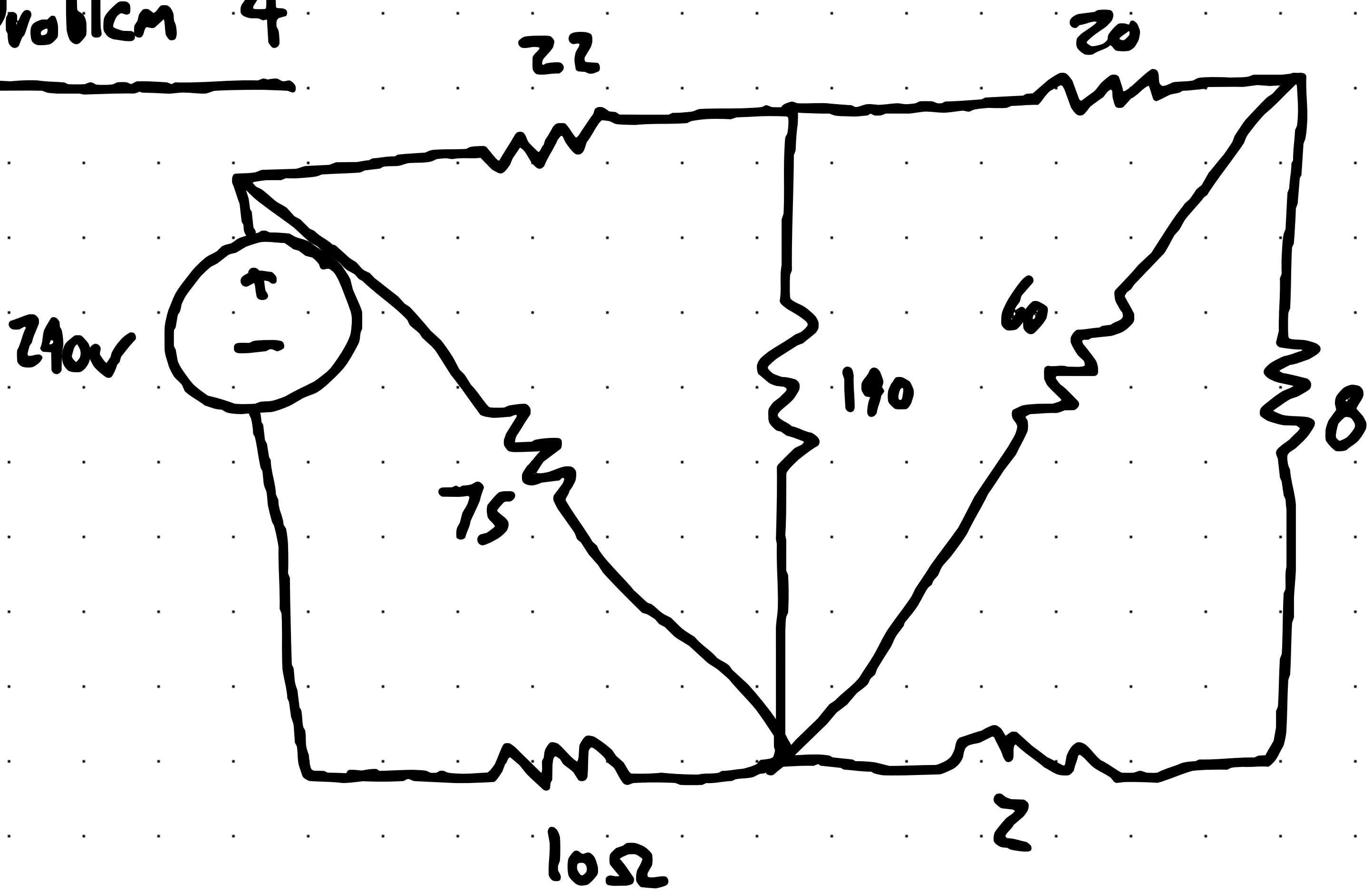


$$R_{tot} = 20 // 60$$

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

$$i_g = \frac{300}{15} = 20A$$

Problem 4



Calculate i_o and power dissipated in 140Ω

$$2 + 8 = 10$$

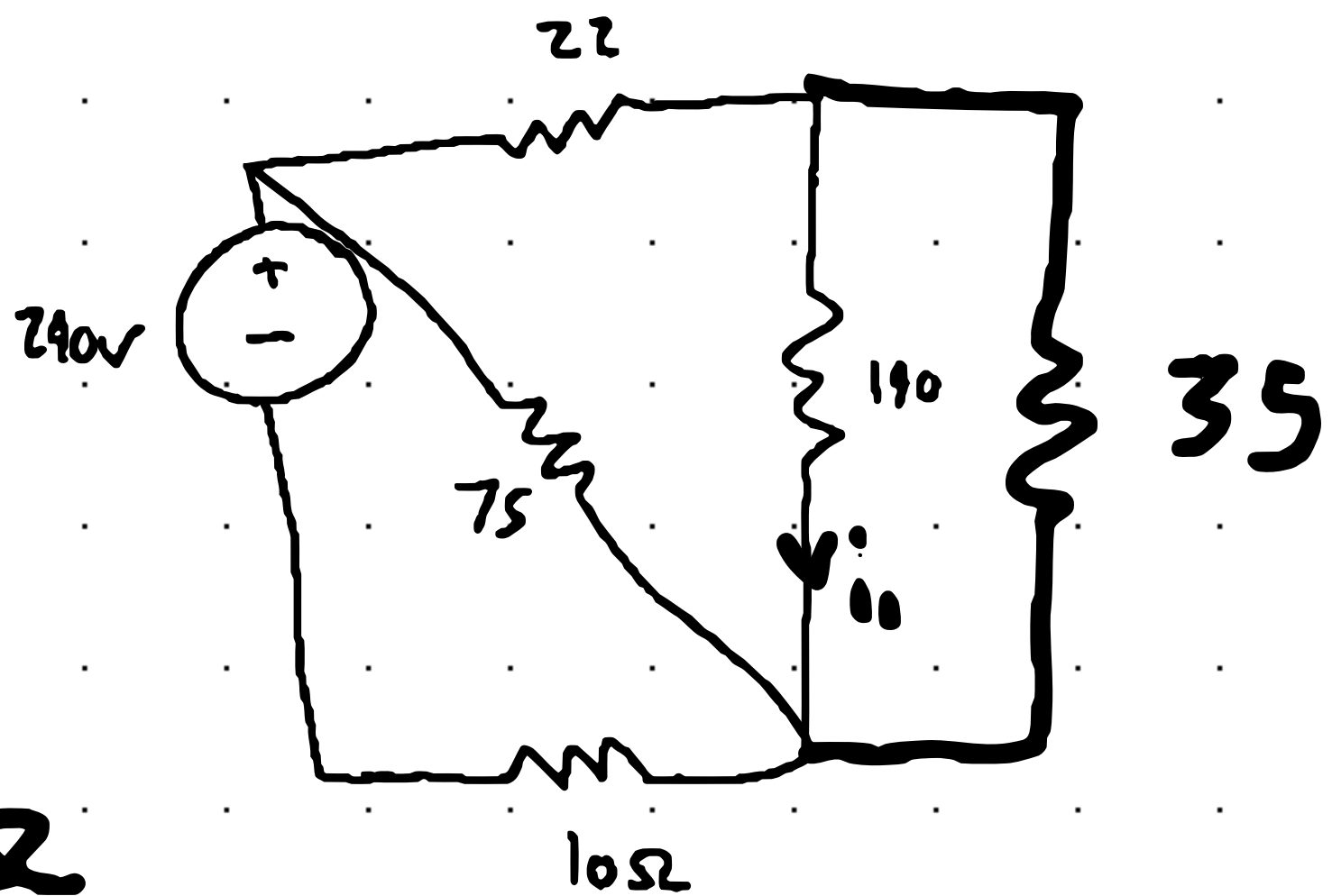
$$60 // 10 = \frac{60(10)}{60 + 10} = 15\Omega$$

$$15 + 20 = 35$$

Power

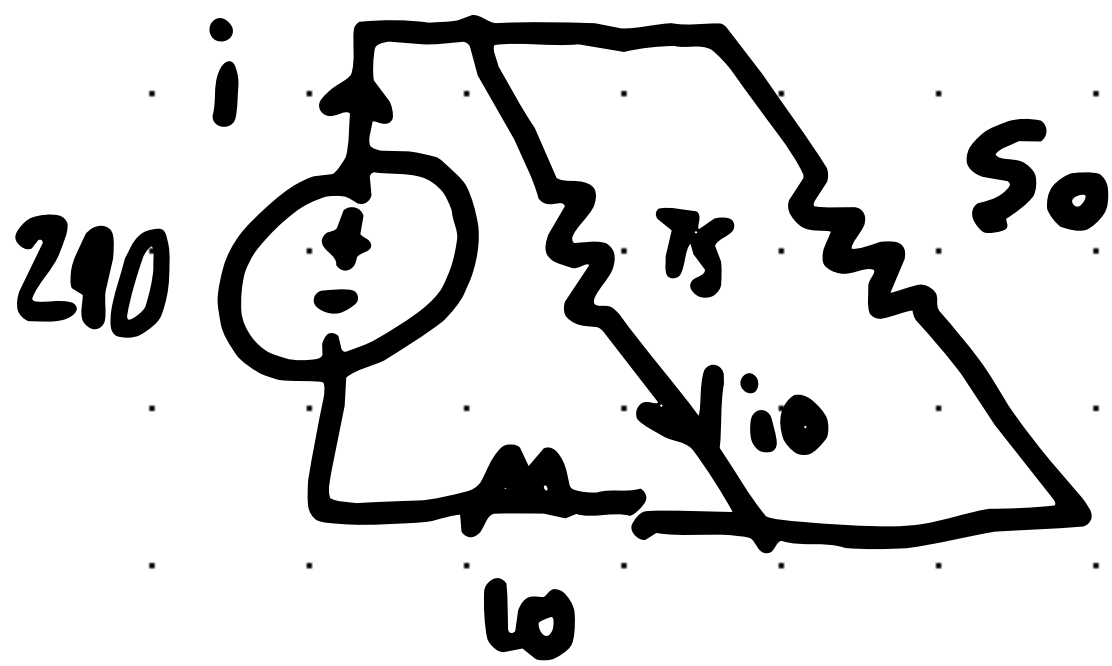
$$140 // 35$$

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



Source

$$\underline{22 + 28 = 50\Omega}$$

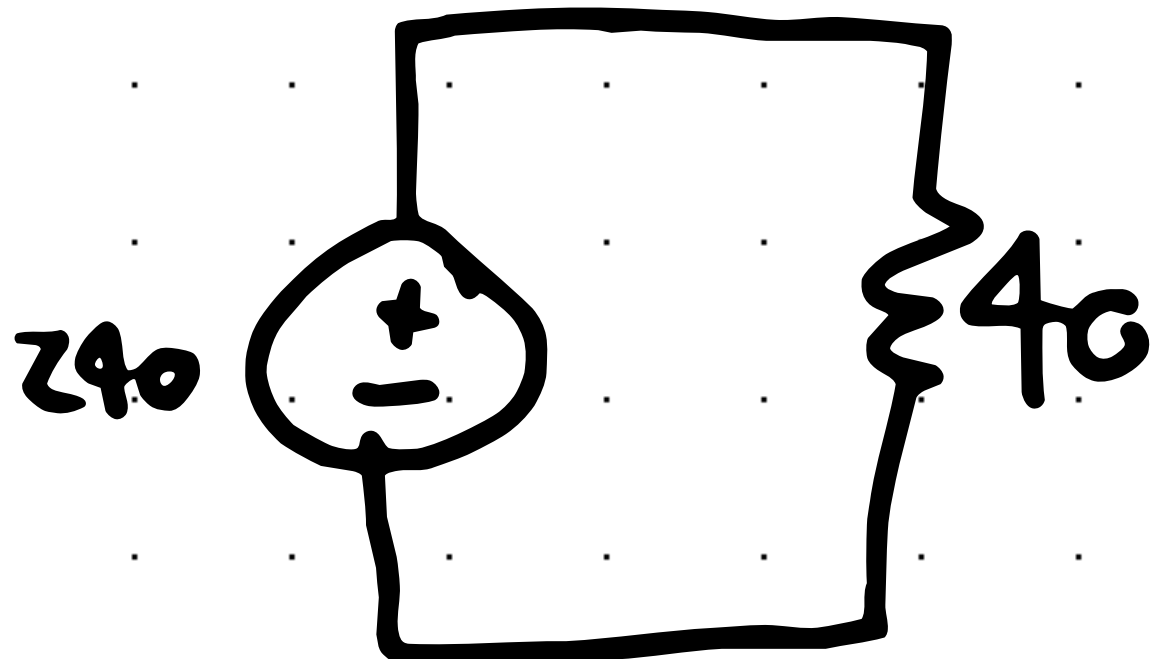


$$50 || 75$$

$$\frac{75(50)}{75+50} = 30$$

Rtotal

$$30 + lo = 40$$

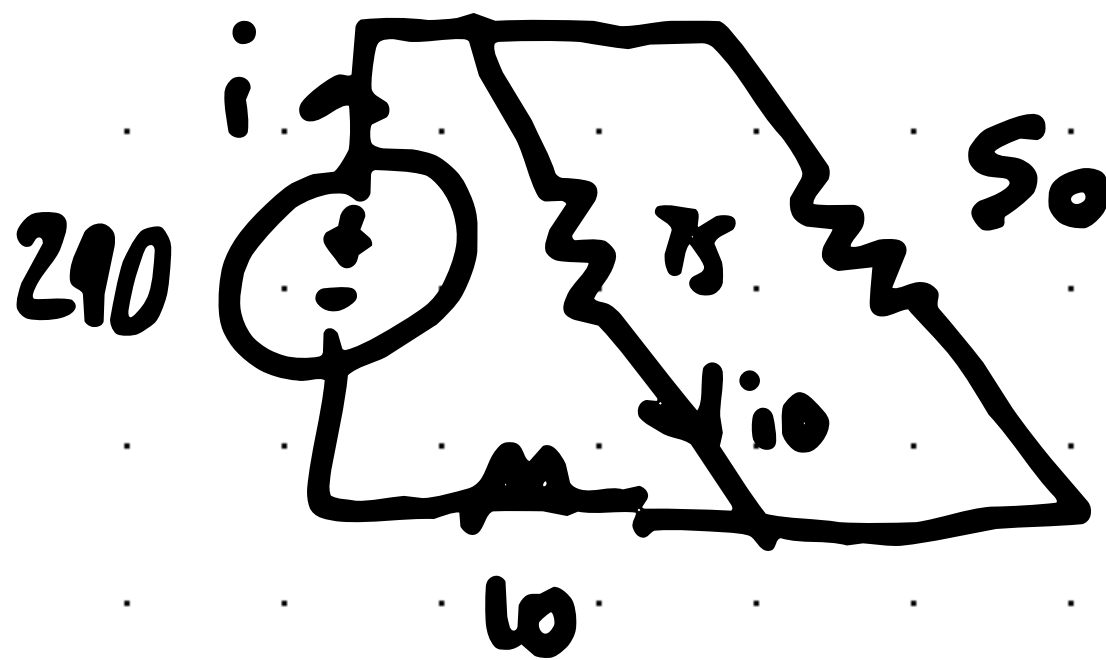


$$V = IR$$

$$240 = I(40)$$

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

Current Divider



$$i_o = i \left(\frac{50}{50+75} \right) = 2.4A$$

$$i_z = i \left(\frac{75}{50+75} \right) = 3.6A$$