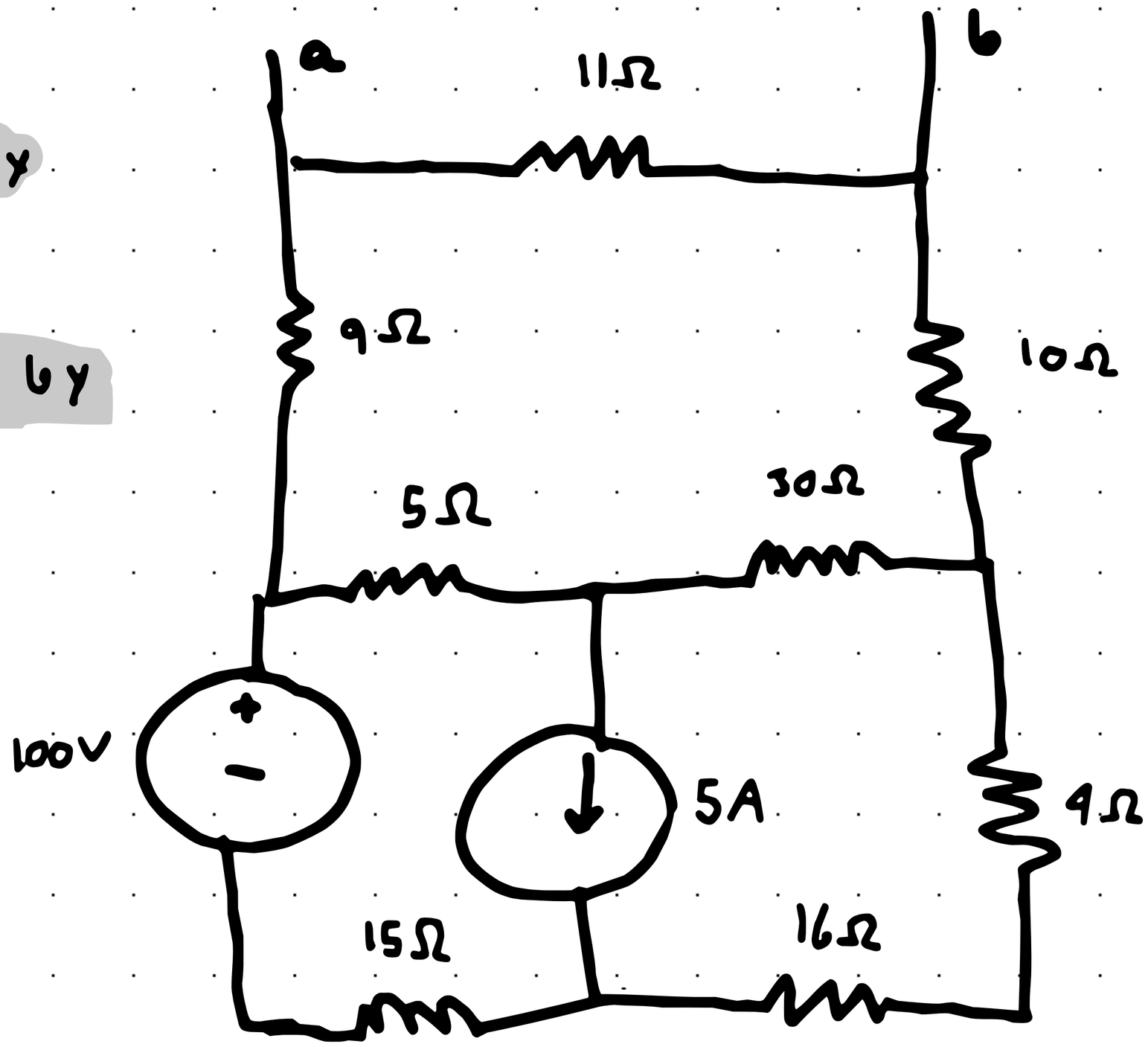
Tutorial 3 Solutions

ECED2000

Problem ①

Substitute Voltage Source by Short Circuit

Substitute Current Source by Open Circuit



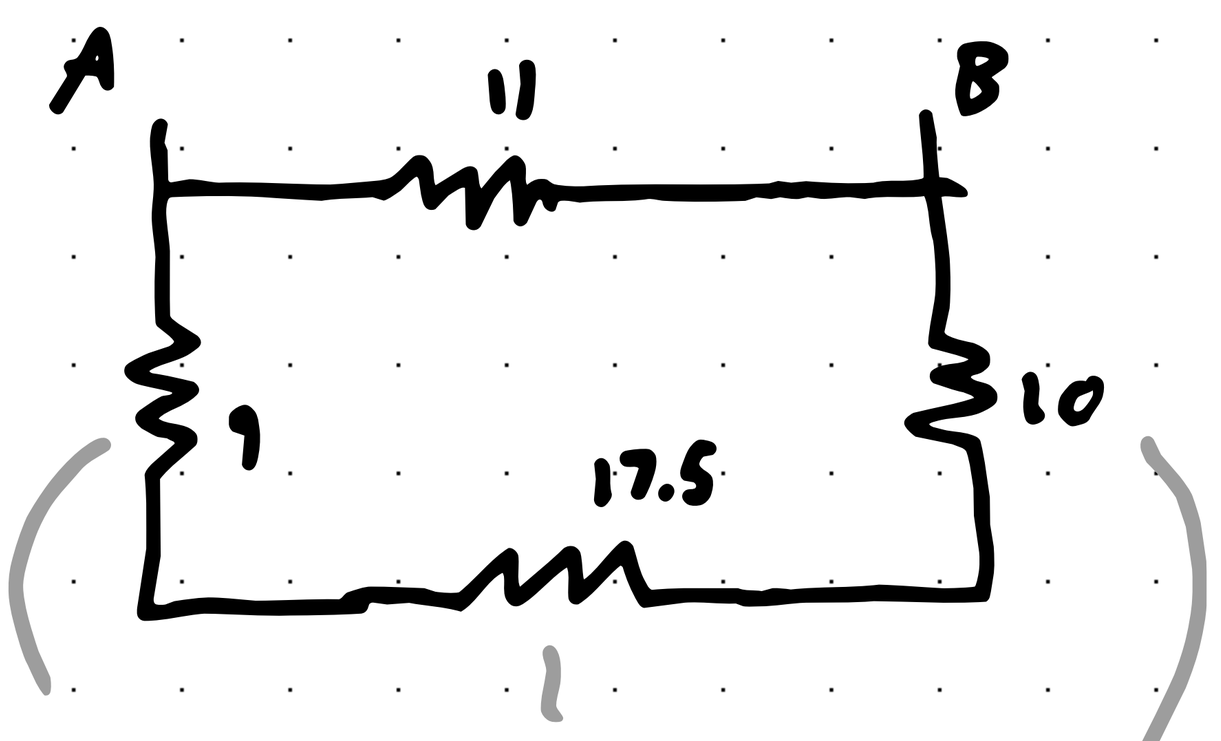
Sub1: Voltage in S.C.

Sub1: Current in S.C.

Reduce Circuit

Find total resistance in between A and B

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

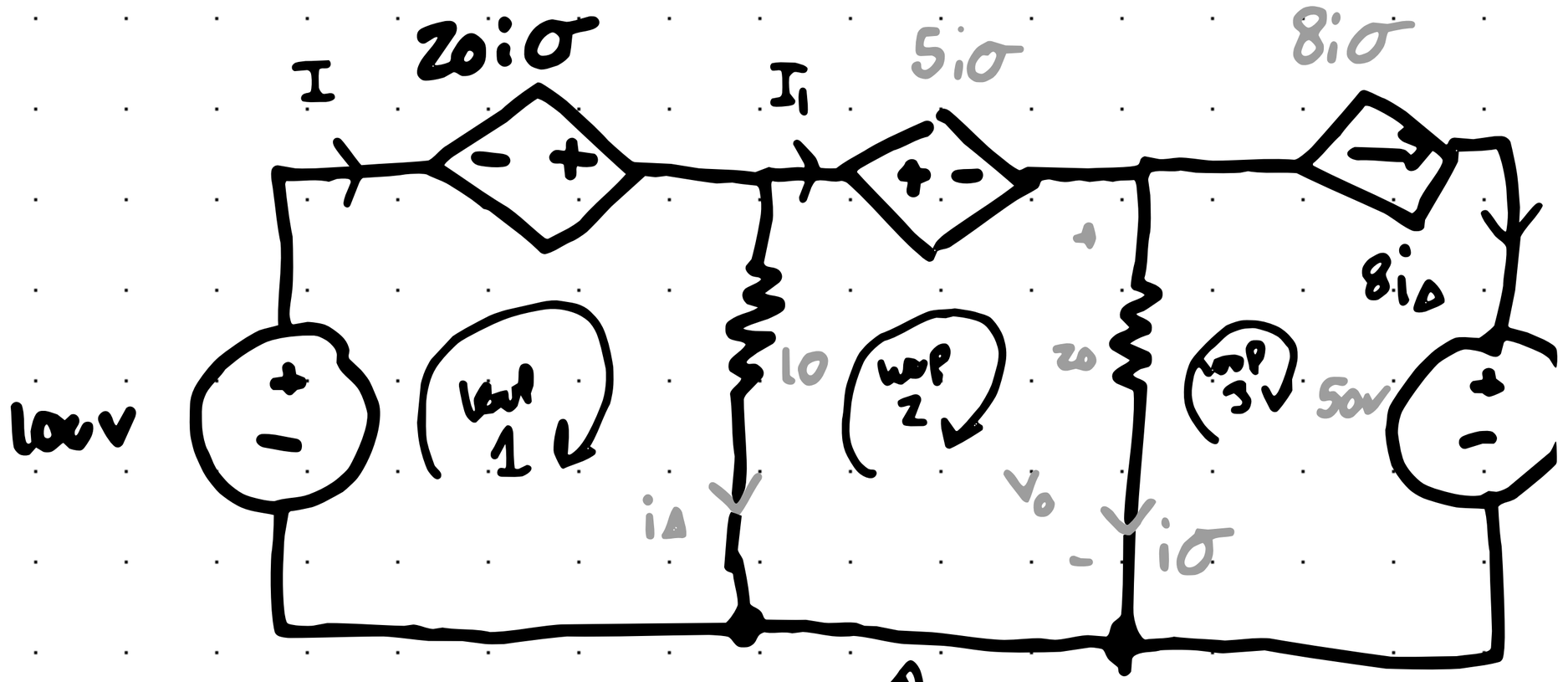


Sums to 36.5Ω

36.5 in parallel with 11

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

Problem 2



a)

Show $\Sigma P_{del} = \Sigma P_{abs}$

New Concept!

If there are Two nodes, with nothing but a wire in between, They Can be Considered the Same node.

Solution

$$\sum_{loop1} V = 100 + 20i_a - 10i_b = 0$$

$$\sum_{loop2} V = 10i_b - 5i_a - 20i_a = 0$$

We have always to solve!

$10i_b = 25i_a$, $i_b = \frac{25}{10} i_a$

$100 + 20i_a - 10\left(\frac{25}{10} i_a\right) = 0$, $i_a = \frac{100}{5} = 20A$

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

$V_o = 20i_a = 20(20) = 400V$

$\sum V=0$

Loop 3

$20i_0 - V_1 - 50 = 0$

$20(2i_0)$

$40i_0 - V_1 - 50 = 0$

$V_1 = 35_0$

$\sum I=0$

Node ①

$I_1 - i_0 - 8i_\Delta = 0$

i_0: 20 — $8i_\Delta$: 3_0

$I_1 = 420\,A$

$\sum I=0$

$I - I_\Delta - I_1 = 0$

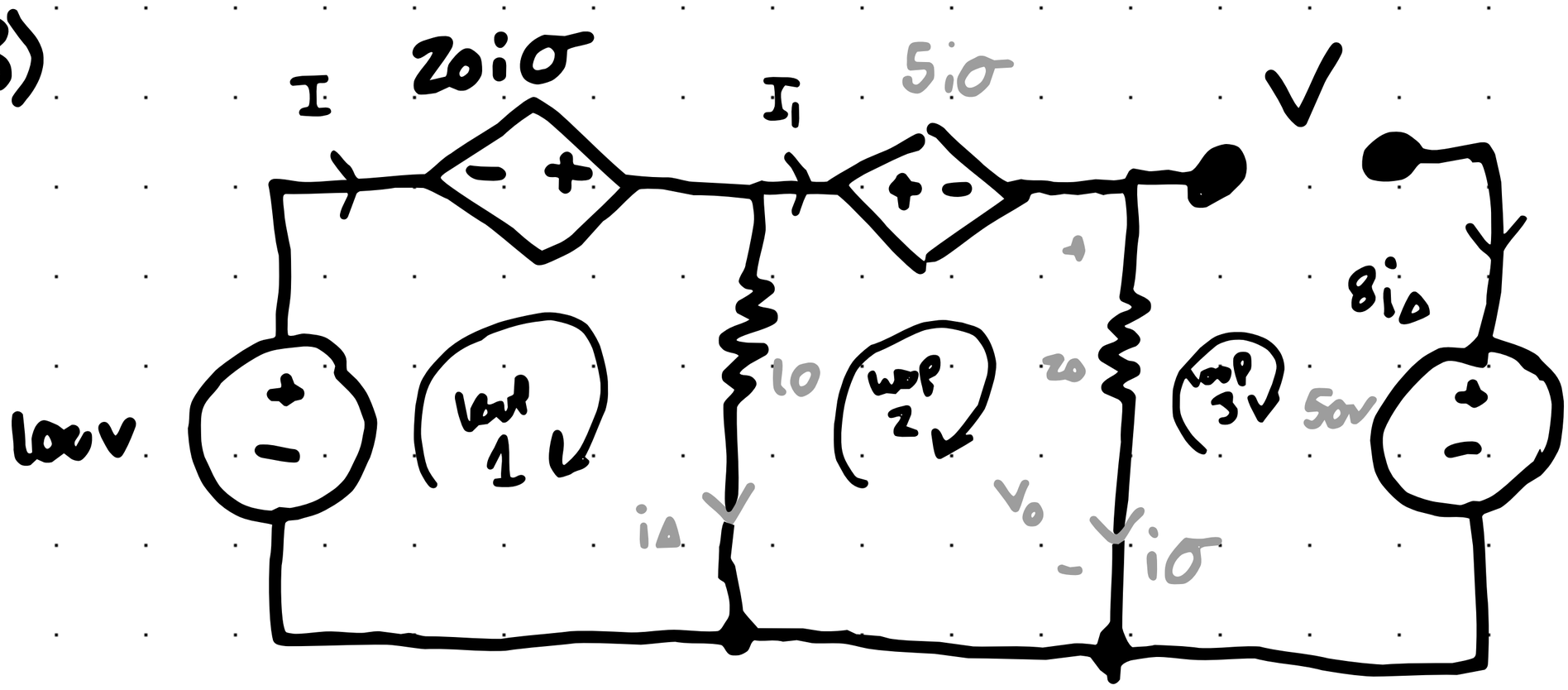
I_Δ: $50A$ — I_1: $420A$

$I = 470A$

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

$\sum P_{Abs} = \sum$ All Power

Part B)



Calculate i_Δ, i_σ, V_o and V

From part A).... $i_\sigma = 20A$, $i_o = 50A$

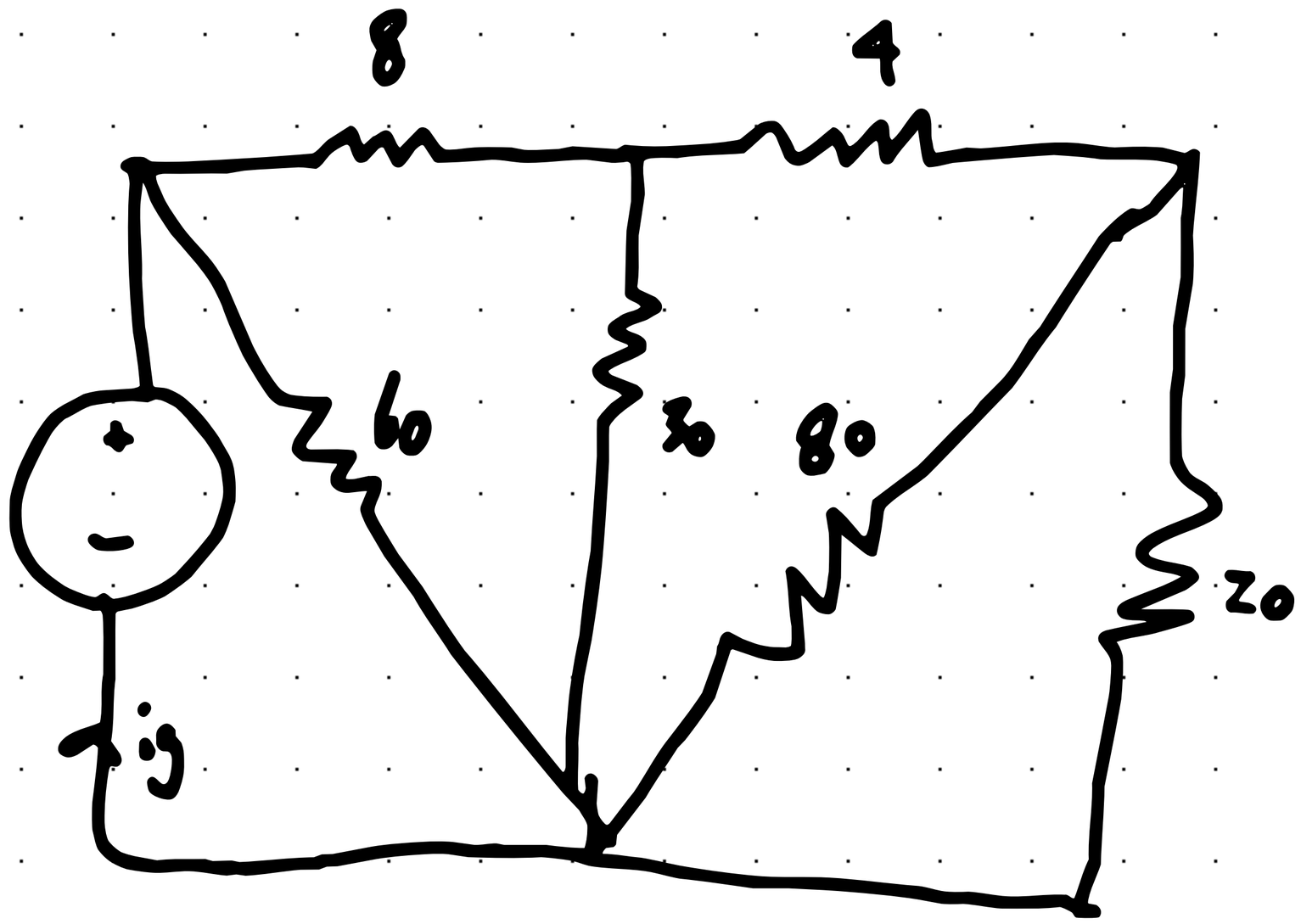
$\sum_{loop_3} V = 0$

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

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

Problem 3

Calculate the total resistance seen by source and i_g



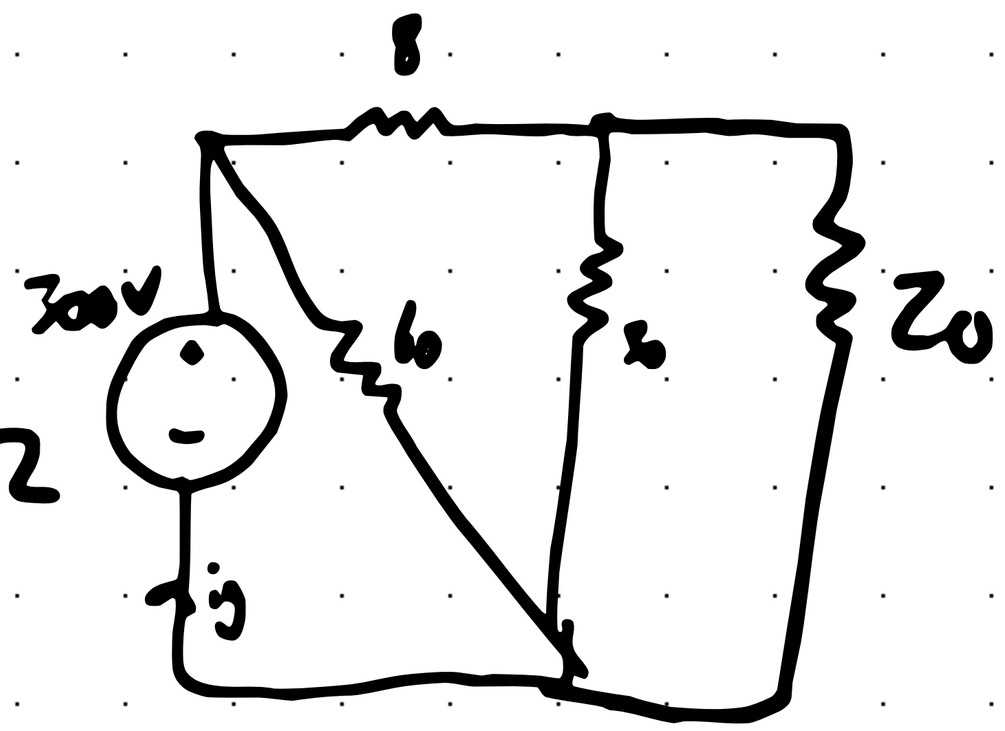
Solution

Parallel

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

Series

$16 + 4 = 20$

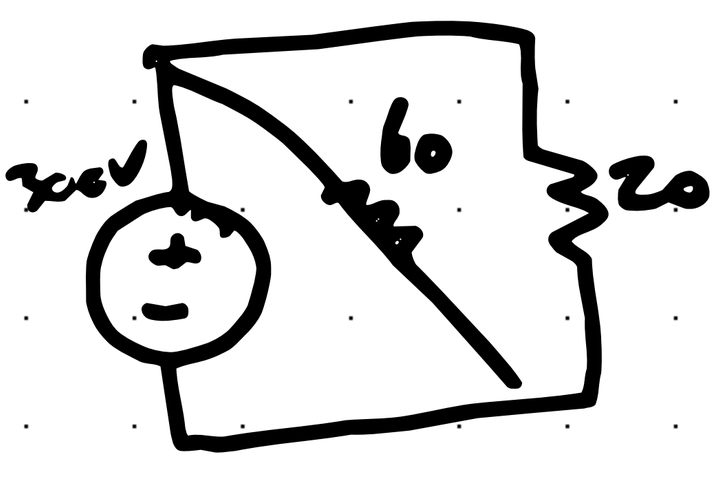


Parallel

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

Series

$8 + 12 = 20\Omega$

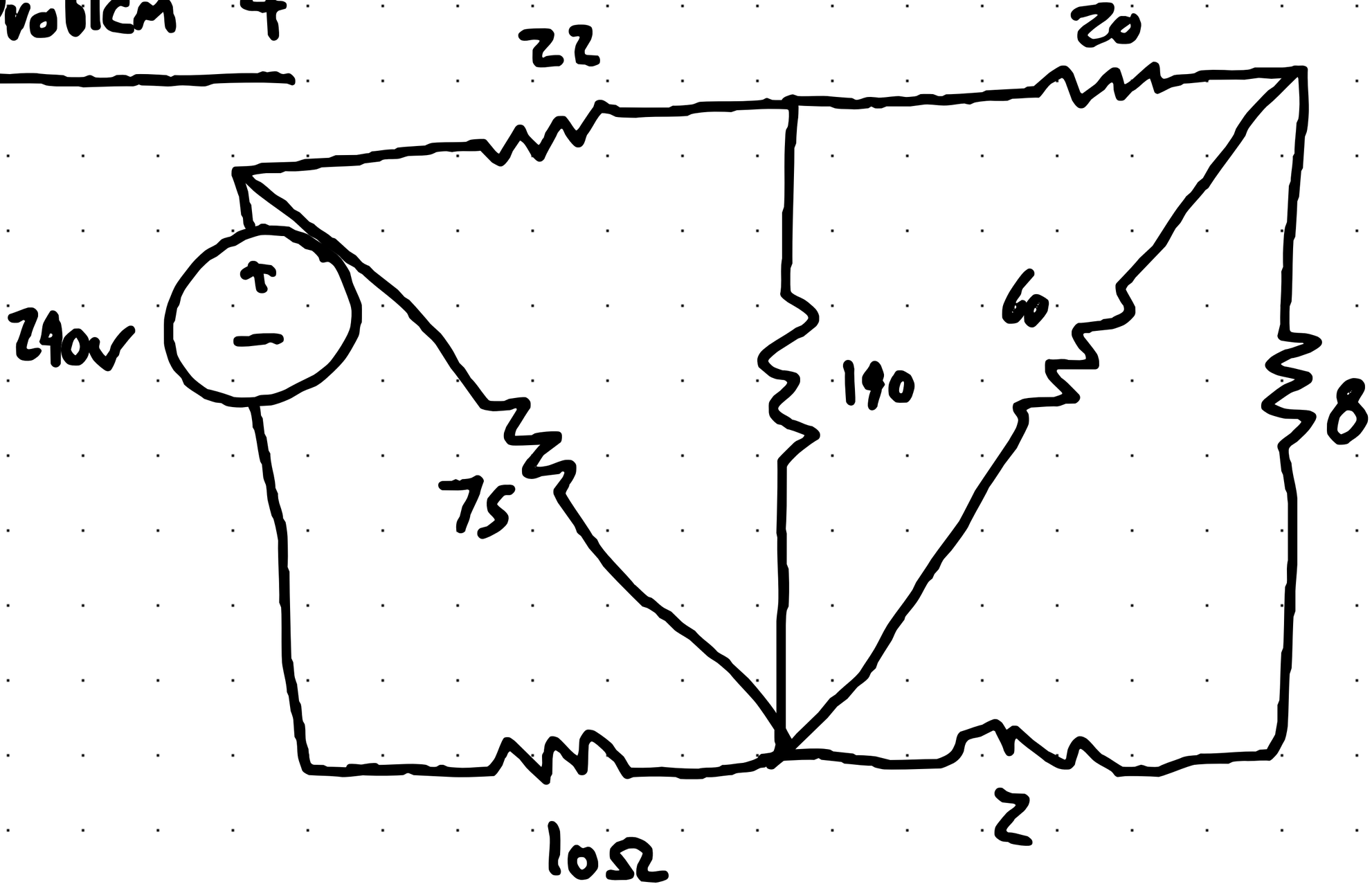


$R_{tot} = 20 // 60$

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

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

Problem 4



Calculate i_o and power dissipated in 140Ω

$22 + 8 = 10$

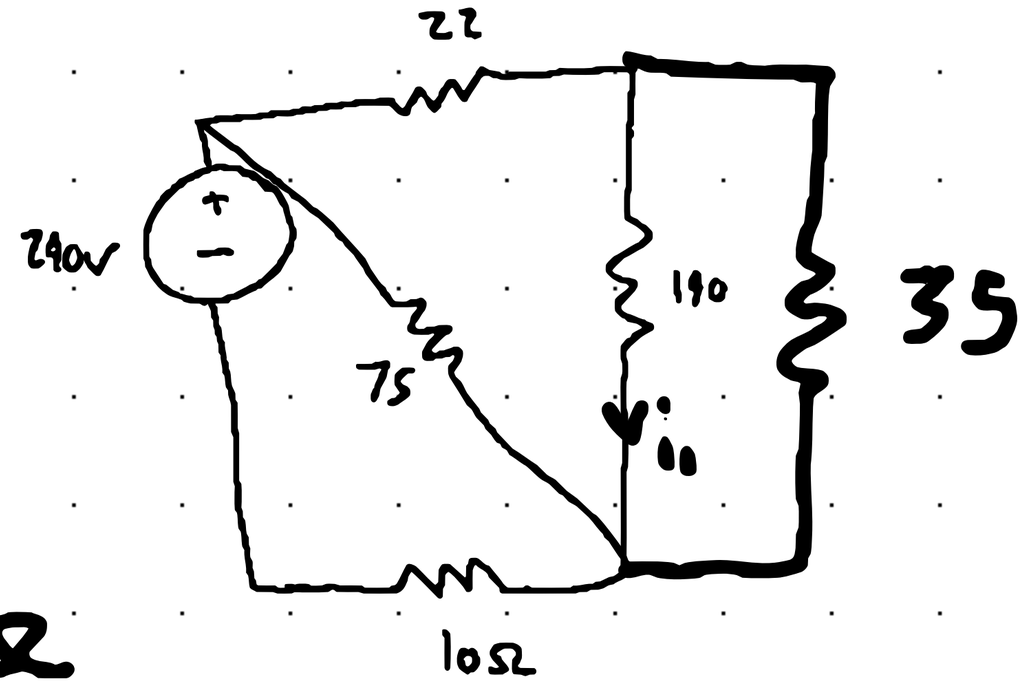
$60 // 10 = \frac{60(10)}{60+10} \approx 15\Omega$

$15 + 20 = 35$

Took

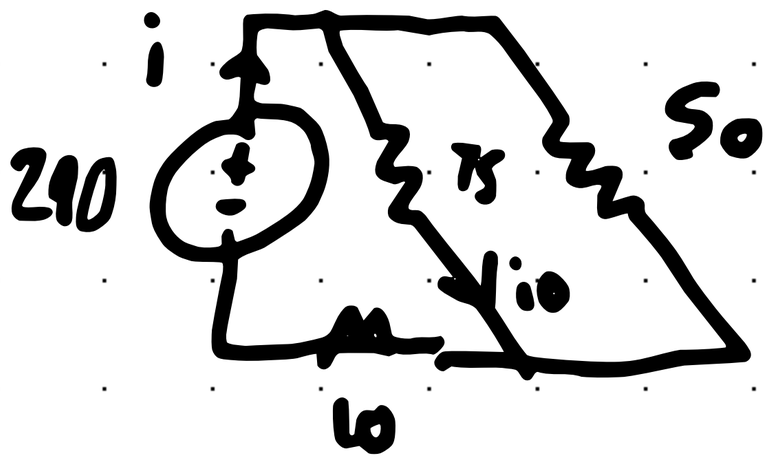
$190 // 35$

$\frac{190(35)}{190+35} = 28\Omega$



Solve

$22 + 28 = 50\Omega$

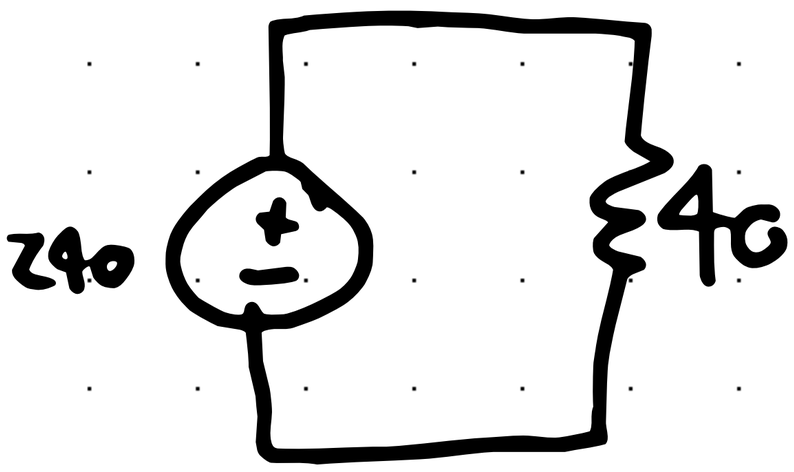


$50 // 75$

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

Rtotal

$30 + 10 = 40$

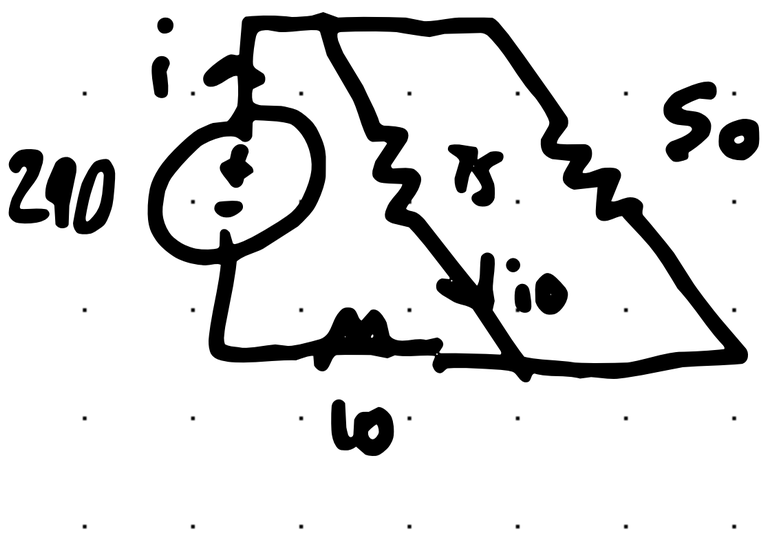


$V = IR$

$240 = I(40)$

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

Current Divider



$$i_0 = i\left(\frac{50}{50+75}\right) = 2.4A$$

$$i_2 = i\left(\frac{75}{50+75}\right) = 3.6A$$