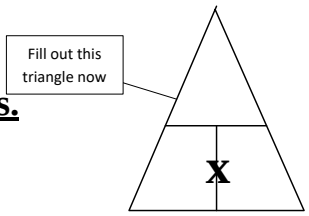
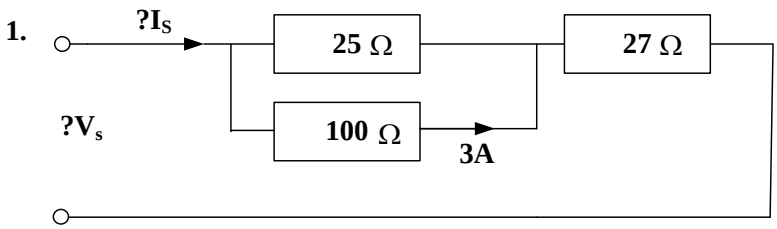
WORKSHEET 16A Q4 WORKED EXAMPLE

Ohms Law.
Work Sheet 16A
Harder Series-Parallel calculations.



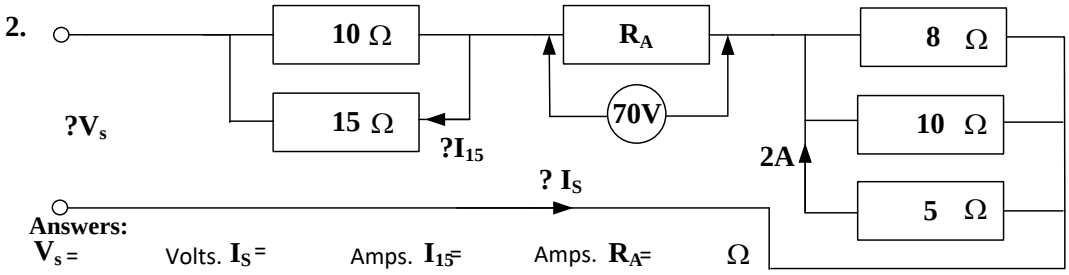
Determine the unknown value(s).
Layout your workings on another page.

1.



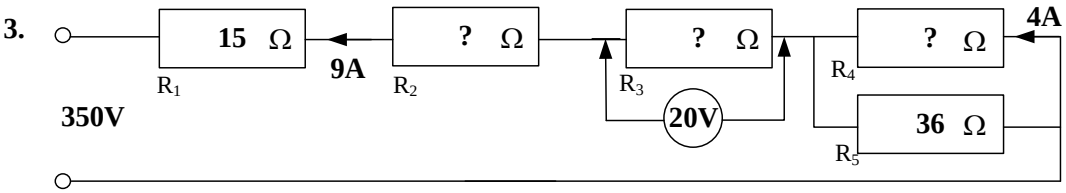
Answers:
I_S = Amps
V_s = Volts

2.



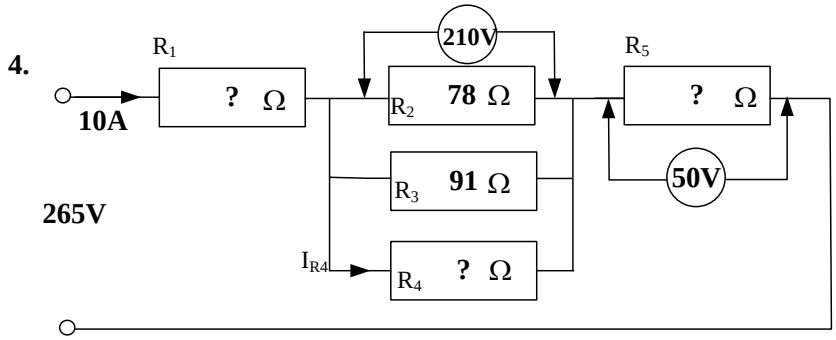
Answers:
V_s = Volts. I_S = Amps. I_{15} = Amps. R_A = Ω

3.



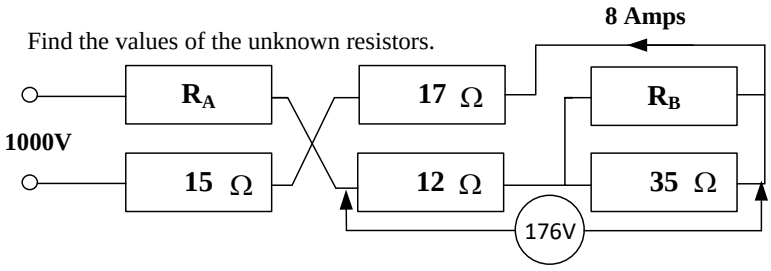
Answers: R_2 = Ω R_3 = Ω R_4 = Ω

4.



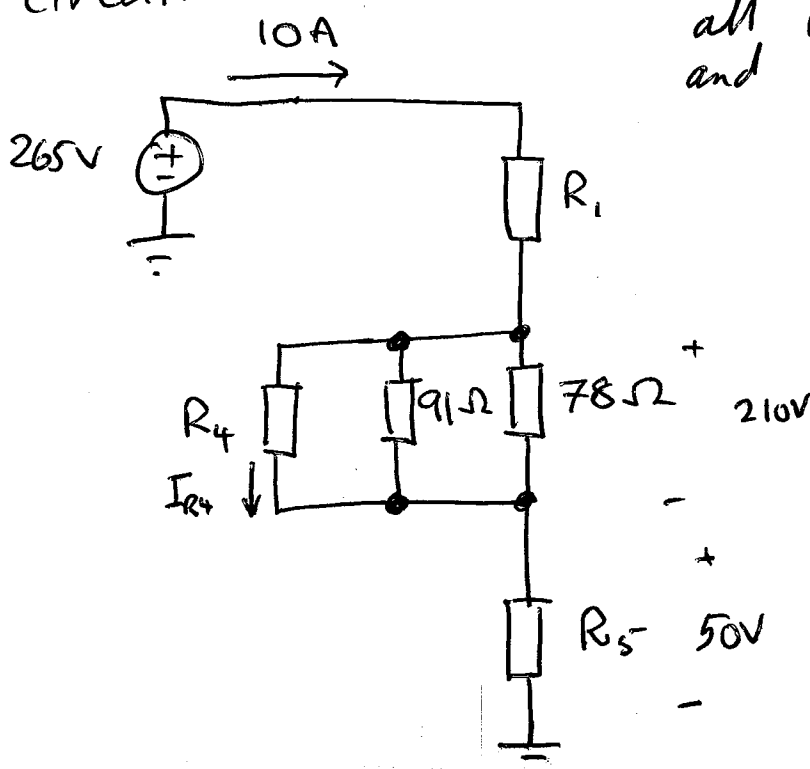
Answers:
R_1 = Ω
R_4 = Ω
R_5 = Ω
I_{R4} = Amps

5. Find the values of the unknown resistors.



Answers:
R_A = Ω
R_B = Ω
I_{R_B} = Amps

The circuit:



The problem: Find all unknown currents and resistances.

There are many orders of solving this question, but it can be broken down into three independent parts.

1. Solving for R_1

Use KVL to get voltage drop across R_1.

$$V_{R1} = 265 - 210 - 50$$
$$= 5V$$

R_1 has 5V drop at 10A

$$\Rightarrow \boxed{R_1 = 0.5\,\Omega}$$

2. Solving for R_5

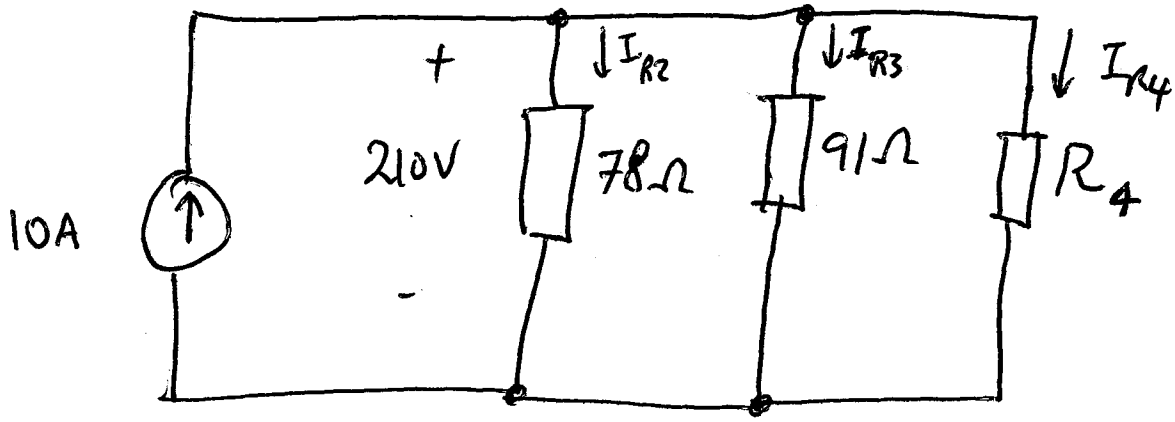
R_5 has 50V drop for 10A current.

$$\Rightarrow R_5 = \frac{50}{10}$$

$$\boxed{R_5 = 5\,\Omega}$$

3. Solving for R_4, I_{R4}

Simplify the circuit to the parts that are relevant to the problem.



The current through the parallel network is 10A, and the volt drop is 210V.

i.e. The total parallel resistance is 21 Ω.

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Use the parallel resistance formula to get R_4.

$$\frac{1}{R_1} + \frac{1}{R_2} + \cdots = \frac{1}{R_T}$$

so $$\frac{R_T}{R_1} + \frac{R_T}{R_2} + \cdots = 1$$

Use this to get R_4, remember $R_T = 21\Omega$

$$\frac{21}{78} + \frac{21}{91} + \frac{21}{R_4} = 1$$

$$\frac{21}{R_4} = 0.5$$

$$\frac{R_4}{21} = 2 \Rightarrow \boxed{R_4 = 42\Omega}$$

Find I_{R4} $\quad I_{R_4} = \frac{210}{42} \Rightarrow \boxed{I_{R_4} = 5A}$