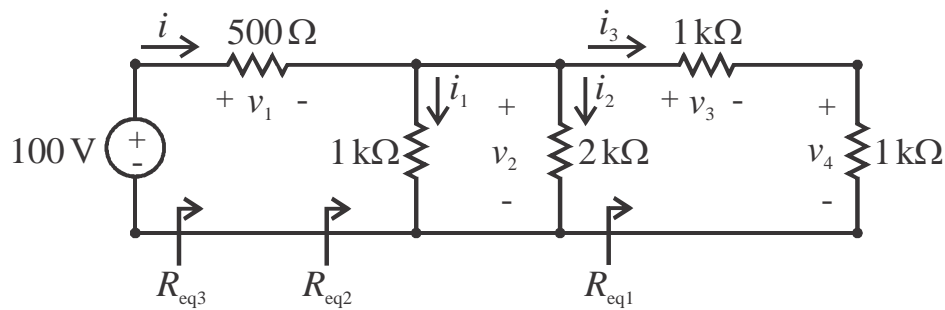


Example- Use circuit reduction techniques to solve for indicated variables

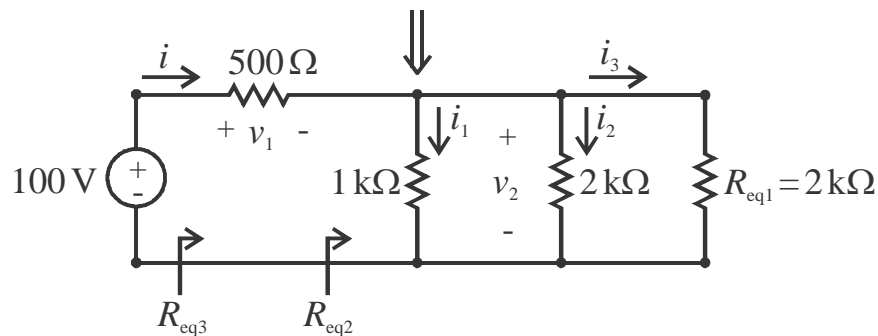


Step 1

Start by noting that the two $1\text{ k}\Omega$ resistors furthest from the source are in series. Combine & replace with equivalent resistance

$$R_{eq1} = 1000 + 1000 \rightarrow \boxed{R_{eq1} = 2\text{ k}\Omega}$$

Note that voltages v_3 and v_4 are 'lost' in the new reduced equivalent circuit.

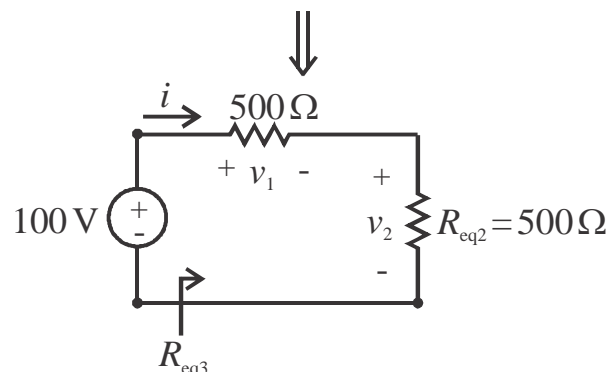


Step 2

Note that the three resistors ($1\text{ k}\Omega$, $2\text{ k}\Omega$, & R_{eq1}) now furthest from the source are in parallel. Combine & replace with equivalent resistance

$$R_{eq2} = [1000^{-1} + 2000^{-1} + 2000^{-1}]^{-1} \rightarrow \boxed{R_{eq2} = 500\text{ }\Omega}$$

Note that currents i_1 , i_2 , and i_3 are 'lost' in the new reduced equivalent circuit.

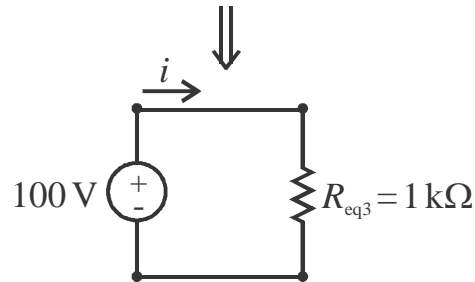


Step 3

Note that the remaining two 500Ω resistors are in series. Combine & replace with equivalent resistance

$$R_{eq3} = 500 + 500 \rightarrow \boxed{R_{eq3} = 1 \text{ k}\Omega}$$

Note that voltages v_1 and v_2 are 'lost' in the final reduced equivalent circuit.



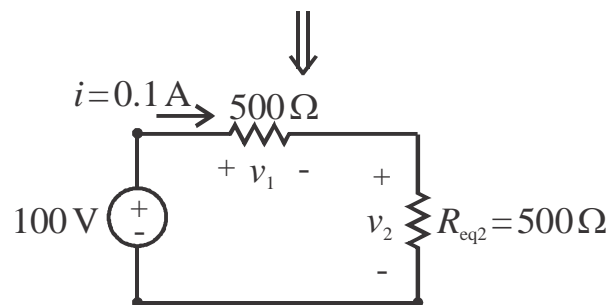
Now, we can start by determining the unknown current i for the final reduced equivalent circuit. By Ohm's Law,

$$i = 100 \text{ V} / R_{eq3} = 100 / 1000 \rightarrow \boxed{i = 0.1 \text{ A} = 100 \text{ mA}}$$

Next, we will 're-expand' or undo the circuit reduction to find the remaining currents and voltages.

Step 4

Knowing i , go back to the circuit of step 2 and find v_1 and v_2 .

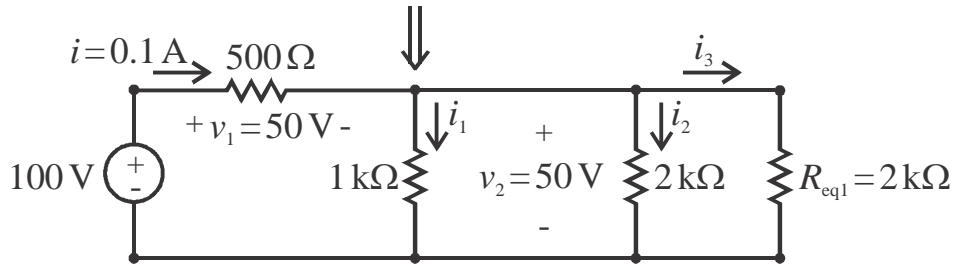


By Ohm's Law,

$$v_1 = v_2 = i (500 \Omega) = 0.1 (500) \rightarrow \boxed{v_1 = v_2 = 50 \text{ V}}$$

Step 5

Knowing i , v_1 , and v_2 , go back to circuit of step 1 and find i_1 , i_2 , & i_3 .



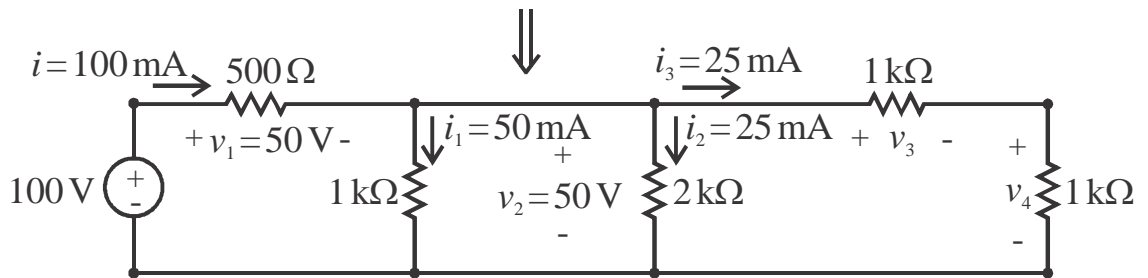
By Ohm's Law,

$$i_1 = v_2 / 1\text{ k}\Omega = 50 / 1000 \rightarrow \boxed{i_1 = 0.05\text{ A} = 50\text{ mA}}, \text{ and}$$

$$i_2 = i_3 = v_2 / 2\text{ k}\Omega = 50 / 2000 \rightarrow \boxed{i_2 = i_3 = 0.025\text{ A} = 25\text{ mA}}.$$

Step 6

Knowing i , v_1 , v_2 , i_1 , i_2 , & i_3 , go back to original circuit and find v_3 & v_4 .



By Ohm's Law,

$$v_3 = v_4 = i_3 (1\text{ k}\Omega) = 25 \cdot 10^{-3} (1000) \rightarrow \boxed{v_3 = v_4 = 25\text{ V}}.$$

Our **final circuit**, with all values computed, is

