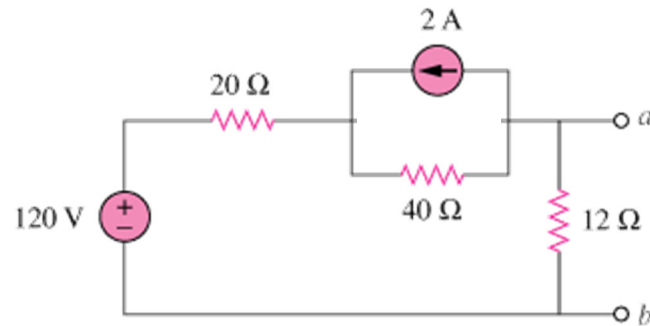


EE1002 Solution of Tutorial 6

(Questions from the Textbook by Alexander & Sadiku, 7th edition Problems 4.37, 4.38, & 4.41)

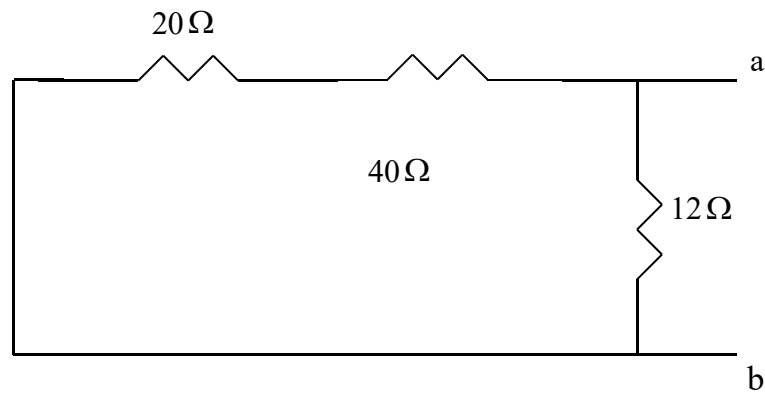
Q1

Find the Norton equivalent with respect to terminals a - b in the following circuit.



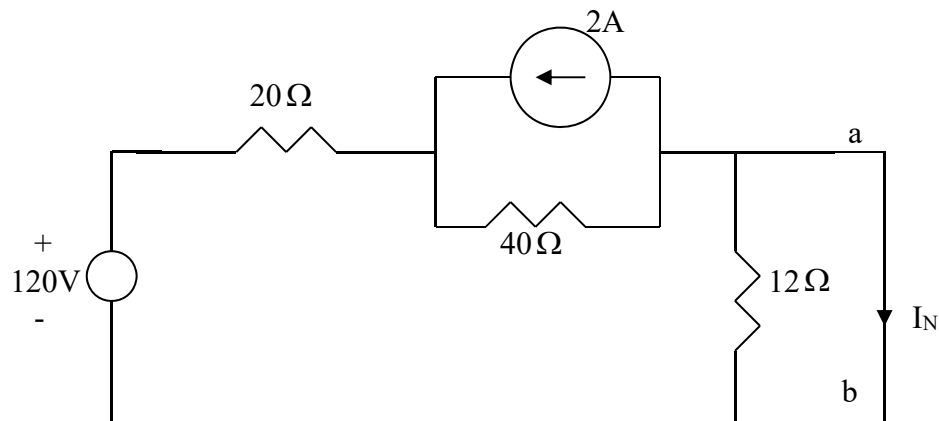
Solution

R_N is found from the circuit below.

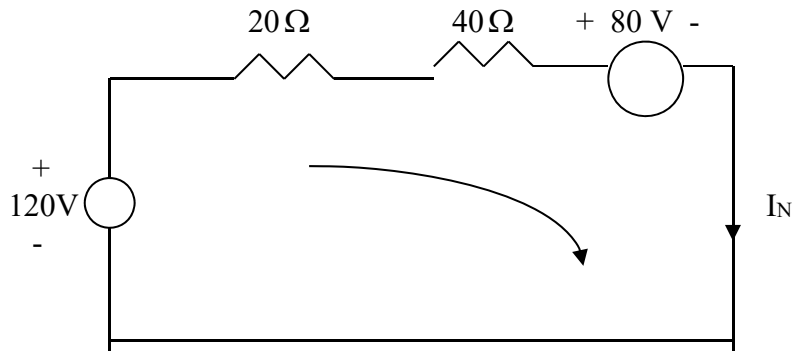


$$R_N = 12 // (20 + 40) = 10\ \Omega$$

I_N is found from the circuit below.



Applying source transformation to the current source yields the circuit below.

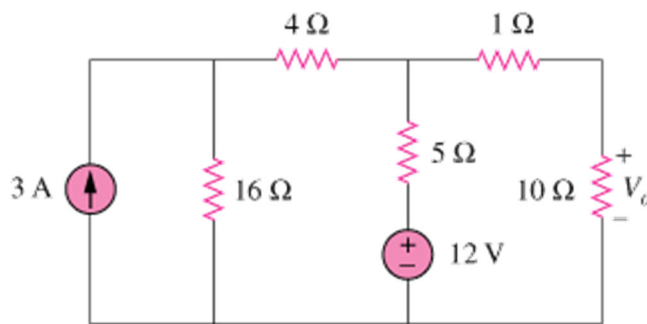


Applying KVL to the loop yields

$$-120 + 80 + 60I_N = 0 \quad \longrightarrow \quad I_N = 40/60 = \mathbf{666.7 \text{ mA.}}$$

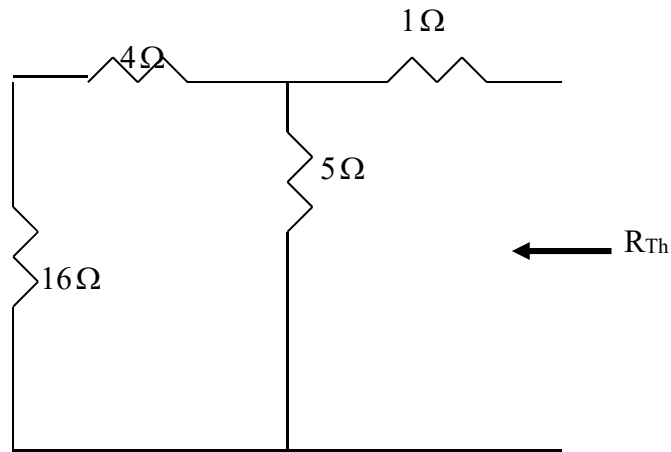
Q2

Apply Thevenin's theorem to find V_o in the following circuit.



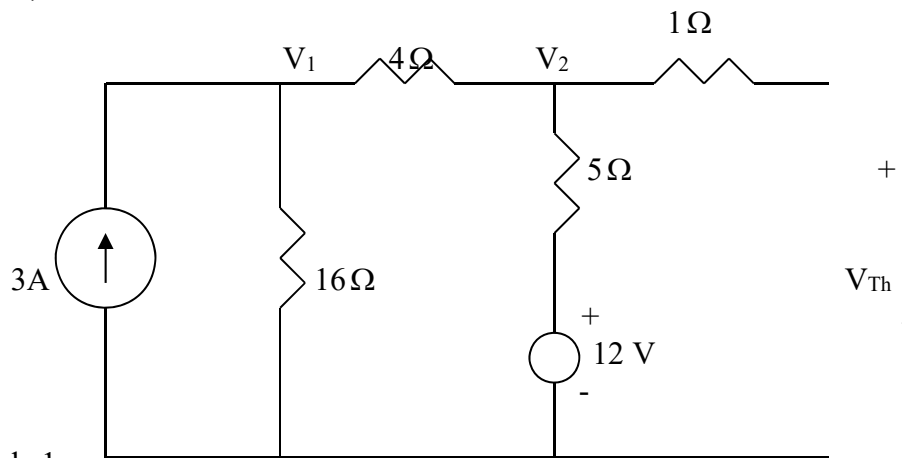
Solution

We find Thevenin equivalent at the terminals of the 10-ohm resistor. For R_{Th} , consider the circuit below.



$$R_{Th} = 1 + 5 // (4 + 16) = 1 + 4 = 5\Omega$$

For V_{Th} , consider the circuit below.



At node 1,

$$3 = \frac{V_1}{16} + \frac{V_1 - V_2}{4} \longrightarrow 48 = 5V_1 - 4V_2 \quad (1)$$

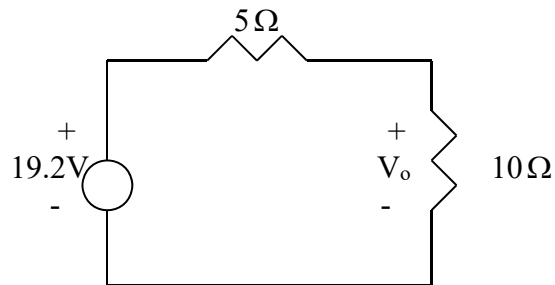
At node 2,

$$\frac{V_1 - V_2}{4} + \frac{12 - V_2}{5} = 0 \longrightarrow 48 = -5V_1 + 9V_2 \quad (2)$$

Solving (1) and (2) leads to

$$V_{Th} = V_2 = 19.2$$

Thus, the given circuit can be replaced as shown below.

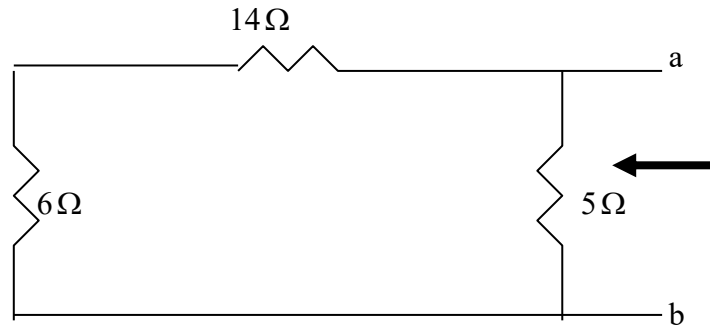


Using voltage division,

$$V_o = \frac{10}{10 + 5} (19.2) = 12.8 \text{ V.}$$

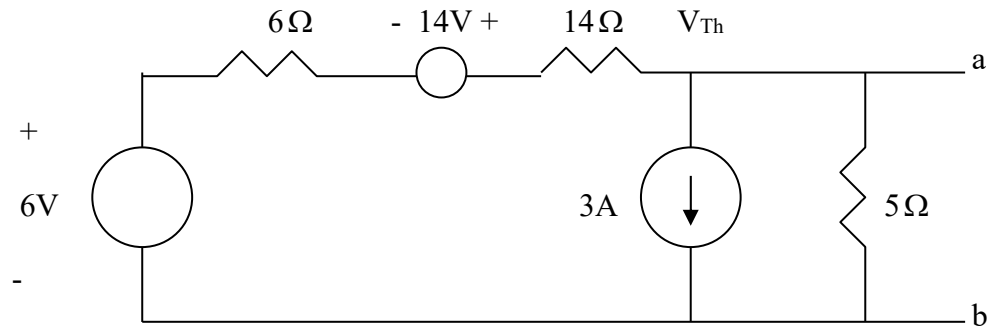
Q3

To find R_{Th} , consider the circuit below



$$R_{Th} = 5 // (14 + 6) = 4\Omega = R_N$$

Applying source transformation to the 1-A current source, we obtain the circuit below.



At node a,

$$\frac{14 + 6 - V_{Th}}{6 + 14} = 3 + \frac{V_{Th}}{5} \quad \longrightarrow \quad V_{Th} = -8 \text{ V}$$

$$I_N = \frac{V_{Th}}{R_{Th}} = (-8) / 4 = -2 \text{ A}$$

Thus,

$$\underline{R_{Th} = R_N = 4\Omega, \quad V_{Th} = -8\text{V}, \quad I_N = -2 \text{ A}}$$