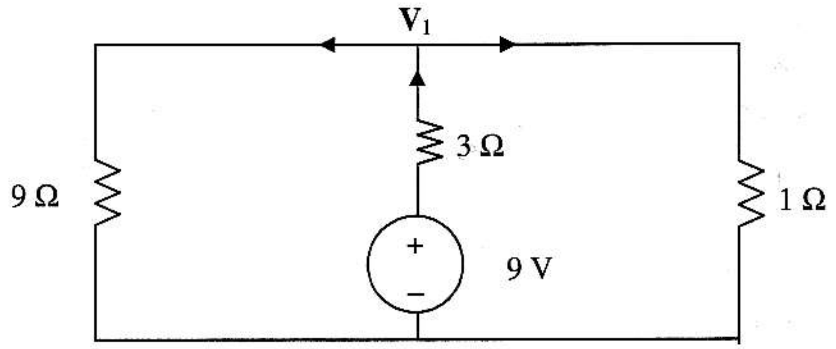
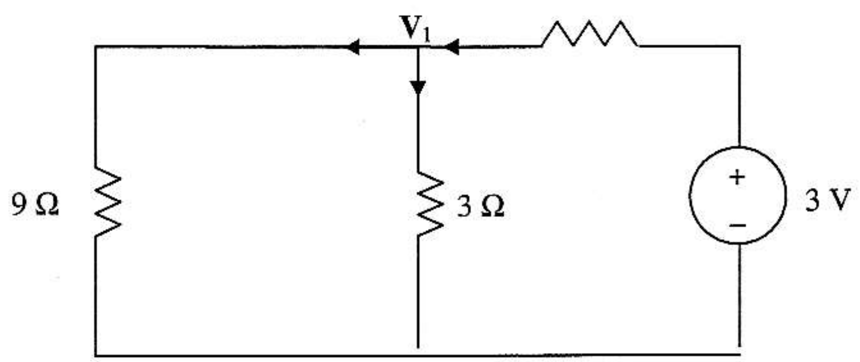
Chapter 4, Solution 8.

Let $V_o = V_1 + V_2$, where V_1 and V_2 are due to 9-V and 3-V sources respectively. To find V_1, consider the circuit below.



$$\frac{9-V_1}{3} = \frac{V_1}{9} + \frac{V_1}{1} \longrightarrow V_1 = 27/13 = 2.0769$$

To find V_2, consider the circuit below.



$$\frac{V_2}{9} + \frac{V_2}{3} = \frac{3-V_2}{1} \longrightarrow V_2 = 27/13 = 2.0769$$

$$V_o = V_1 + V_2 = \underline{\mathbf{4.1538\ V}}$$

Chapter 4, Problem 25.

Obtain v_o in the circuit of Fig. 4.93 using source transformation. Check your result using *PSpice.*

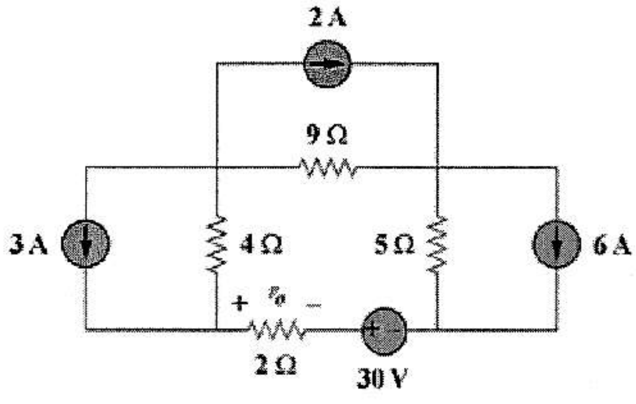
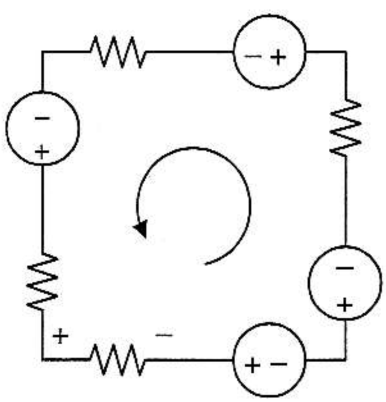


Figure 4.93

Chapter 4, Solution 25.

Transforming only the current source gives the circuit below.



Applying KVL to the loop gives,

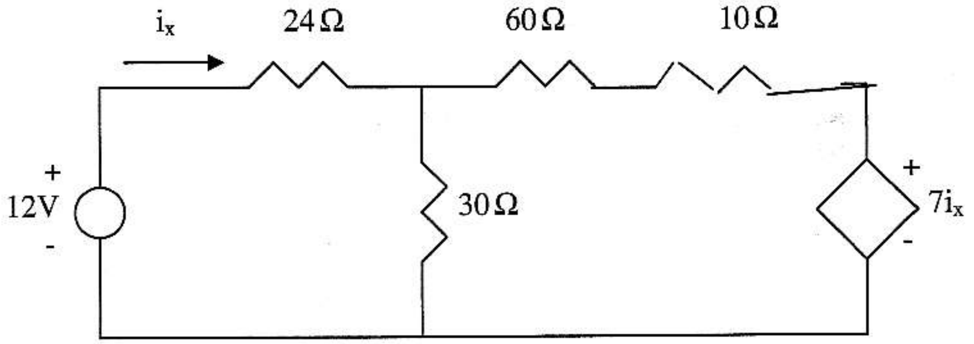
$$-(4 + 9 + 5 + 2)i + 12 - 18 - 30 - 30 = 0$$

$$20i = -66 \text{ which leads to } i = -3.3$$

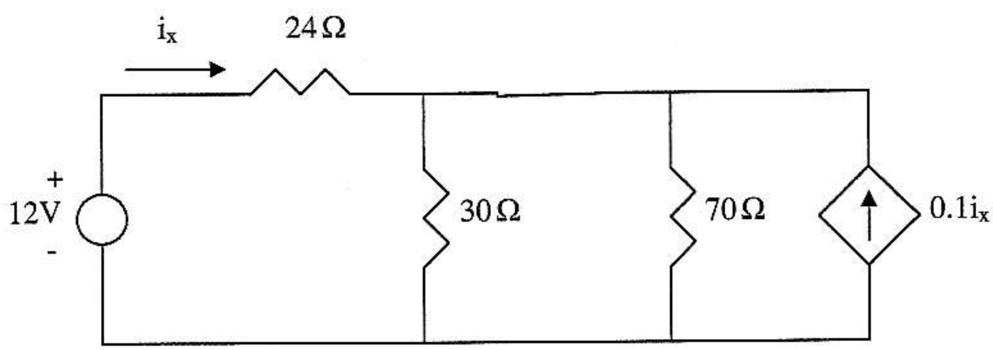
$v_o = 2i =$ **-6.6 V**

Chapter 4, Solution 30

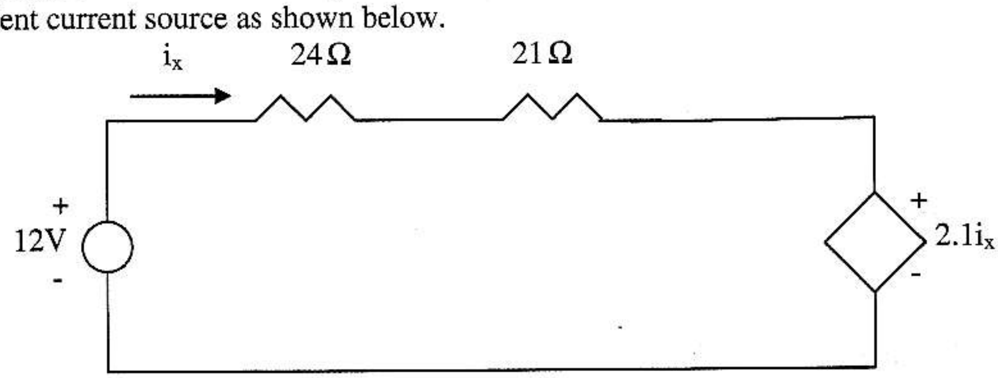
Transform the dependent current source as shown below.



Combine the 60-ohm with the 10-ohm and transform the dependent source as shown below.



Combining 30-ohm and 70-ohm gives 30//70 = 70x30/100 = 21-ohm. Transform the dependent current source as shown below.



Applying KVL to the loop gives

$$45i_x - 12 + 2.1i_x = 0 \longrightarrow i_x = \frac{12}{47.1} = \underline{254.8\text{ mA}}$$

Chapter 4, Problem 33.

Determine R_{Th} and V_{Th} at terminals 1-2 of each of the circuits of Fig. 4.101.

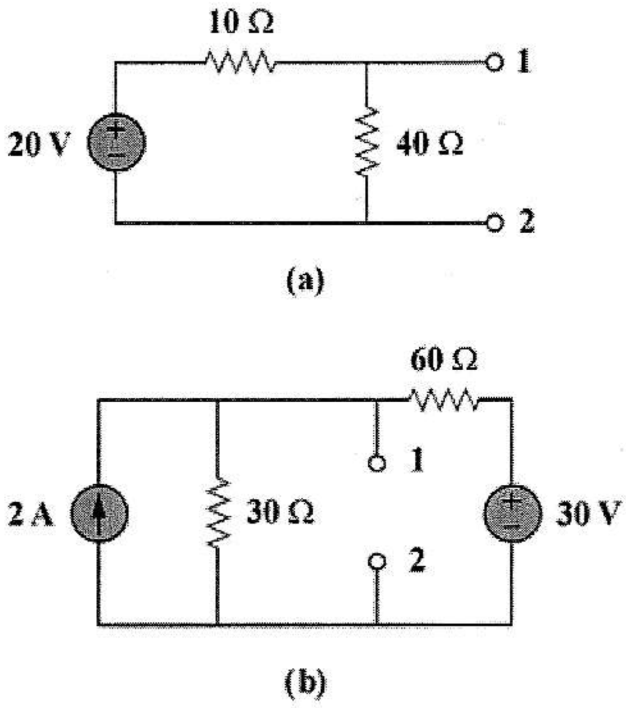


Figure 4.101

Chapter 4, Solution 33.

(a) $R_{Th} = 10 \| 40 = 400/50 = \underline{\textbf{8 ohms}}$

$$V_{Th} = (40/(40 + 10))20 = \underline{\textbf{16 V}}$$

(b) $R_{Th} = 30 \| 60 = 1800/90 = \underline{\textbf{20 ohms}}$

$$2 + (30 - v1)/60 = v_1/30, \text{ and } v_1 = V_{Th}$$

$$120 + 30 - v_1 = 2v_1, \text{ or } v_1 = 50 \text{ V}$$

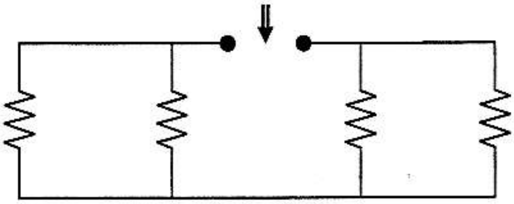
$$V_{Th} = \underline{\textbf{50 V}}$$

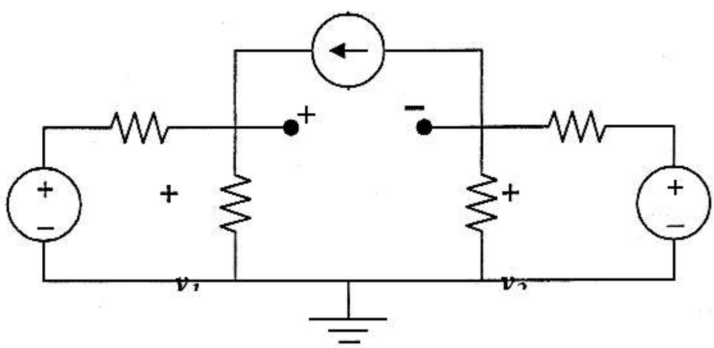
Chapter 4, Solution 35.

To find R_{Th}, consider the circuit in Fig. (a).

$$R_{Th} = R_{ab} = 6||3 + 12||4 = 2 + 3 = 5 \text{ ohms}$$

To find V_{Th}, consider the circuit shown in Fig. (b).

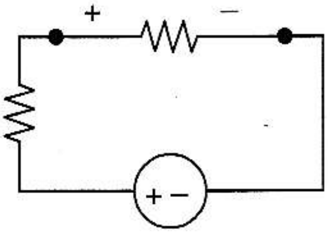




At node 1, $\quad 2 + (12 - v_1)/6 = v_1/3, \text{ or } v_1 = 8$

At node 2, $\quad (19 - v_2)/4 = 2 + v_2/12, \text{ or } v_2 = 33/4$

But, $\quad -v_1 + V_{Th} + v_2 = 0, \text{ or } V_{Th} = v_1 - v_2 = 8 - 33/4 = -0.25$



$$v_o = V_{Th}/2 = -0.25/2 = \underline{\mathbf{-125\ mV}}$$

Chapter 4, Problem 38.

Apply Thèvenin's theorem to find V_o in the circuit of Fig. 4.105.

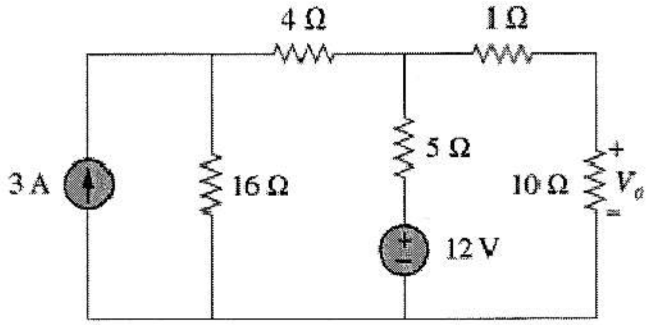
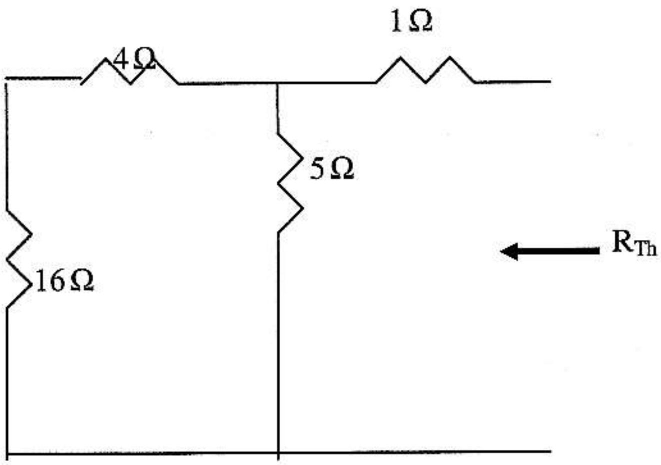


Figure 4.105

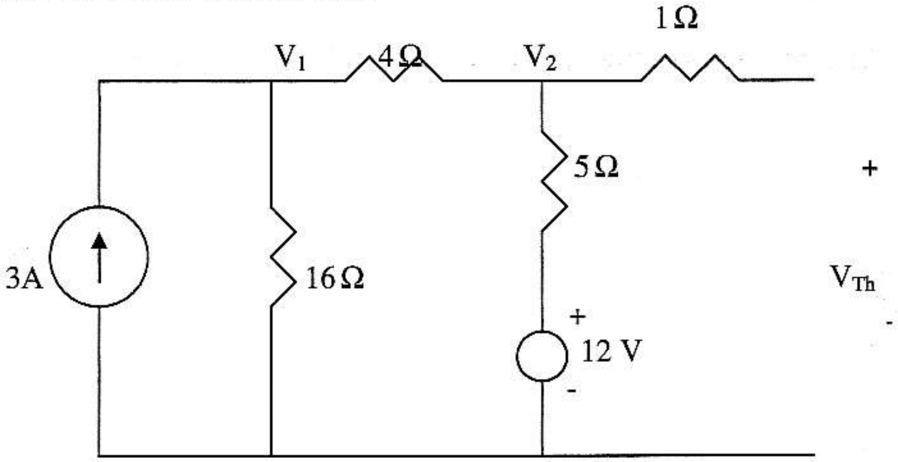
Chapter 4, Solution 38

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,

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

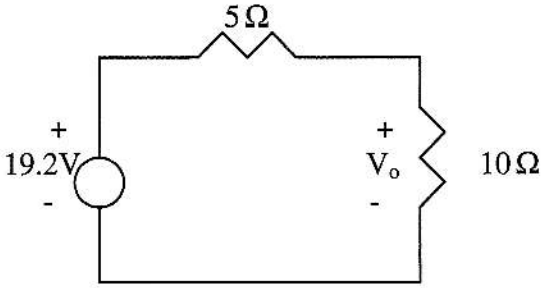
At node 2,

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

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,

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

Chapter 4, Problem 40.

Find the Thevenin equivalent at terminals a-b of the circuit in Fig. 4.107.

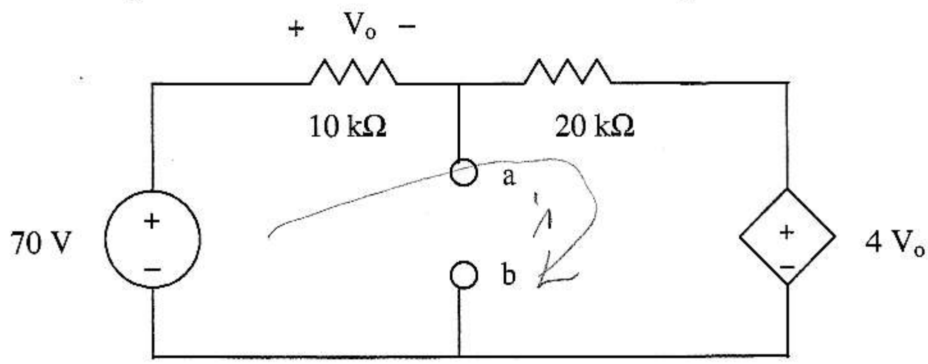


Figure 4.107 For Prob. 4.40.

Chapter 4, Solution 40.

To obtain V_{Th}, we apply KVL to the loop.

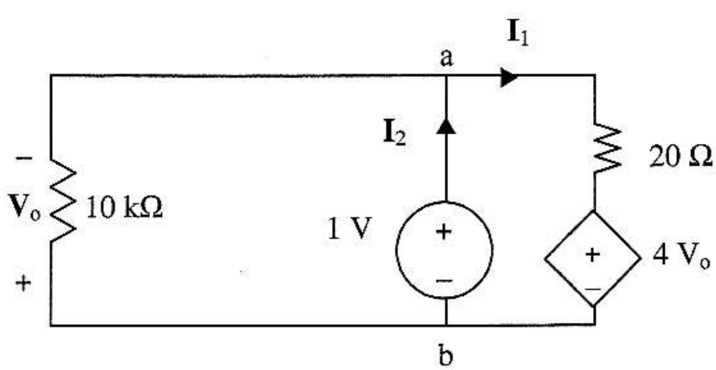
$$-70+(10+20)kI+4V_o=0$$

But $V_o=10kI$

$$70=70kI \longrightarrow I=1mA$$

$$-70+10kI+V_{Th}=0 \longrightarrow V_{Th}=\underline{60\text{ V}}$$

To find R_{Th}, we remove the 70-V source and apply a 1-V source at terminals a-b, as shown in the circuit below.



We notice that $V_o = -1$ V.

$$-1+20kI_1+4V_o=0 \longrightarrow I_1=0.25\text{ mA}$$

$$I_2=I_1+\frac{1V}{10k}=0.35\text{ mA}$$

$$R_{Th}=\frac{1V}{I_2}=\frac{1}{0.35}k\Omega=\underline{2.857\text{ k}\Omega}$$