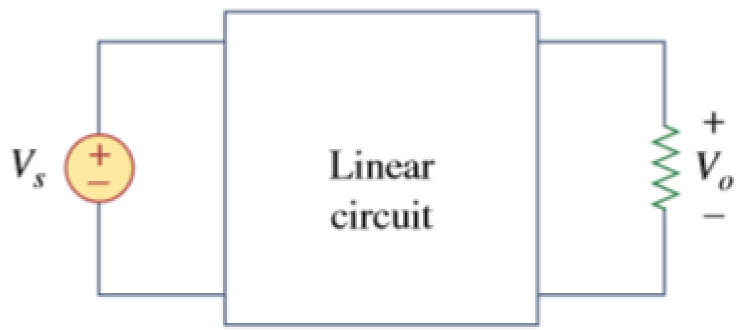
4.6 For the linear circuit shown in Fig. 4.74, use linearity to complete the following table.

Experiment	V_s	V_o
1	12 V	4 V
2		16 V
3	1 V	
4		−2 V

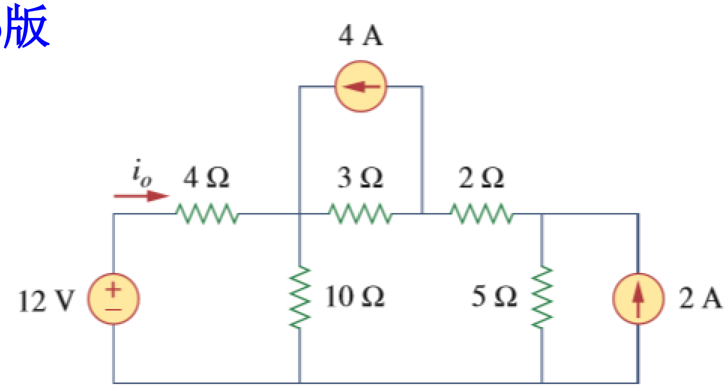


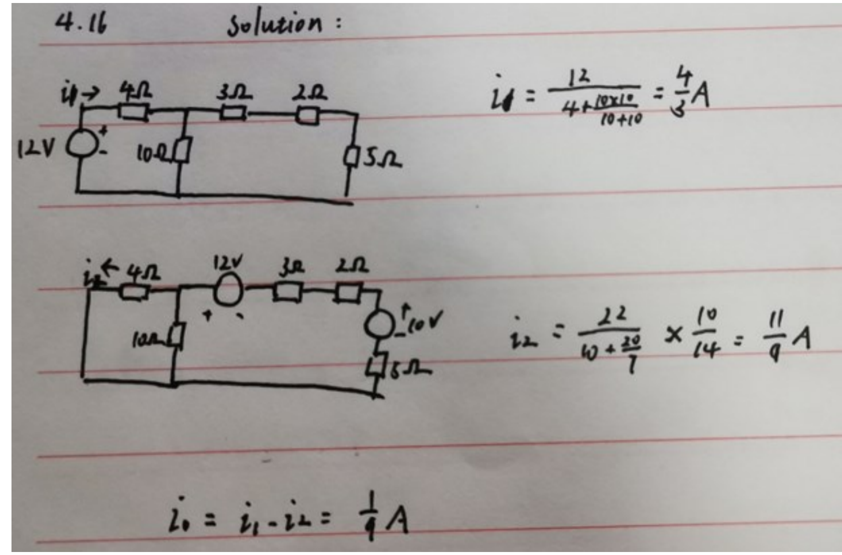
4.6

	V_s	V_o
1	$12V$	$4V$
2	$4 \times 12V = 48V$	$16V = 4 \times 4V$
3	$1V = \frac{1}{12} \times 12V$	$\frac{1}{12} \times 4V = \frac{1}{3}V$
4	$-\frac{1}{2} \times 12V = -6V$	$-2V = -\frac{1}{2} \times 4V$

4.16 Given the circuit in Fig. 4.84, use superposition to obtain i_o.

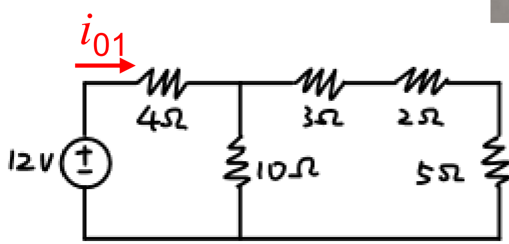
第5版





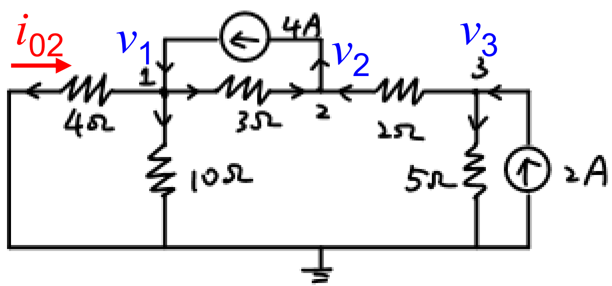
4.16

12-V source only:



$$i_{01} = \frac{12}{4+10||(3+2+5)} = \frac{4}{3}$$

current source only :



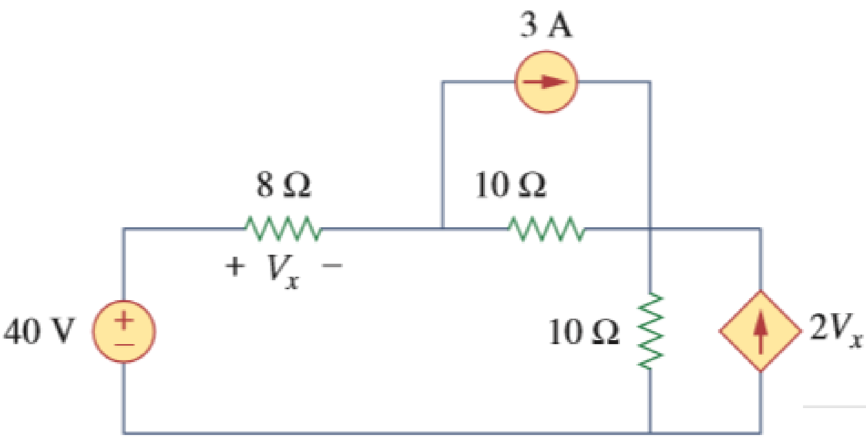
$$\begin{cases} \text{node 1: } \frac{V_1}{4} + \frac{V_1}{10} + \frac{V_1 - V_2}{3} = 4A \\ \text{node 2: } \frac{V_1 - V_2}{3} + \frac{V_3 - V_2}{2} = 4A \\ \text{node 3: } \frac{V_3 - V_2}{2} + \frac{V_3}{5} = 2A \end{cases} \Rightarrow v_1 = \frac{44}{9}$$

Then: $i_{02} = -\frac{44}{9*4} = -\frac{11}{9}$

So: $i_0 = i_{01} + i_{02} = \frac{1}{9}$

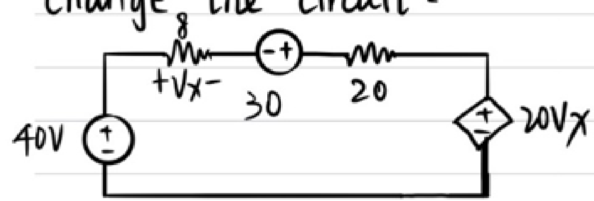
第6版 $i_0 = 12 - 11 = 1A$

4.24 Use source transformation to find the voltage V_x in the circuit of Fig. 4.92.



Solution:

Change the circuit:



Use KVL:

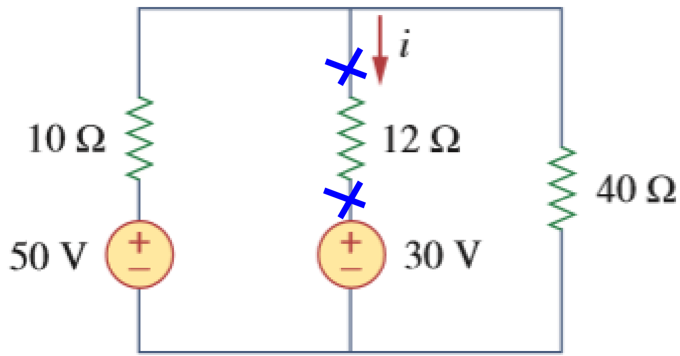
① $i = \frac{Vx}{8}$

② $-40 + Vx - 30 + 20 \times \frac{Vx}{8} + 20Vx = 0$

Result: $Vx = \frac{140}{47}$ V

4.36 Solve for the current i in the circuit of Fig. 4.103 using Thevenin's theorem. (*Hint:* Find the Thevenin equivalent seen by the 12-Ω resistor.)

第5版



$$v_{TH} = \frac{40}{10+40} \times 50 - 30 = 10\text{V}$$

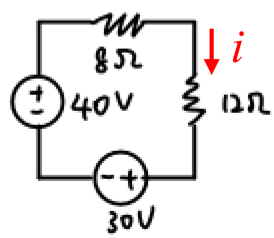
$$i = \frac{10}{8+12} = 0.5\text{A}$$

4.36

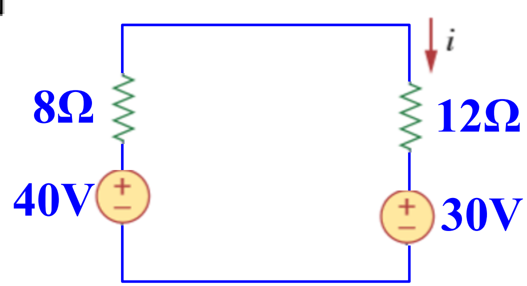
$$R_{Th} = \frac{1}{\frac{1}{10}+\frac{1}{40}} = 8\Omega$$

$$V_{Th} = \frac{40}{10+40} \times 50\text{V} = 40\text{V}$$

∴

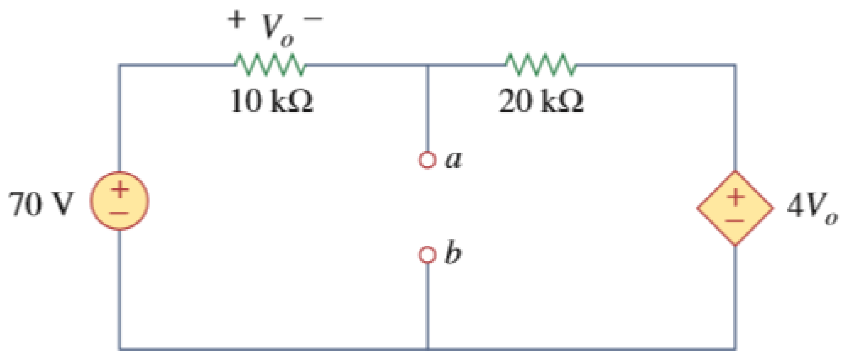


$$\therefore\ i = \frac{40-30}{8+12}\text{A} = 0.5\text{A}$$

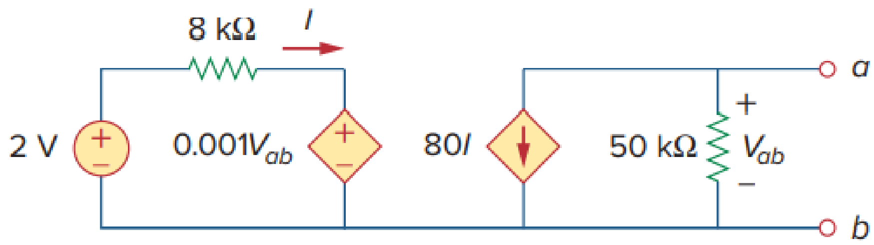


第6版 $i = 3$A

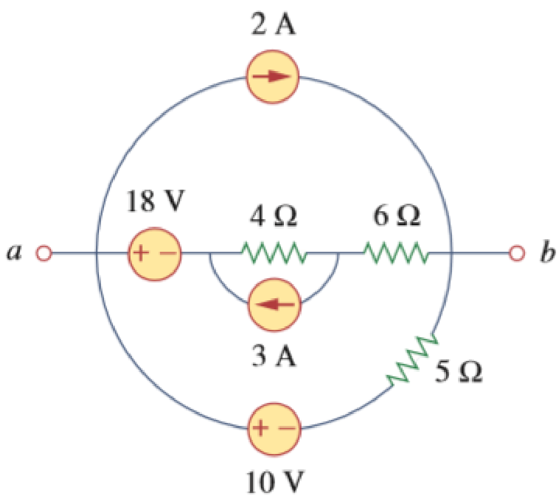
4.40 Find the Thevenin equivalent at terminals *a-b* of the circuit in Fig. 4.107.

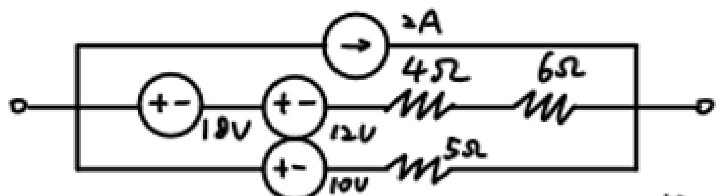


***4.55** Obtain the Norton equivalent at terminals *a*-*b* of the circuit in Fig. 4.121.

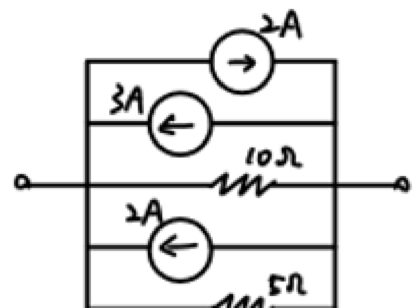


***4.60** For the circuit in Fig. 4.126, find the Thevenin and Norton equivalent circuits at terminals *a*-*b*.

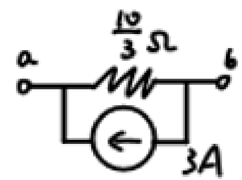




$\Rightarrow$



$\therefore I_N = 3 + 2 - 2 = 3A$



$$R_N = R_{Th} = 10||5 = \frac{10}{3}$$

$\therefore V_{Th} = 3 \times \frac{10}{3} = 10V$

***4.62** Find the Thevenin equivalent of the circuit in Fig. 4.128.

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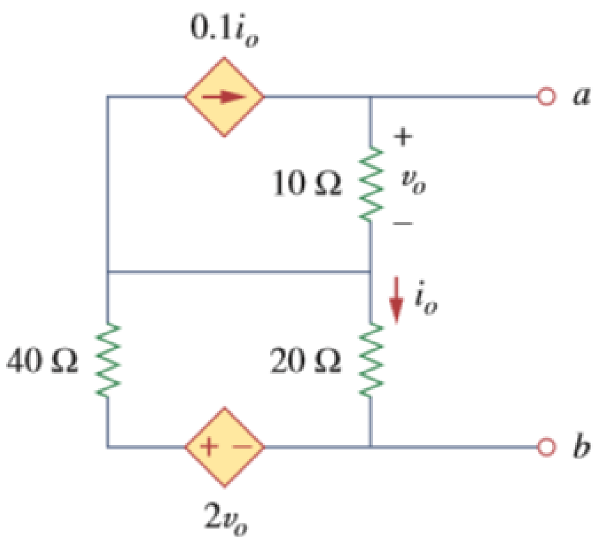
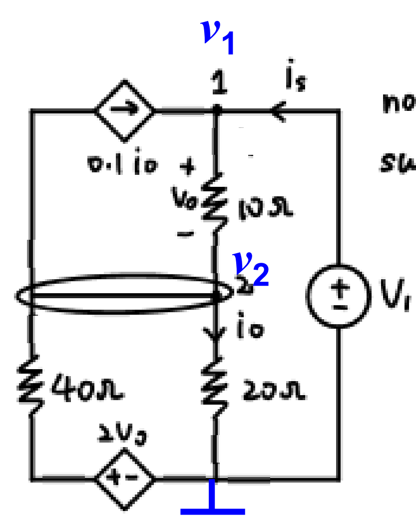


4.62

R_{Th}:



node 1: $i_s + 0.1\, i_o = \frac{V_1 - V_2}{10}$

supernode 2: $\frac{V_1 - V_2}{10} + \frac{2V_o - V_2}{40} = 0.1\, i_o + \frac{V_2}{20}$

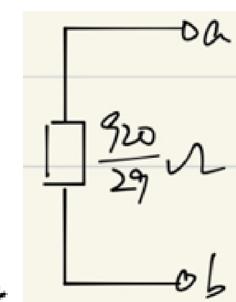
$i_o = \frac{V_2}{20}$

$V_o = V_1 - V_2$

∴ $V_2 = \frac{15}{23} V_1$ $\quad i_o = \frac{3}{92} V_1$

∴ $i_s = \frac{29}{920} V_1$

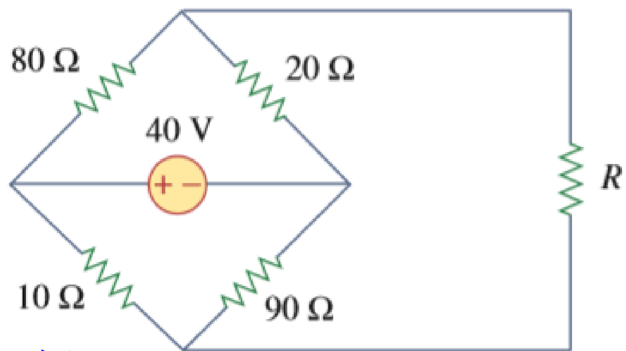
$R_{Th} = \frac{V_1}{i_s} = \frac{920}{29}\,\Omega \approx 31.72\,\Omega$



$V_{Th} = 0V$

4.67 The variable resistor R in Fig. 4.133 is adjusted until it absorbs the maximum power from the circuit.
(a) Calculate the value of R for maximum power.
(b) Determine the maximum power absorbed by R.

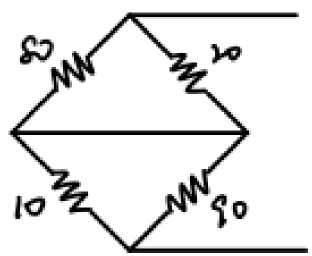
第6版 $R = 25\text{k}\Omega$
$p_{max} = 49\text{mW}$



第5版

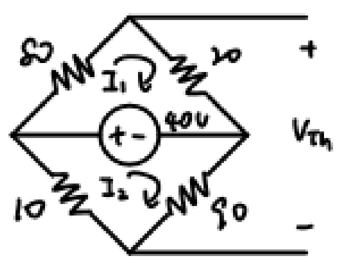
4.67

(a.) :



$R_{Th} = (80 /\!/ 20) + (10 /\!/ 90) = 25\,\Omega = R$

(b.) :



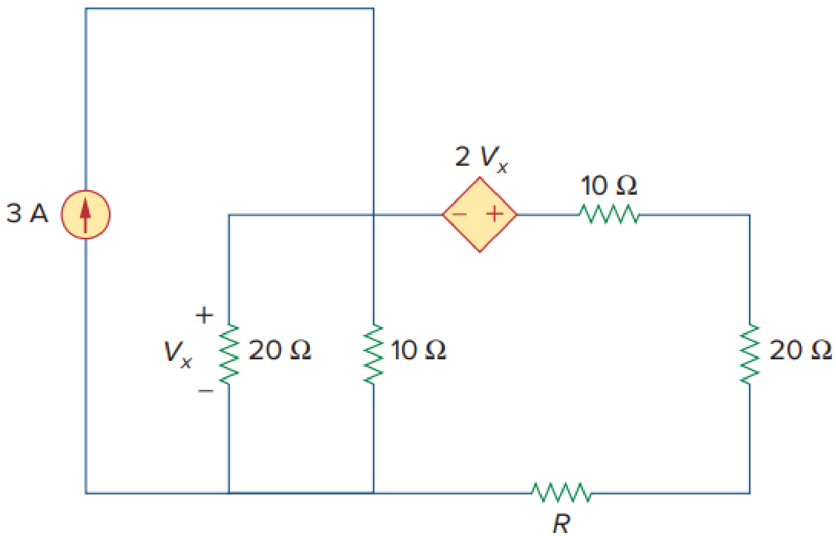
$(80+20) I_1 = 40$ $\therefore I_1 = 0.4\text{A}$

$(10+90) I_2 = -40$ $\therefore I_2 = -0.4\text{A}$

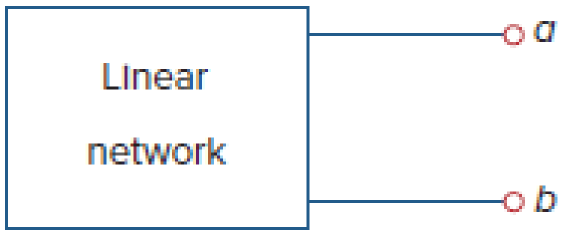
$\therefore V_{Th} = 20 I_1 + 90 I_2 = 8 - 36 = -28\text{V}$

$$P = \frac{V_{Th}^2}{4R_{Th}} = \frac{(-28)^2}{4 \times 25} = 7.84\text{W}$$

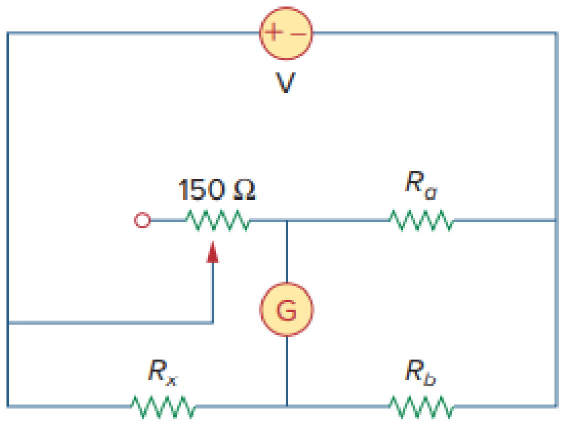
4.70 Determine the maximum power delivered to the variable resistor R shown in the circuit of Fig. 4.136.



4.85 The Thevenin equivalent at terminals *a*-*b* of the linear network shown in Fig. 4.142 is to be determined by measurement. When a 10-kΩ resistor is connected to terminals *a*-*b*, the voltage V_{ab} is measured as 20 V. When a 30-kΩ resistor is connected to the terminals, V_{ab} is measured as 40 V. Determine: (a) the Thevenin equivalent at terminals *a*-*b*, (b) V_{ab} when a 20-kΩ resistor is connected to terminals *a*-*b*.



4.91 (a) In the Wheatstone bridge circuit of Fig. 4.147 select the values of R_a and R_b such that the bridge can measure R_x in the range of 0–25 Ω.
(b) Repeat for the range of 0–250 Ω.



Solution:

The condition of The bridge is balanced is :

$$R_a R_x = R_b R_{0-150}$$

(a) When $R_{0\text{-}150} = 150\Omega$

$R_x = 25\Omega$

We get: $R_a = 6\,R_b$

Such,we select : $R_b = 10\Omega$, $R_a = 60\Omega$

(b) When $R_{0\text{-}150} = 150\Omega$

$R_x = 250\Omega$

We get: $R_a = 3/5\,R_b$

Such,we select : $R_b = 10\Omega$, $R_a = 6\Omega$