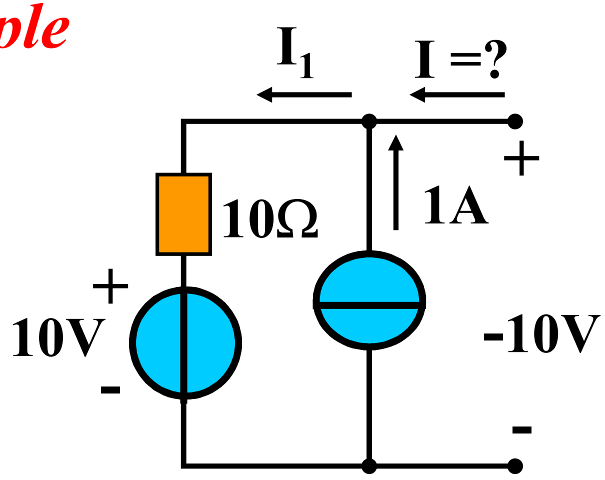
Example



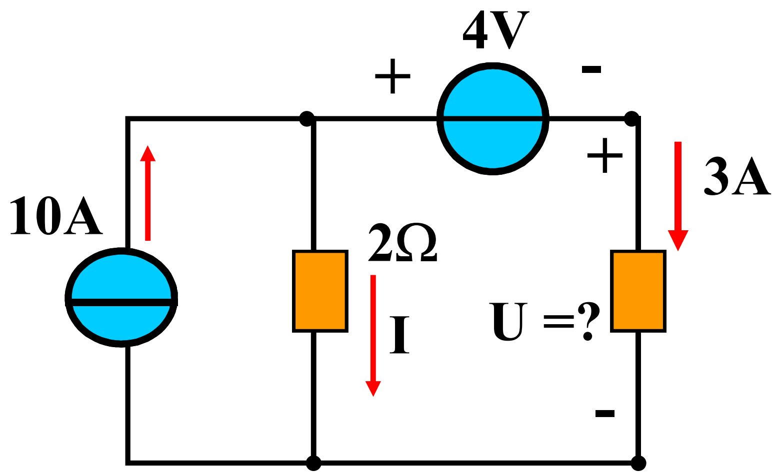
Solution

$$10I_1 + 10 - (-10) = 0$$

$$I_1 = -2A$$

$$I = I_1 - 1 = -2 - 1 = -3A$$

Example



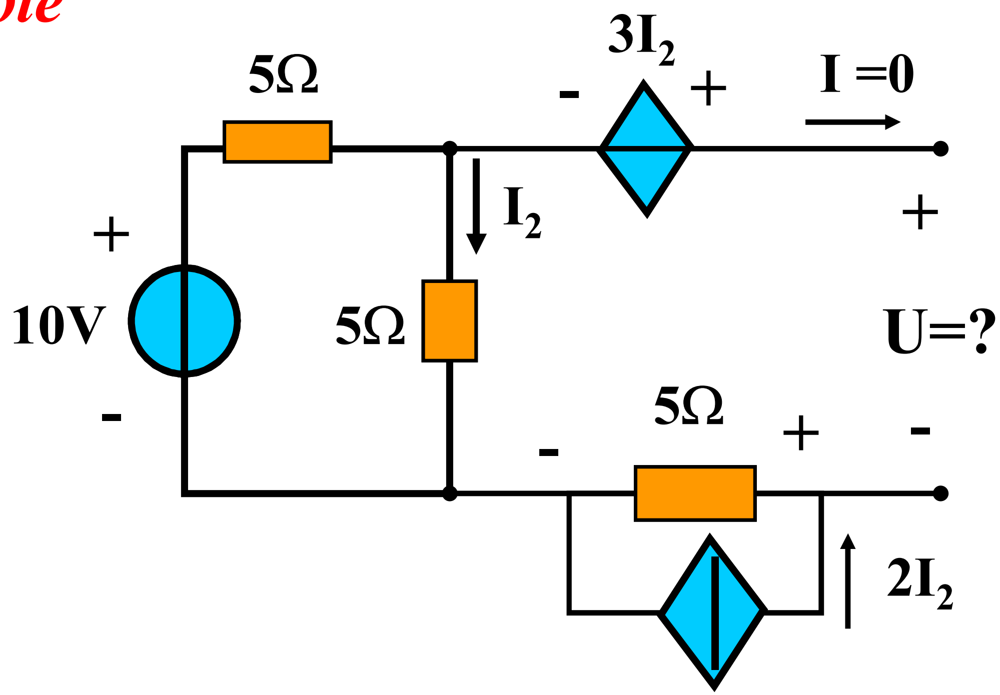
Solution

$$I = 10 - 3 = 7A$$

$$4 + U - 2I = 0$$

$$U = 2I - 4 = 14 - 4 = 10V$$

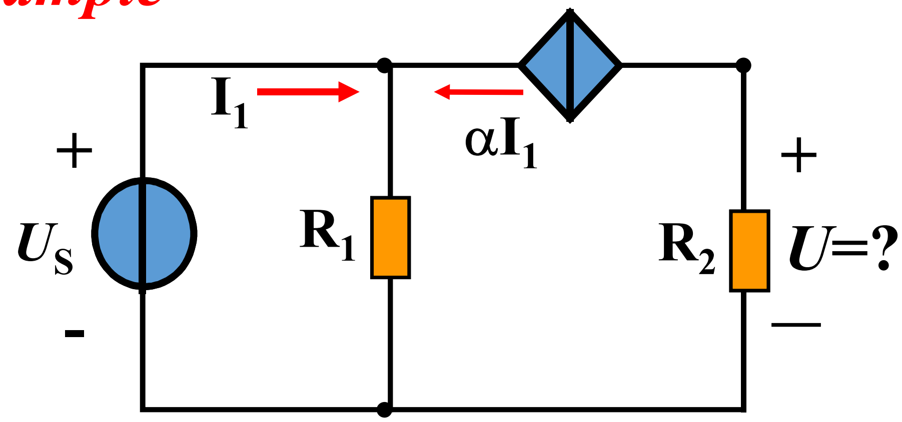
Example



Solution

$$I_2 = \frac{10}{5+5} = 1A$$

Example



Solution

$$U = -R_2\alpha I_1$$

$$I_1 + \alpha I_1 = U_S / R_1$$

$$\Rightarrow I_1 = \frac{U_S}{R_1(1+\alpha)}$$

$$\Rightarrow U = -\frac{\alpha R_2 U_S}{R_1(1+\alpha)}$$

$$\left|\frac{U}{U_S}\right| = \frac{R_2}{R_1}\frac{\alpha}{(1+\alpha)}$$

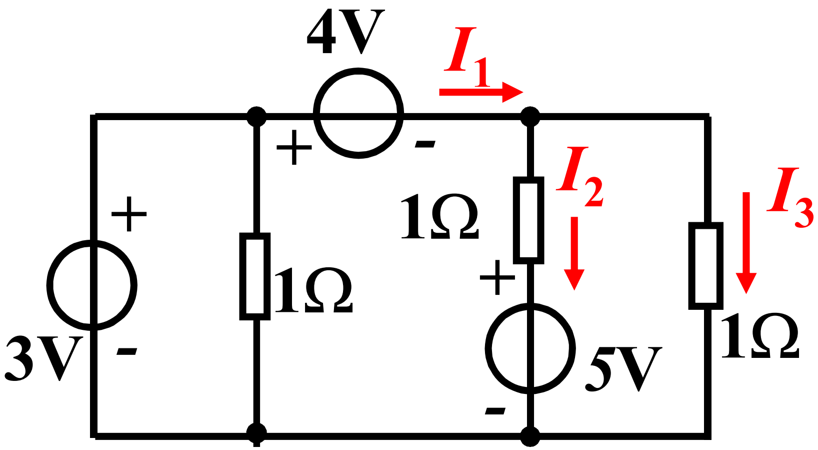
$$P_S = U_S I_1 = \frac{U_S^2}{R_1(1+\alpha)}$$

$$P_o = R_2\alpha^2 \frac{U_S^2}{R_1^2(1+\alpha)^2}$$

$$\left|\frac{P_0}{P_S}\right| = \frac{R_2}{R_1}\frac{\alpha^2}{(1+\alpha)}$$

选择参数可以得到电压和功率放大

Quiz



Find: I_1、I_2 、I_3

?

$$I_3 = \frac{3-4}{1} = -1\ \text{A}$$

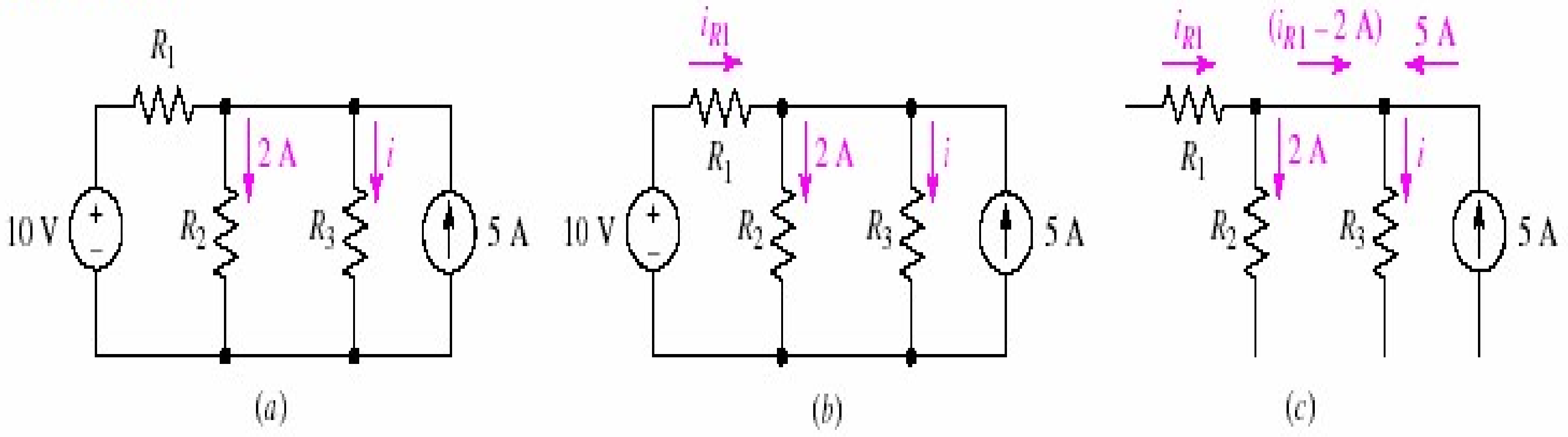
$$I_2 = \frac{3-4-5}{1} = -6\ \text{A}$$

$$I_1 = I_2 + I_3 = -7\ \text{A}$$

Example 4

For the circuit in Fig. 2.5*a*, compute the current through resistor R_3 if is known that the voltage source supplies a current of 3 A.

Fig. 2.5



(*a*) Simple circuit for which the current through resistor R_3 is desired. (*b*) The current through resistor R_1 is labeled so that a KCL equation can be written. (*c*) The currents into the top node of R_3 are redrawn for clarity.

Example 6

Find the current I_T in Fig. 2.7(a)

Solution

Applying KCL to node *a* yields

$I_T + I_2 = I_1 + I_3$

or

$I_T = I_1 - I_2 + I_3$

Note: a circuit cannot contain two different currents, I_1 and I_2, in series , unless $I_1 = I_2$; otherwise KCL will be violated

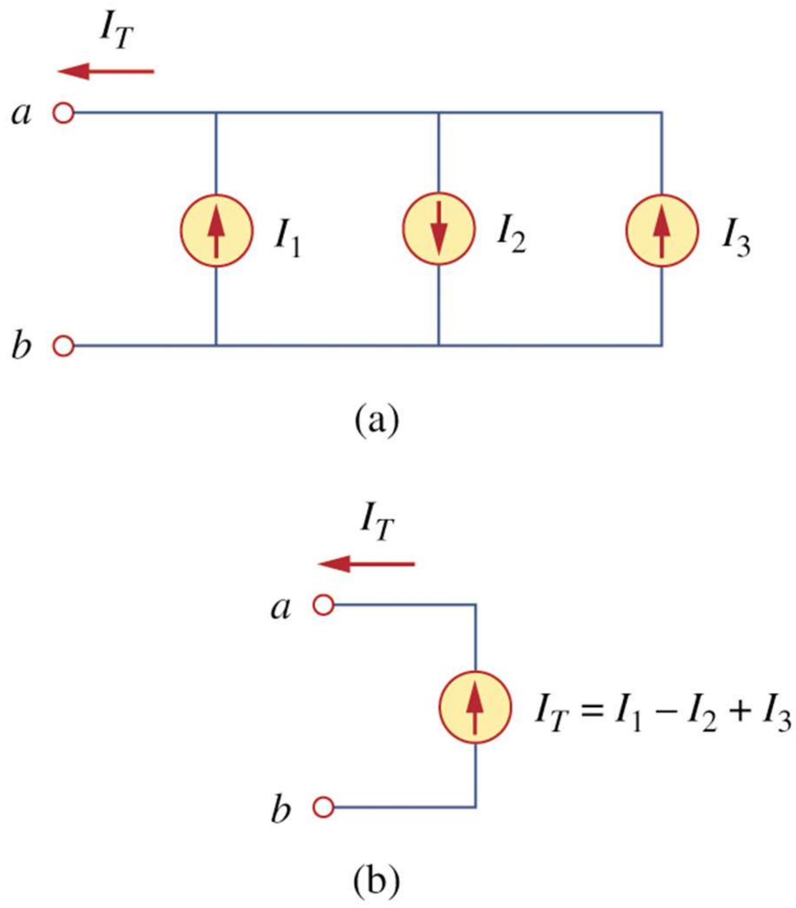


Fig. 2.7

Example 7

Determine the voltage v_{ab} in Fig. 2.8(a)

Solution

By applying KVL , we obtain

$$-V_{ab} + V_1 + V_2 - V_3 = 0$$

or

$$V_{ab} = V_1 + V_2 - V_3$$

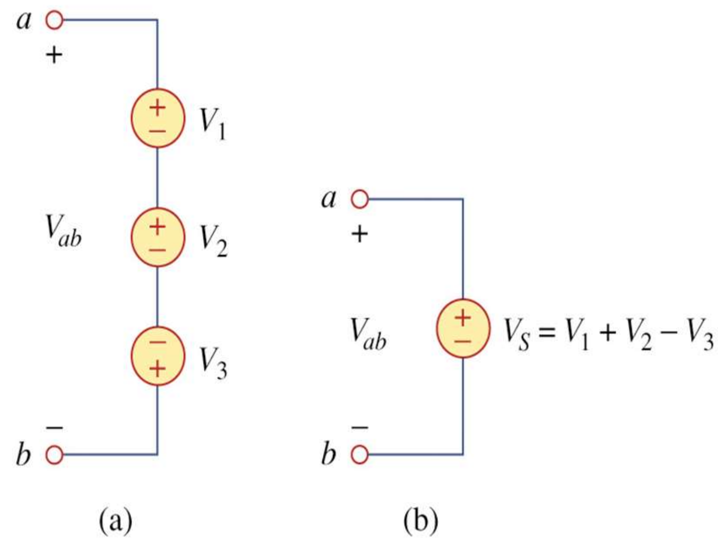


Fig. 2.8

To avoid violating KVL, a circuit cannot contain two different voltages V_1 and V_2 in parallel unless V_1=V_2.

Example 8

For the circuit in Fig. 2.9(a), find voltages v_1 and v_2.

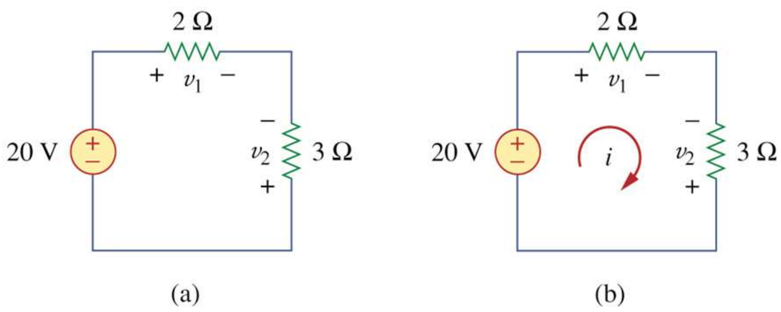


Fig. 2.9

Solution:

To find $v1$ and $v2$, we apply Ohm' law and Kirchhoff,s voltage law. Assume that current i flows through the loop as shown in Fig.2.9(b).

From Ohm's law,

$$v_1=2i, \qquad v_2=-3i$$

Applying KVL around the loop gives

$$-20+v_1-v_2=0$$

Substituting v_1 and v_2 into above equation, we obtain

$$-20 + 2i + 3i = 0 \quad \text{or} \quad 5i = 20 \quad \Rightarrow \quad i = 4\text{A}$$

Substituting i into the equations of the v_1 and v_2 finally gives

$$v_1 = 8\text{V}, \ \ v_2 = -12\text{V}$$

Example 9

Determine v_0 and i

In the circuit shown in Fig.2.10

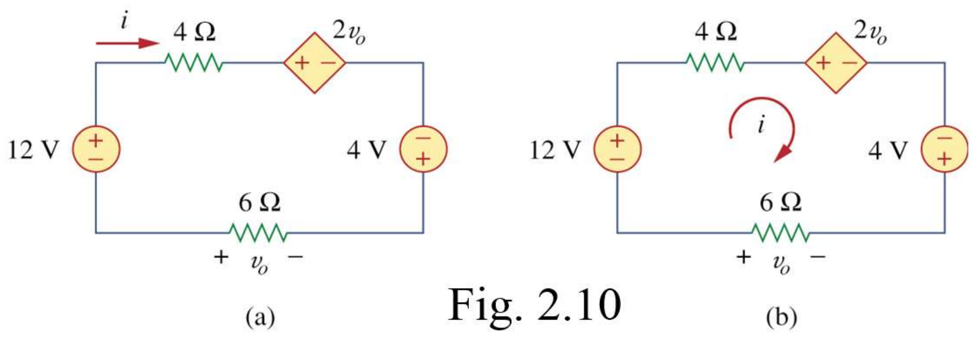


Fig. 2.10

Solution:

We apply KVL around the loop as shown in Fig. 2.10(b). The results is

$$-12 + 4i + 2v_0 - 4 + 6i = 0 \qquad (*)$$

Applying Ohm's law to the 6-Ω resistor gives

$$v_0 = -6i$$

Substituting v_0 into Eq.(*) yields

$$- 16 + 10i - 12i = 0 \quad \Rightarrow \quad i = - 8 \text{ A}$$

Example 10

Determine current i_0 and voltage v_0 and In the circuit shown in Fig.2.11

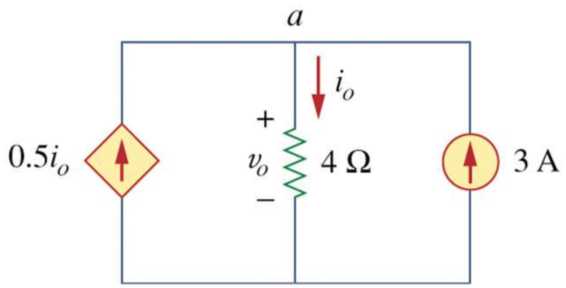


Fig. 2.11

Solution:

Applying KCL to node a, we obtain

$$3 + 0.5i_0 - i_0 = 0 \quad \Rightarrow \quad i_0 = 6 \text{ A} \quad v_0 = 24\text{V}$$

Example 11

Find the currents and voltages in the circuit shown in Fig. 2.12(a).

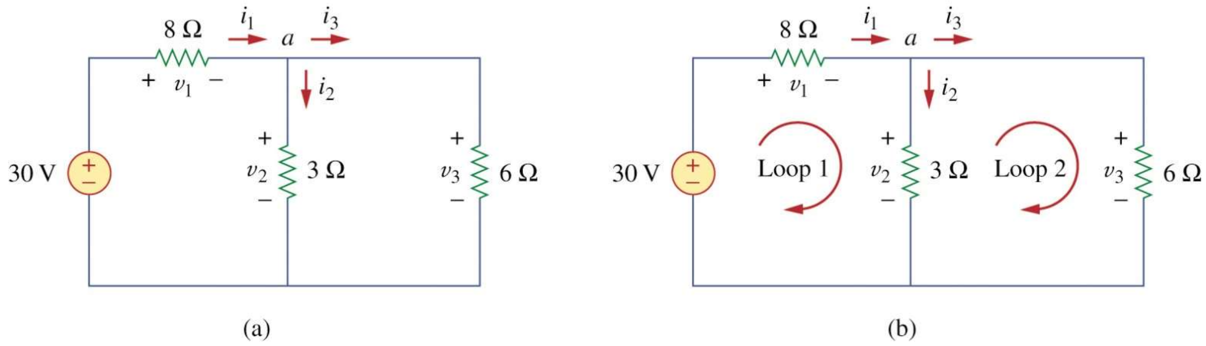


Fig. 2.12

Solution

We apply Ohm's law and Kirchhoff's laws. By Ohm's law,

$$v_1 = 8i_1, \qquad v_2 = 3i_2, \qquad v_3 = 6i_3 \qquad (2\text{-}1)$$

Since the voltage and current of each resistor are related by Ohm's law as shown, we are really looking for three things:(v_1, v_2, v_3) or (i_1, i_2, i_3). At node a, KCL gives

$$i_1 - i_2 - i_3 = 0 \qquad (2\text{-}2)$$

Applying KVL to loop 1 as in Fig. 2.12(b),

$$-30 + v_1 + v_2 = 0 \qquad (2\text{-}3)$$

We express this in terms of i_1 and i_2 as in Eq.(2-1) to obtain

$$-30 + 8i_1 + 3i_2 = 0 \qquad (2\text{-}4)$$

or

$$i_1 = \frac{(30 - 3i_2)}{8}$$

Applying KVL to loop 2,

$$-v_2 + v_3 = 0 \quad \Rightarrow \quad v_3 = v_2$$

as expected since the two resistors are in parallel. We express v1 and v2 in terms of i1 and i2 as in Eq.(2-1).Euation (2-4) becomes

$$6i_3 = 3i_2 \quad \Rightarrow \quad i_3 = \frac{i_2}{2} \qquad (2\text{-}5)$$

Substituting Eqs.(2-3) and (2-3) into (2-2) gives

$$\frac{30-3i_2}{8}-i_2-\frac{i_2}{2}=0$$

or i_2=2A. From the value of $i_{2,}$ we now use Eqs. .(2-1) and (2-5) to obtain

i_1 =3A , i_3 = 1A, v_1 = 24V, v_2 = 6V, v_3 =6V