Electrical Circuits for Engineers (EC1000)

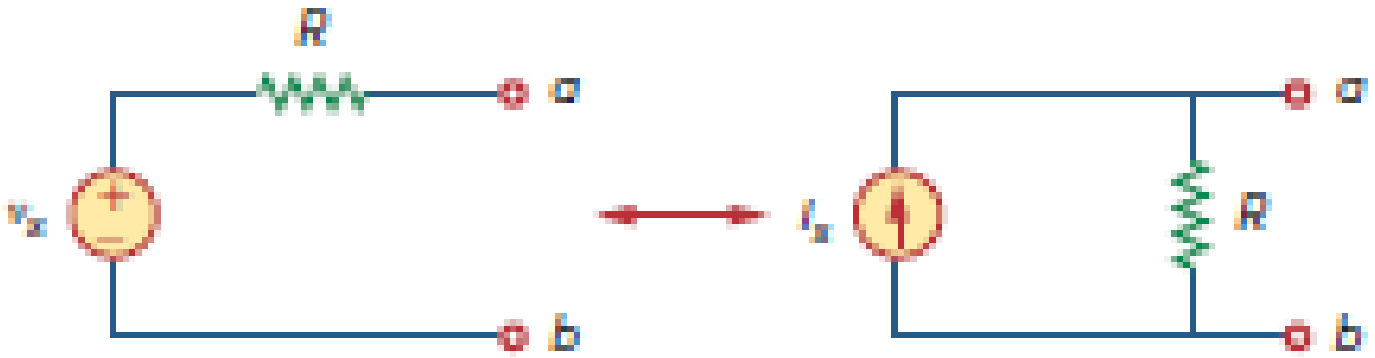
Lecture - 4(a)
Source Transformation
(Chapter 4)

Overview

- Source Transformation
- Thevenin's Theorem
- Norton's Theorem
- Maximum Power Transfer Theorem
- Superposition Theorem

1. Source Transformation (Chapter-4.4)

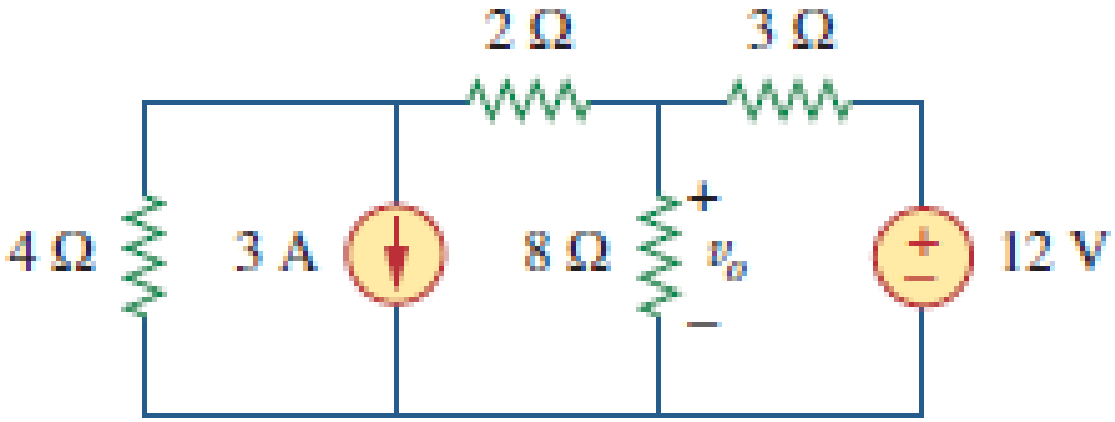
Source Transformation

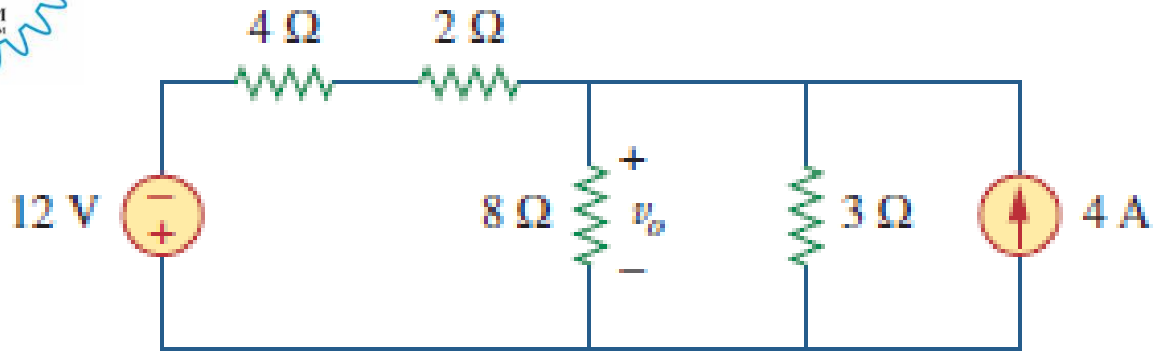


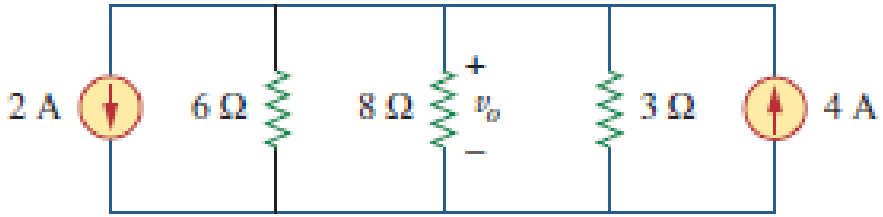
A **source transformation** is the process of replacing a voltage source V_s in series with a resistor R by a current source i_s in parallel with a resistor R, or vice versa.

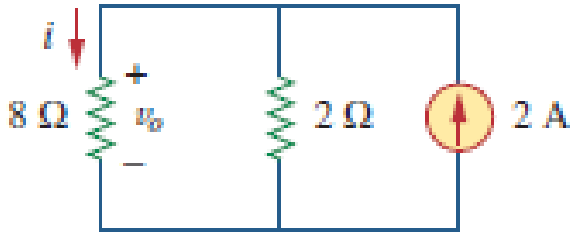
Source Transformation

1. Use source transformation to find V_o







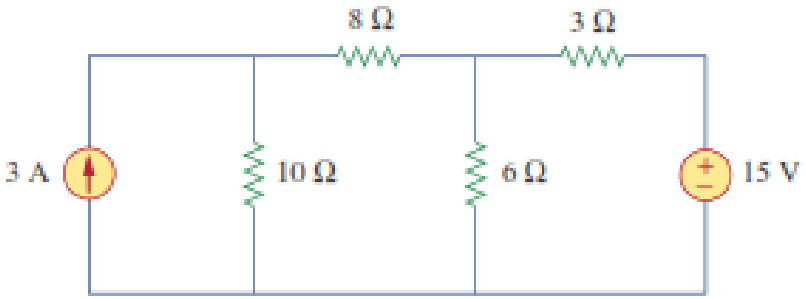


$$i = \frac{2}{2+8}(2) = 0.4 \text{ A}$$

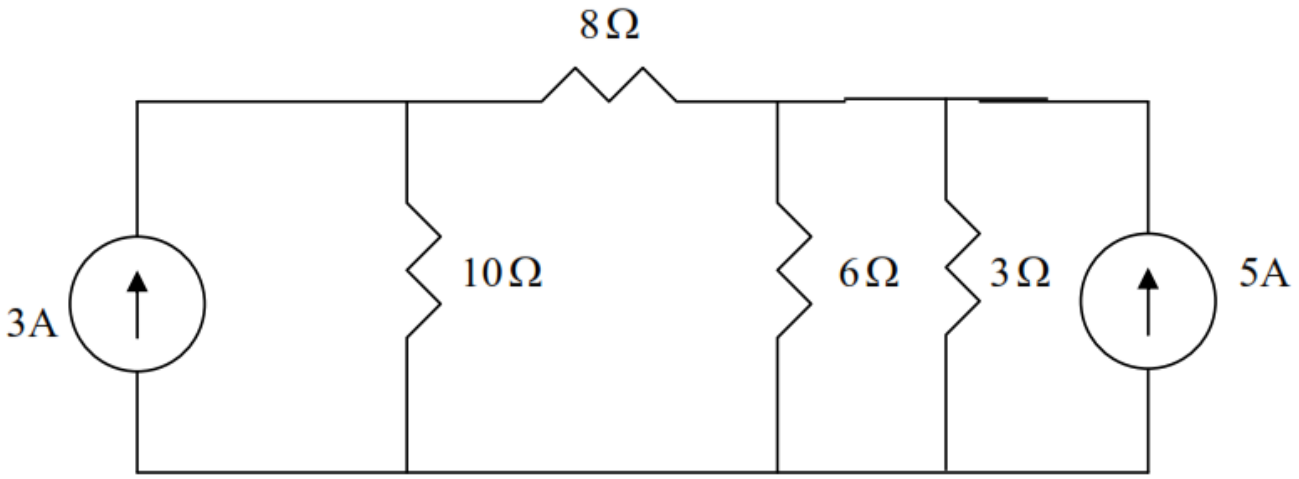
$$v_o = 8i = 8(0.4) = 3.2 \text{ V}$$

Source Transformation

2. Referring to below figure, use source transformation to determine the current and power absorbed by the 8 Ohm resistor.



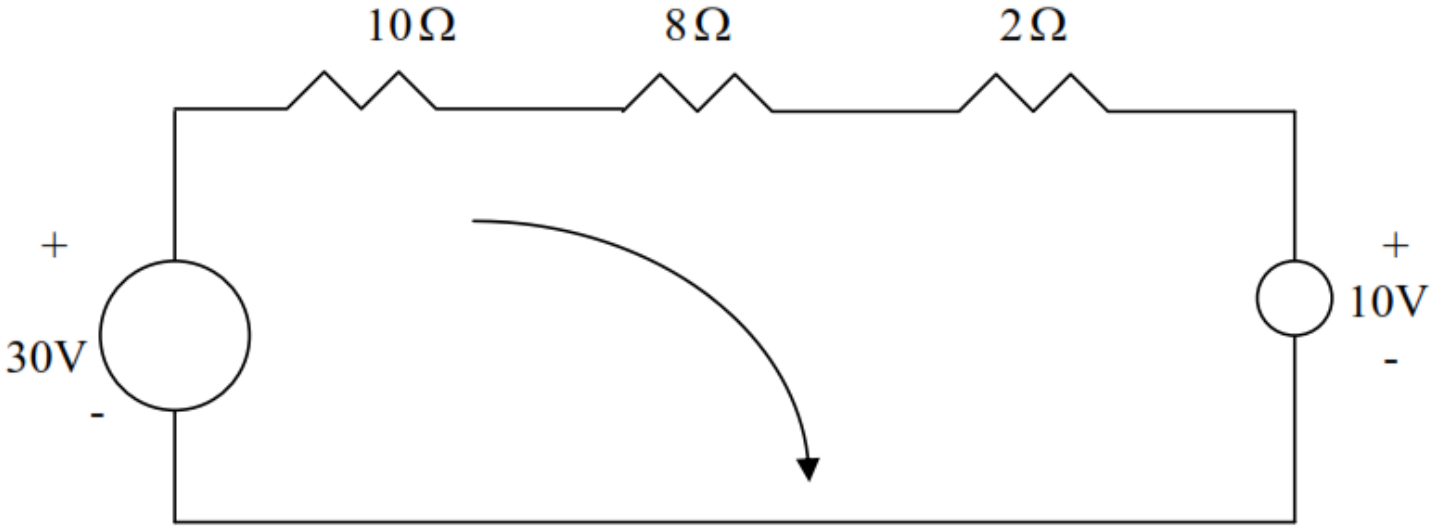
Solution



Source Transformation

Contd.,

3//6 = 2-ohm. Convert the current sources to voltages sources as shown below.



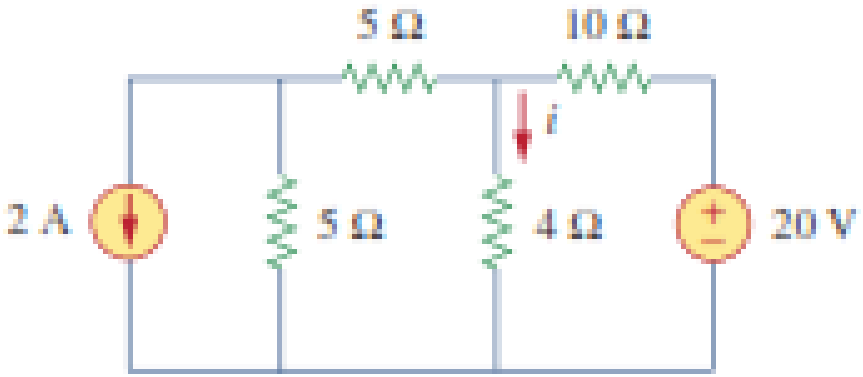
Applying KVL to the loop gives

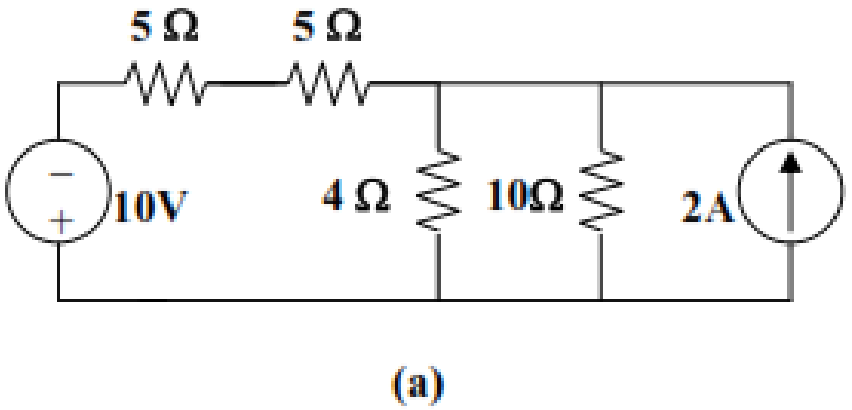
$$-30+10+I(10+8+2)=0 \longrightarrow \mathrm{I}=\mathbf{1\ A}$$

$$p=VI=I^2R=\ \mathbf{8\ W}$$

Source Transformation

3. For the circuit in shown below, use source transformation to find *i.*

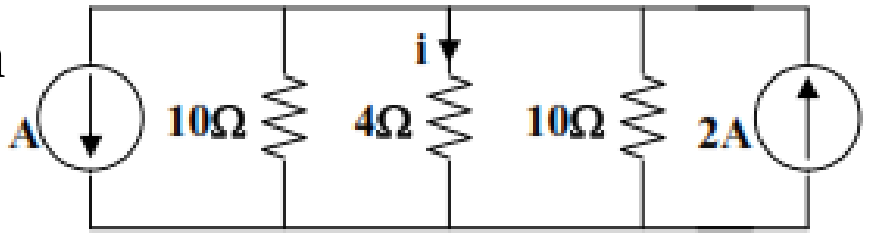




(a)

Solution

We now transform only the voltage source to obtain the circuit in Fig. (b).

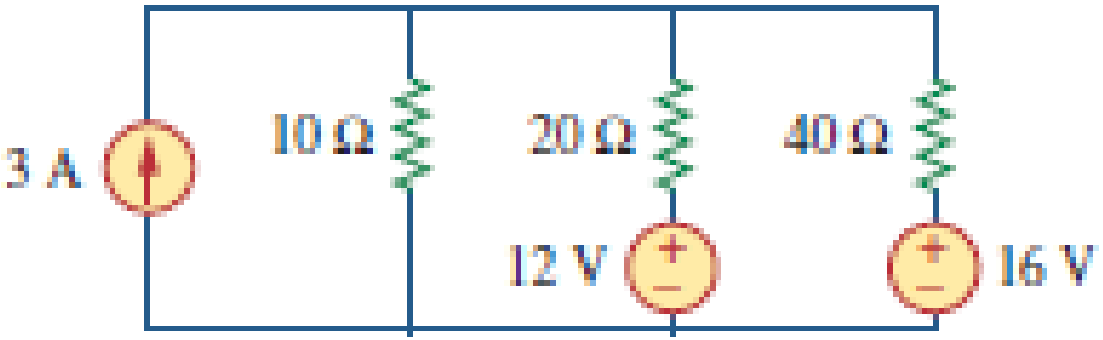


(b)

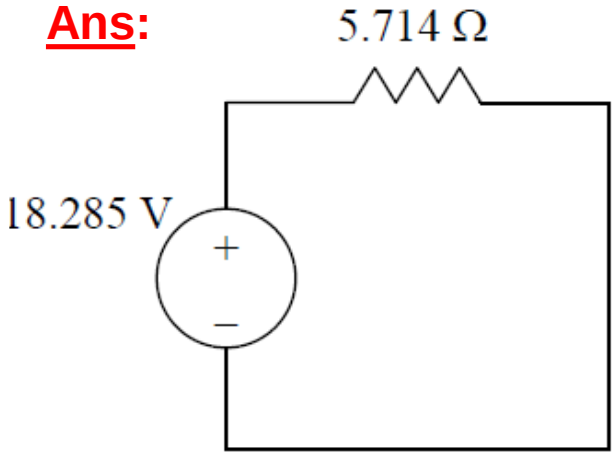
10||10 = 5 Ω, i=[5/(5 + 4)](2 – 1)=5/9= **555.5 mA**

Problems

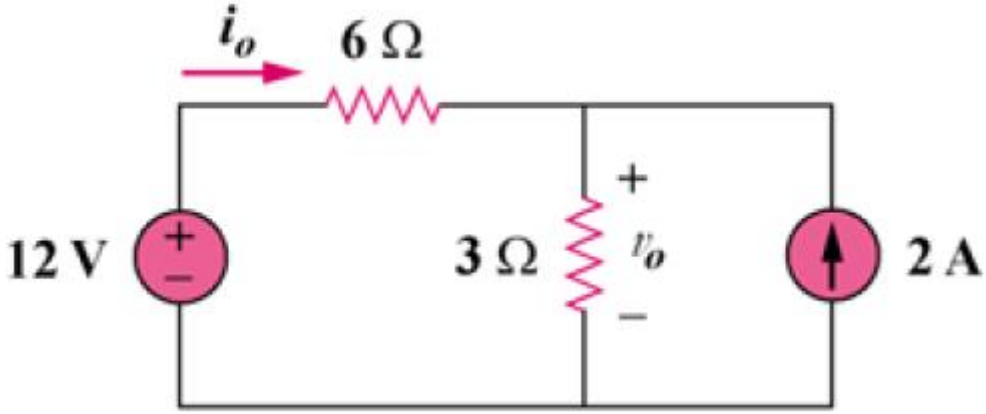
1. Use source transformation to reduce the circuit in Figure to a single voltage source in series with a single resistor.



Ans:



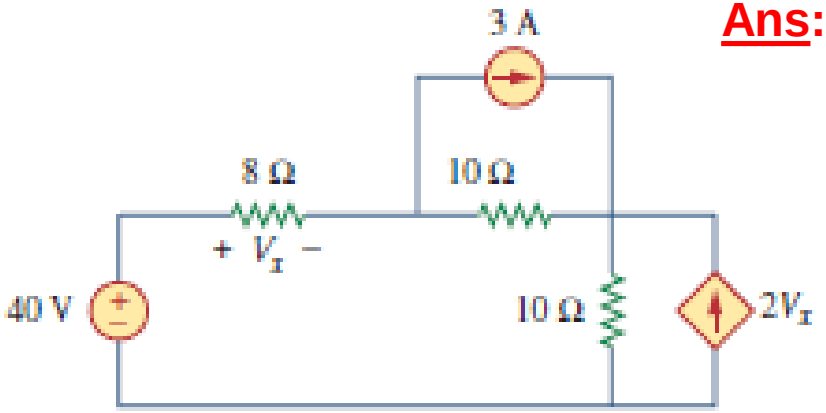
2. Apply source transformation to find V_0 and i_0 in the circuit of below Figure.



Ans: 666.7 mA, 8 V

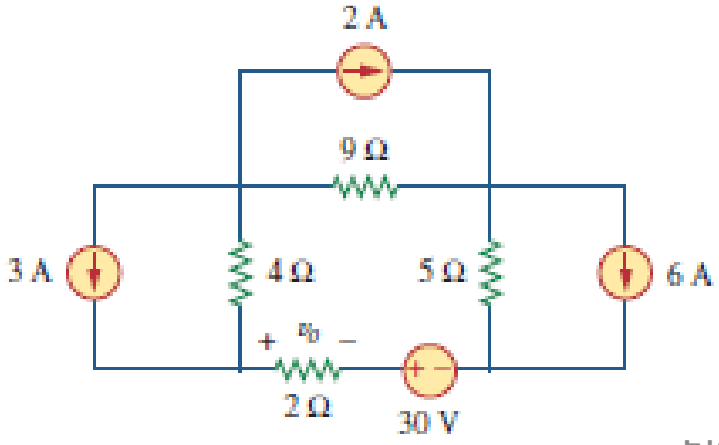
Problems

3. Use source transformation to find v_x the voltage in the circuit of Figure.



Ans: 2.978 V

4. Use source transformation to find v_0 in the circuit of Figure.



Ans: -6.6 V