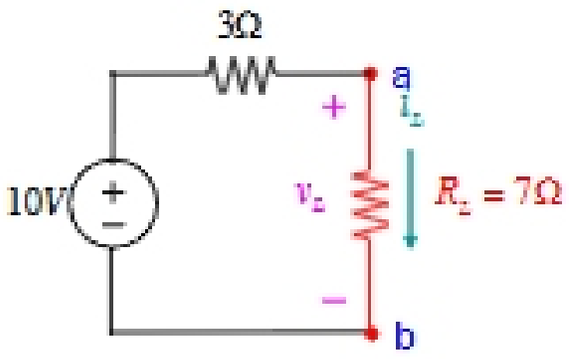
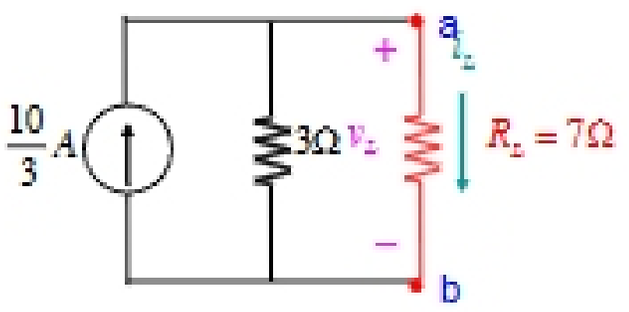
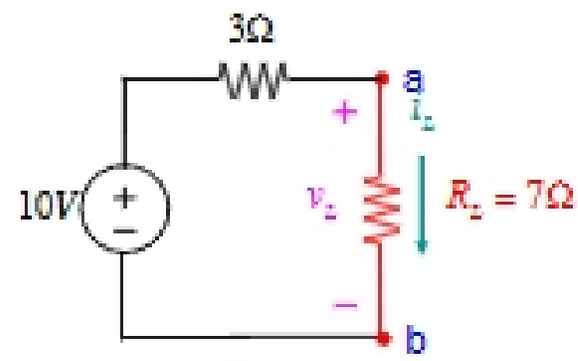
Exercise :

Connect a resistive load between (a) and (b) in the two circuits

For: $R_L = 7\Omega$ Find : $V_L = ?$ $i_L = ?$





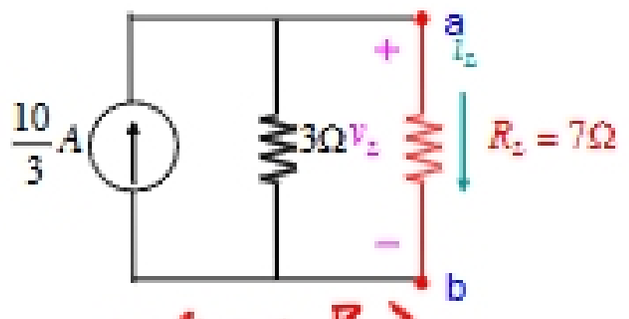


$(V_s)(\frac{R_L}{R_{Tot}})$

$V_L = (10)\frac{7}{3+7}$ $V_L = 7V$

$i_L = \frac{10}{3+7}$ $i_L = 1A$

$i = \frac{V}{R}$



$i = (i_s)(\frac{R}{R_{Tot}})$

$i_L = \left(\frac{10}{3}\right)\frac{3}{3+7}$ $i_L = 1A$

$V_L = (i_L)7$ $V_L = 7V$

$V = iR$

Conclusion:

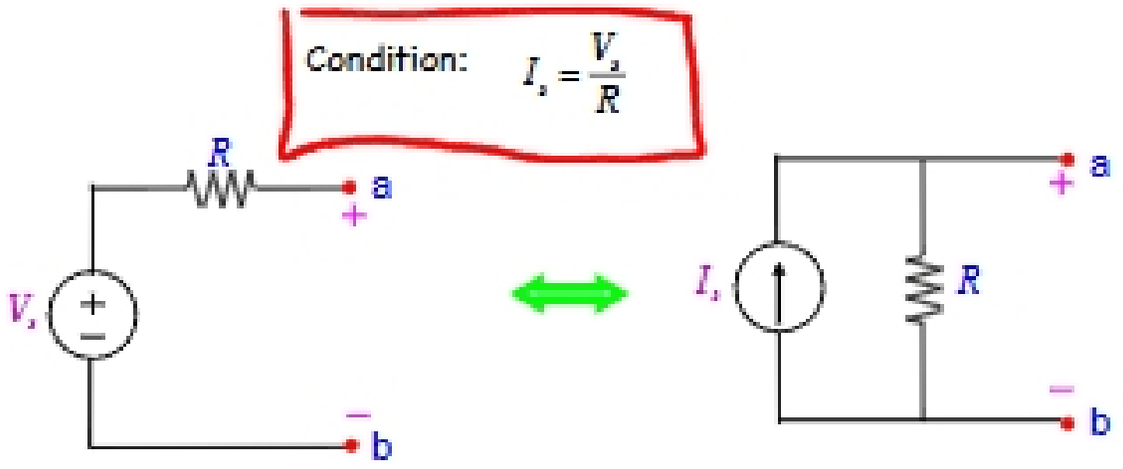
For the resistive load, the two circuits are equivalent!

Source Transformation

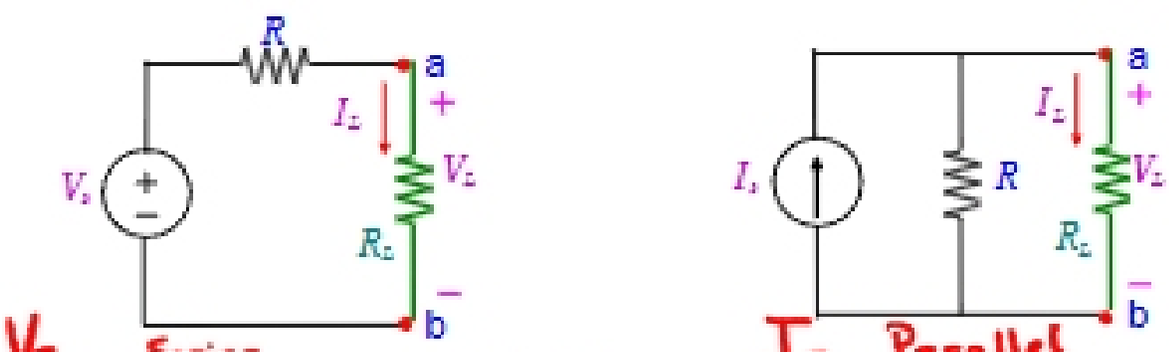
Between node (a) and (b):

Voltage source V_s in series with resistor R can be replaced by a current source I_s in parallel with R and vice versa.

Condition: $I_s = \frac{V_s}{R}$



Proof: Concept of equivalent circuits



Series

$$V_L = \frac{V_s}{R_L + R}[R_L]$$

$$I_L = \frac{V_s}{R + R_L}$$

Voltage Devision Rule

Parallel

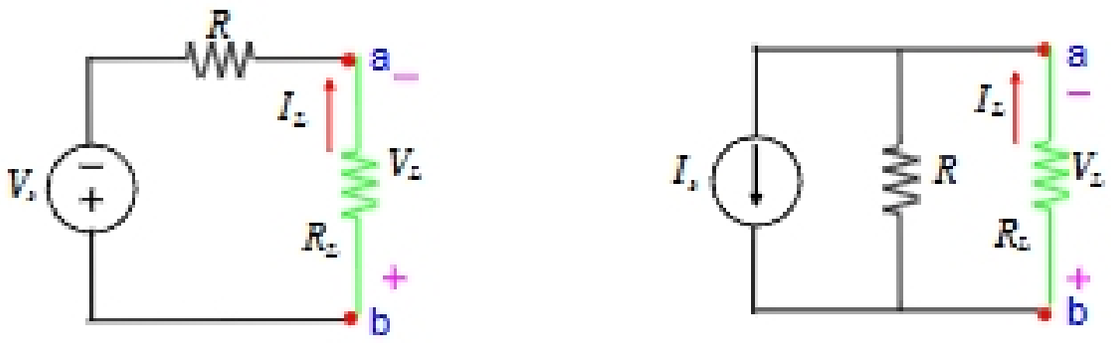
$$V_L = [I_s]\left[\frac{R\,R_L}{R + R_L}\right]$$

$$I_L = [I_s]\left[\frac{R}{R + R_L}\right]$$

$$I_s = \frac{V_s}{R}$$

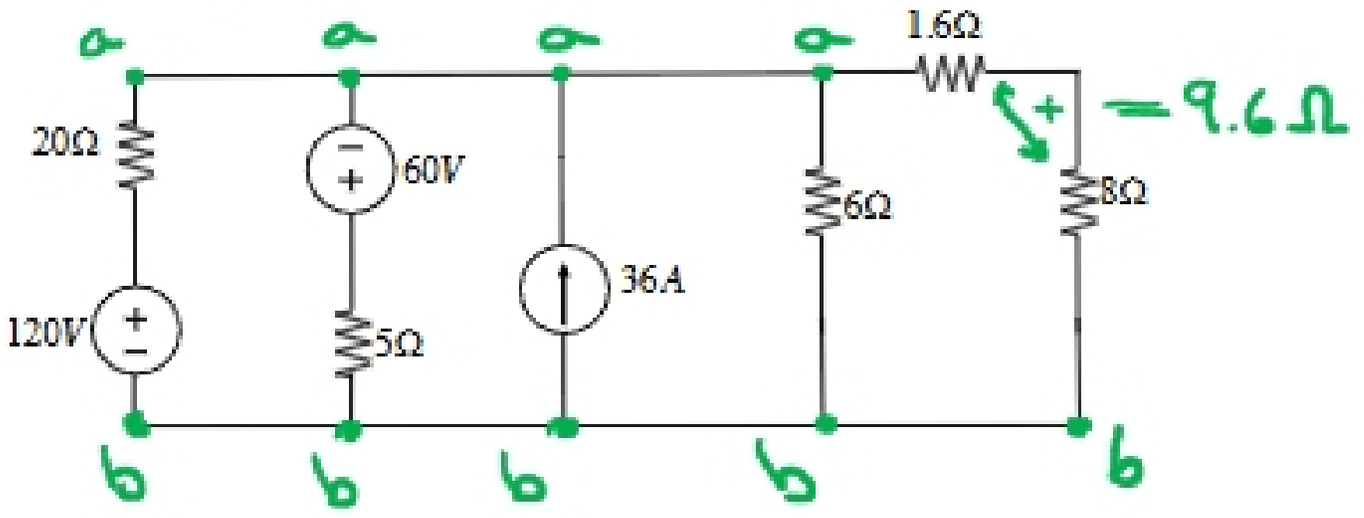
The (i–v) characteristic between (a) and (b) are identical

Note: If the polarity of the voltage source is reversed, the direction of the current source must also be reversed as shown.



for $I_s = \frac{V_s}{R}$

Example (1)



Questions

Use source transformation to find :

- The voltage across the 8 Ohms resistor.
- The power related to the current source
- The power related to the 120V source