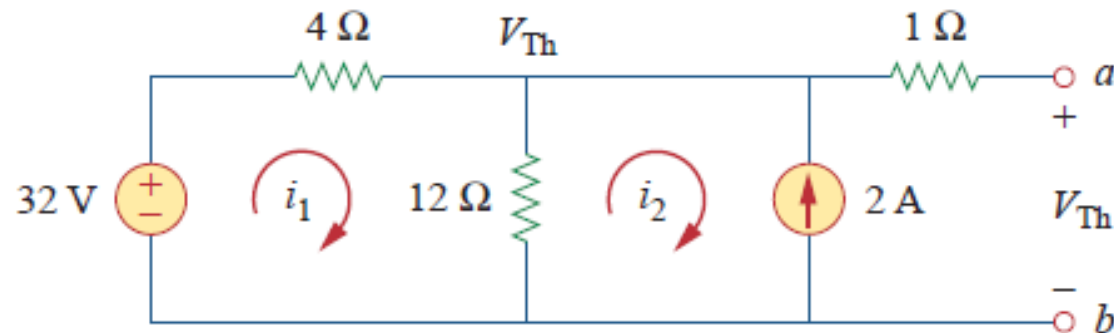
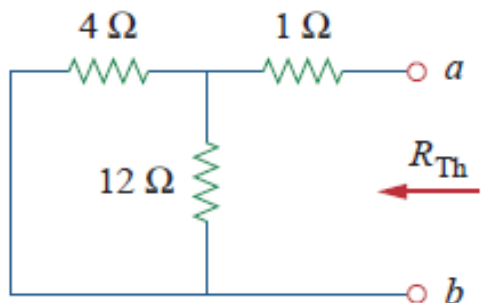
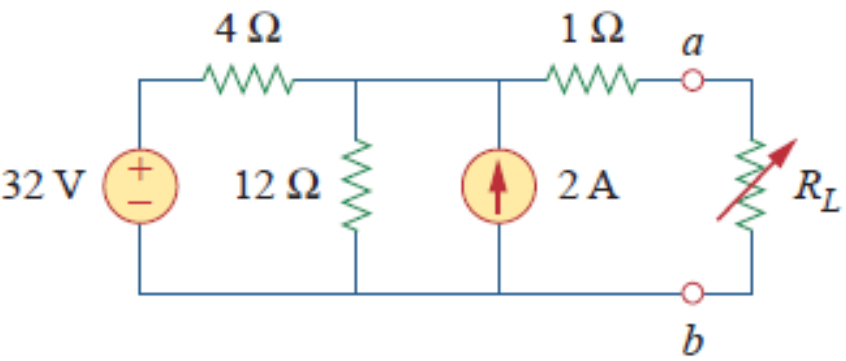


Thevenin



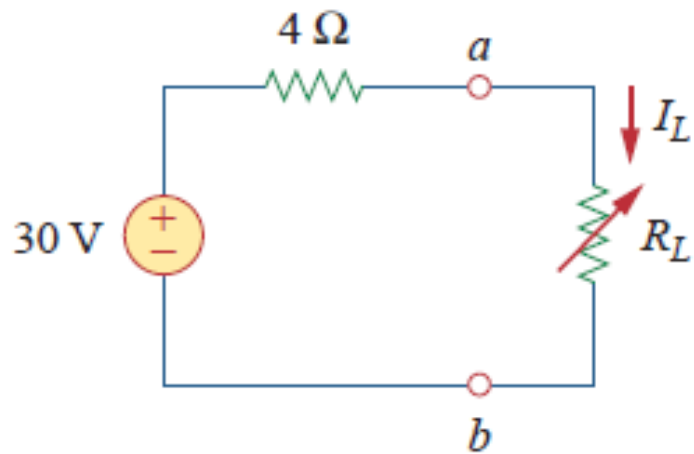
$$R_{Th} = 4 \parallel 12 + 1 = \frac{4 \times 12}{16} + 1 = 4 \Omega$$

$$-32 + 4i_1 + 12(i_1 - i_2) = 0, \quad i_2 = -2 \text{ A}$$

$$i_1 = 0.5 \text{ A.}$$

$$V_{Th} = 12(i_1 - i_2) = 12(0.5 + 2.0) = 30 \text{ V}$$

$$I_L = \frac{V_{Th}}{R_{Th} + R_L} = \frac{30}{4 + R_L}$$



When $R_L = 6$,

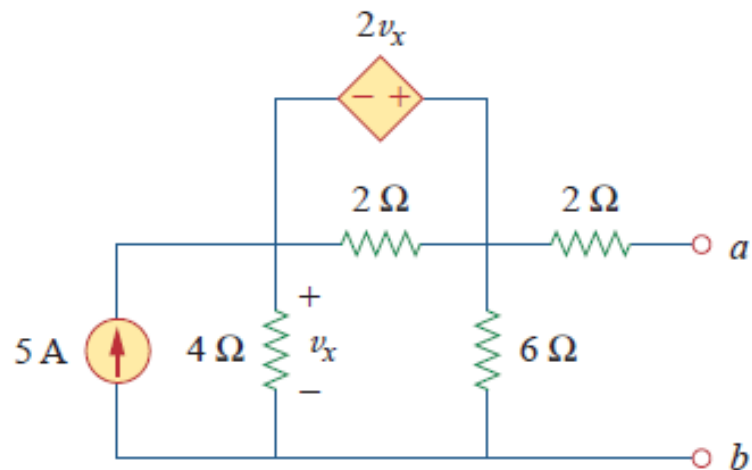
$$I_L = \frac{30}{10} = 3 \text{ A}$$

When $R_L = 16$,

$$I_L = \frac{30}{20} = 1.5 \text{ A}$$

When $R_L = 36$,

$$I_L = \frac{30}{40} = 0.75 \text{ A}$$



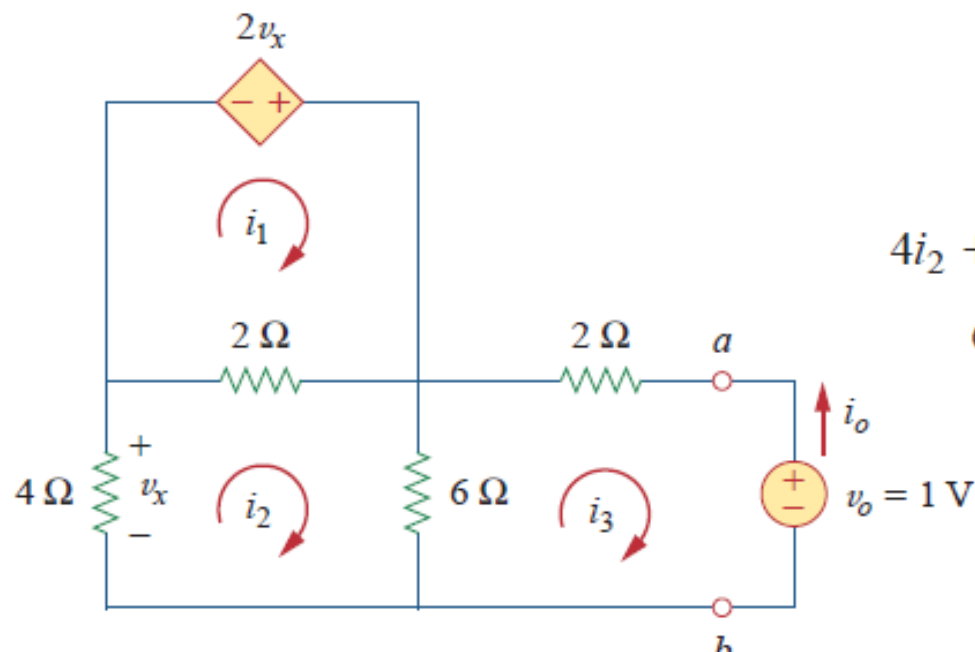
$$-2v_x + 2(i_1 - i_2) = 0 \quad \text{or} \quad v_x = i_1 - i_2$$

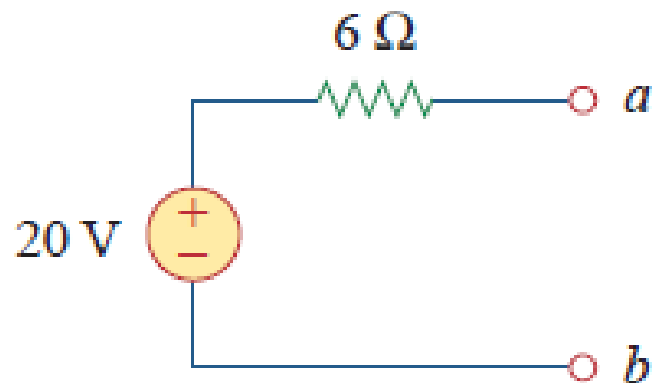
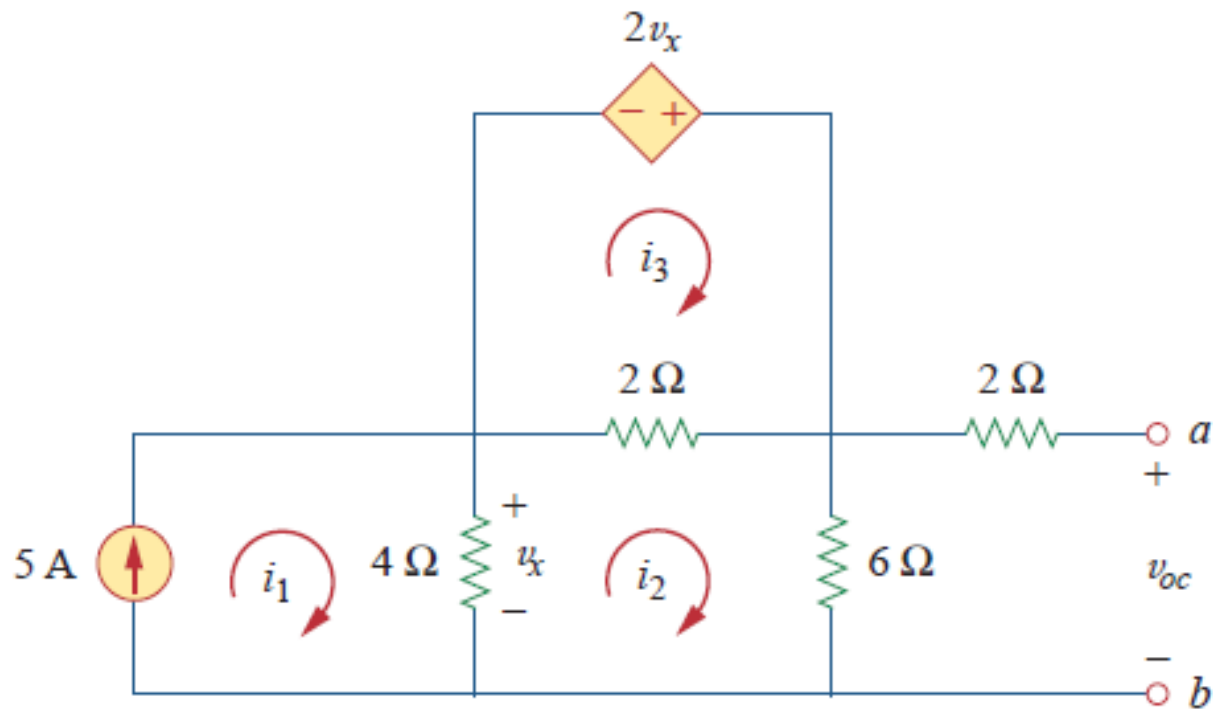
$$-4i_2 = v_x = i_1 - i_2 \quad i_1 = -3i_2$$

$$4i_2 + 2(i_2 - i_1) + 6(i_2 - i_3) = 0 \quad i_3 = -\frac{1}{6} \text{ A}$$

$$6(i_3 - i_2) + 2i_3 + 1 = 0$$

$$R_{\text{Th}} = \frac{1 \text{ V}}{i_o} = 6 \Omega$$





$$V_{Th} = v_{oc} = 6i_2 = 20 \text{ V}$$

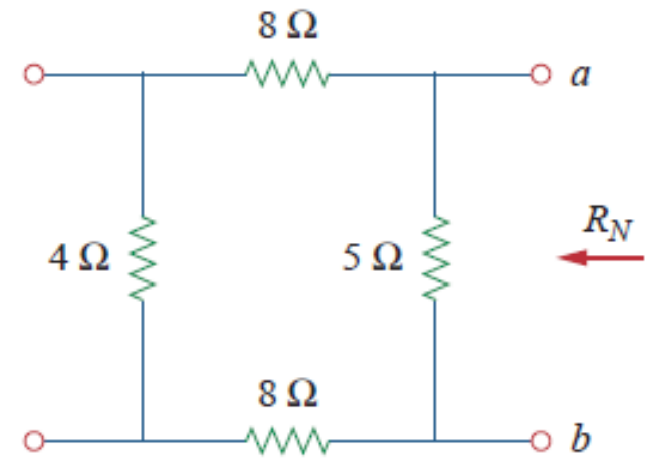
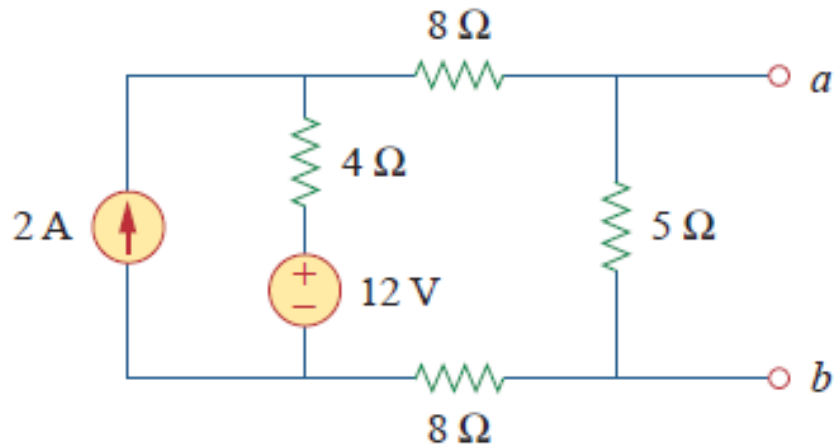
$$i_1 = 5$$

$$-2v_x + 2(i_3 - i_2) = 0 \quad \Rightarrow \quad v_x = i_3 - i_2$$

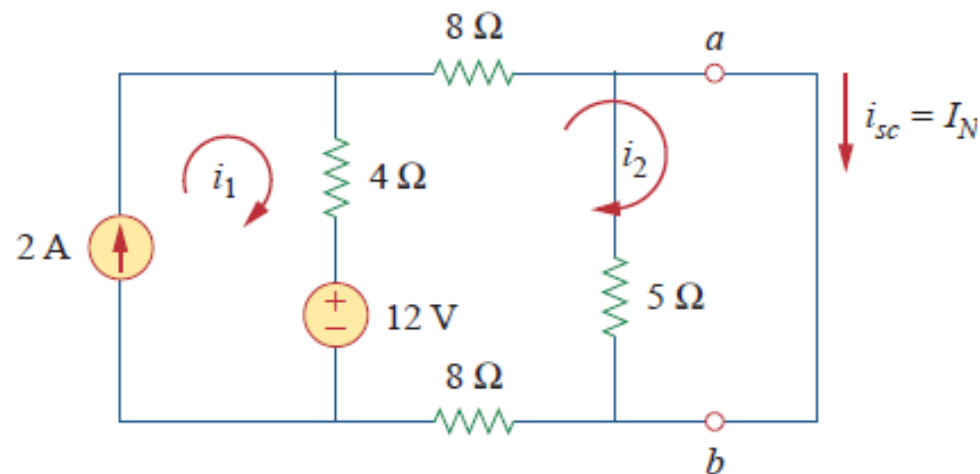
$$4(i_2 - i_1) + 2(i_2 - i_3) + 6i_2 = 0$$

$$12i_2 - 4i_1 - 2i_3 = 0$$

Norton

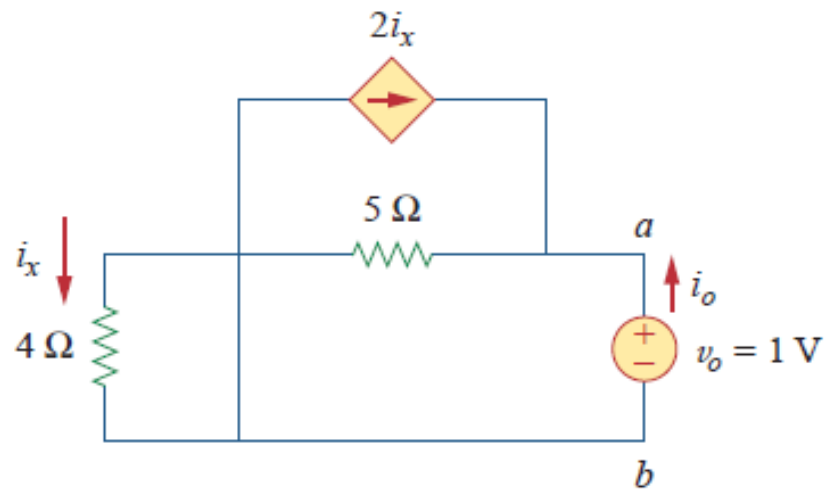
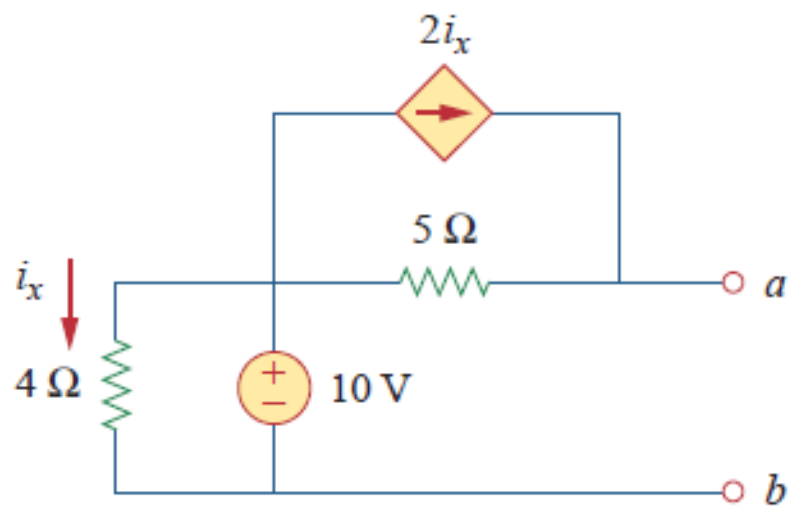


$$R_N = 5 \parallel (8 + 4 + 8) = 5 \parallel 20 = \frac{20 \times 5}{25} = 4 \Omega$$

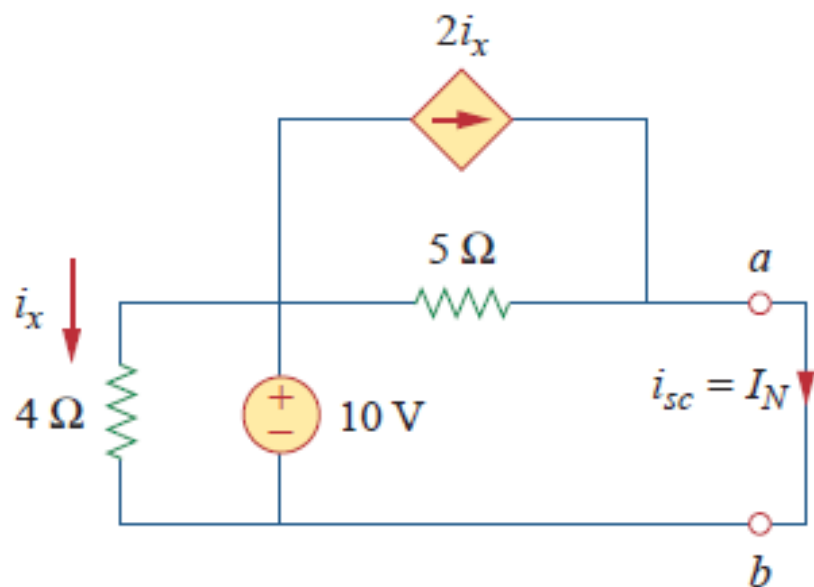


$$i_1 = 2 \text{ A}, \quad 20i_2 - 4i_1 - 12 = 0$$

$$i_2 = 1 \text{ A} = i_{sc} = I_N$$



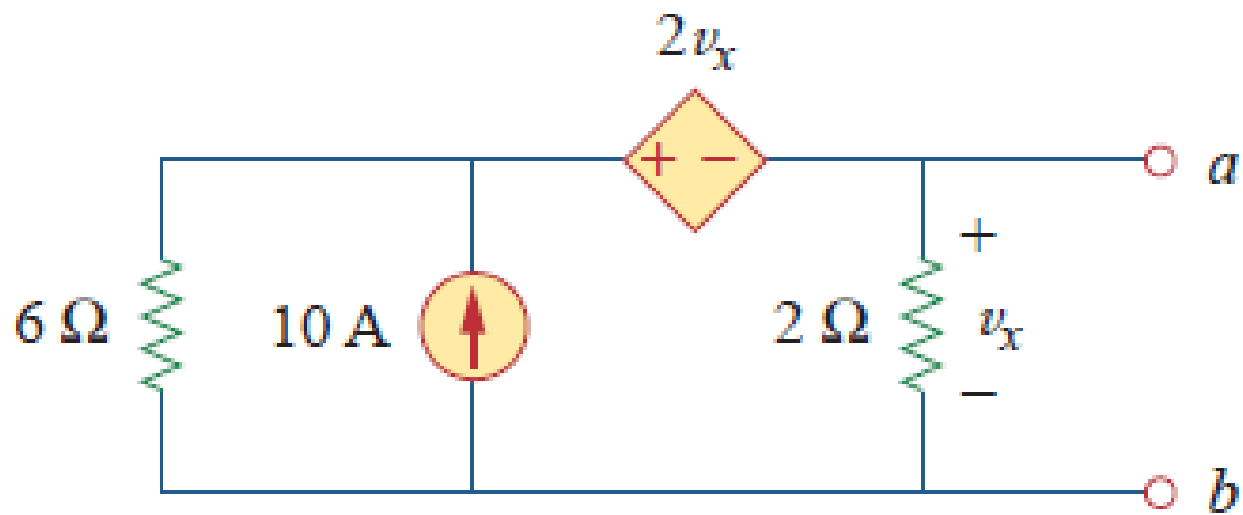
$$R_N = \frac{v_o}{i_o} = \frac{1}{0.2} = 5\ \Omega$$

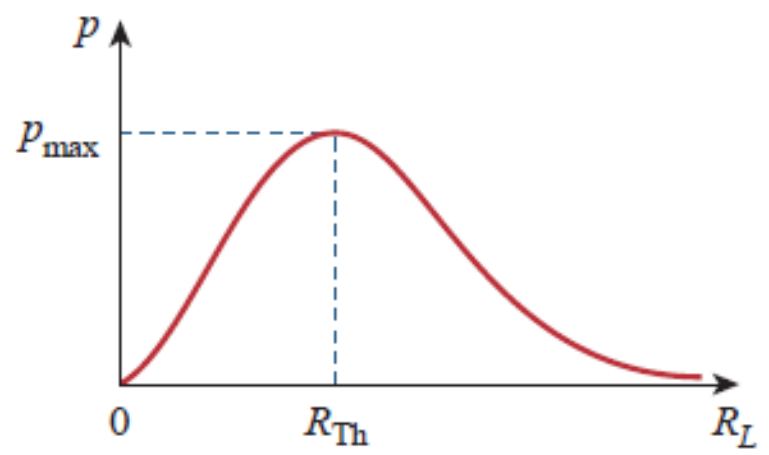
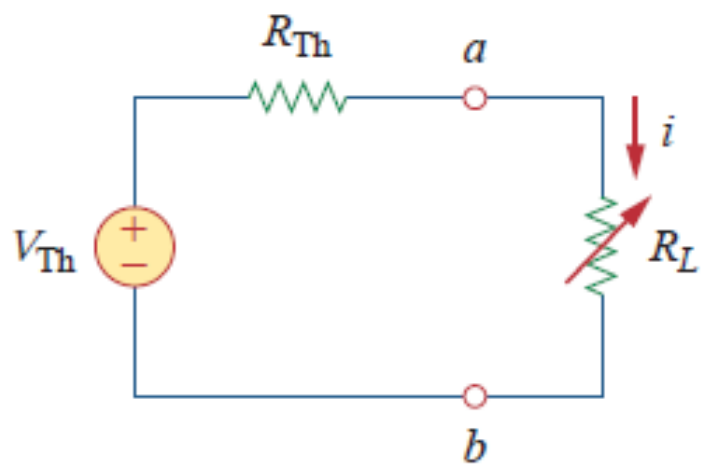


$$i_x = \frac{10}{4} = 2.5\text{ A}$$

$$i_{sc} = \frac{10}{5} + 2i_x = 2 + 2(2.5) = 7\text{ A}$$

$$I_N = 7\text{ A}$$

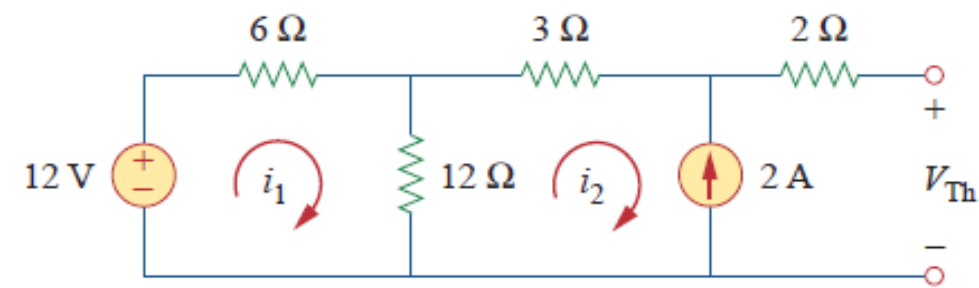
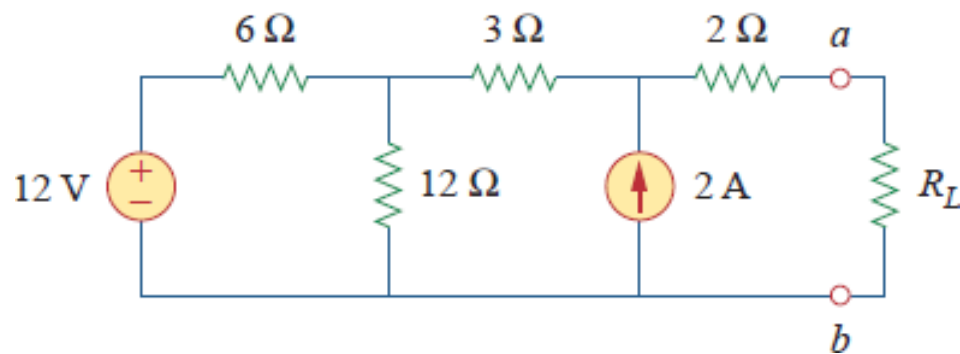
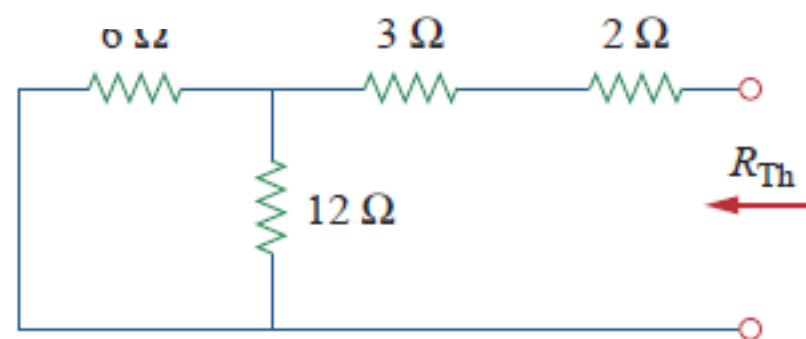




$$p = i^2 R_L = \left(\frac{V_{Th}}{R_{Th} + R_L} \right)^2 R_L$$

$$P_{max} = \frac{V_{Th}^2}{4R_{Th}}$$

$$R_L = R_{Th}$$



$$R_{Th} = 2 + 3 + 6 \parallel 12 = 5 + \frac{6 \times 12}{18} = 9 \Omega$$

$$i_1 = -2/3 \dots \quad R_L = R_{Th} = 9 \Omega$$

$$-12 + 18i_1 - 12i_2 = 0, \quad i_2 = -2 \text{ A}$$

$$-12 + 6i_1 + 3i_2 + 2(0) + V_{Th} = 0 \quad \Rightarrow$$

$$V_{Th} = 22 \text{ V}$$

$$p_{\max} = \frac{V_{Th}^2}{4R_L} = \frac{22^2}{4 \times 9} = 13.44 \text{ W}$$

