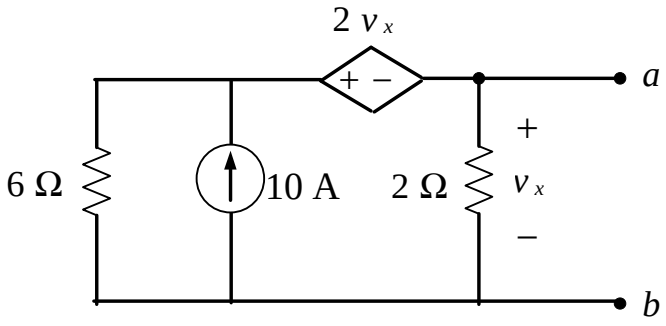
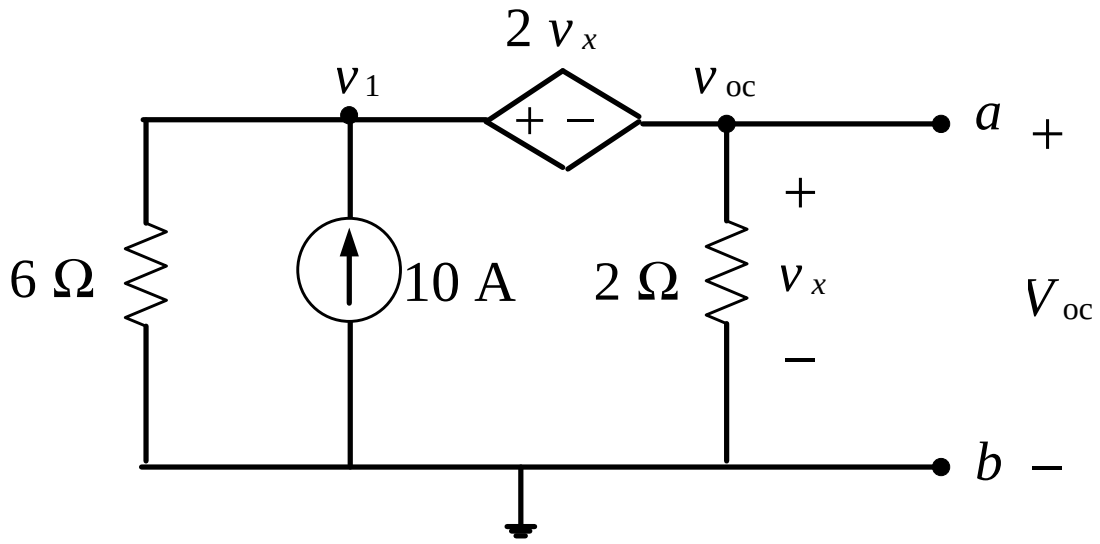
EE 202-06-Fall 2013(131)
QZ3

Sec	Ser	ID	Name **KEY**



For the circuit shown above, find the followings:
(a) The Thevenin's equivalent between terminals a and b ?
(b) If a load resistor is connected between a and b , find the load resistor that will absorb the maximum power and find the maximum power



KCL on supper node

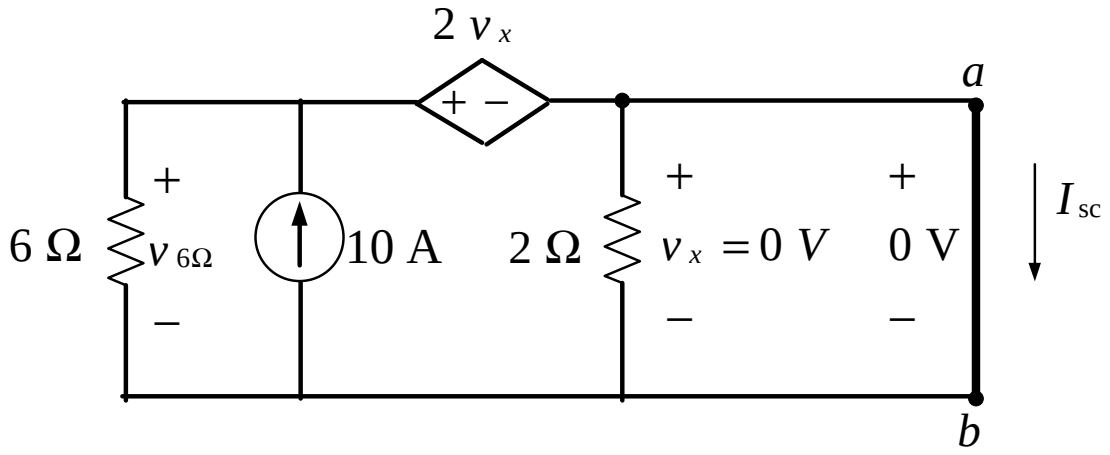
$$\frac{v_1}{6} - 10 + \frac{V_{oc}}{2} = 0 \Rightarrow v_1 + 3V_{oc} = 60 \text{ ----(1)}$$

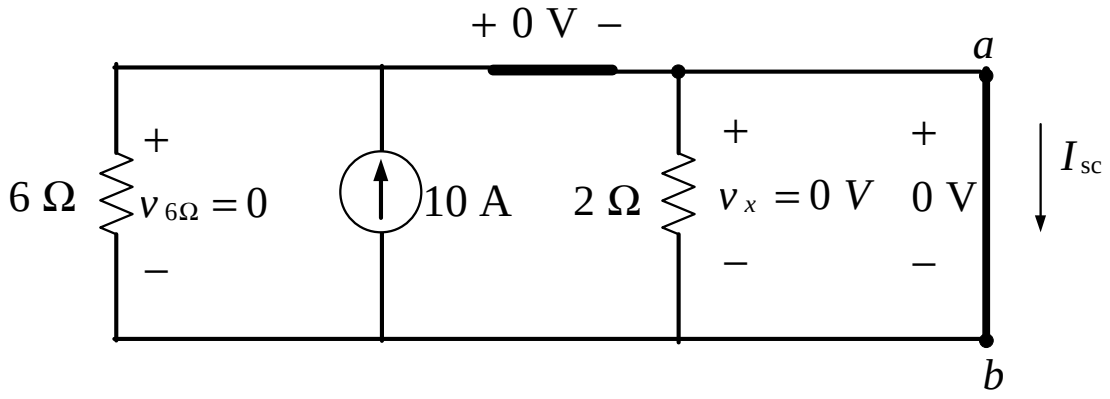
Voltage Restriction $v_1 - V_{oc} = 2v_x = 2V_{oc} \Rightarrow v_1 - 3V_{oc} = 0$ ----(2)

Solving (1) and (2) $V_{oc} = 10$ V

Finding R_{TH}

Method I : using $R_{TH} = \dfrac{v_{oc}}{I_{sc}}$



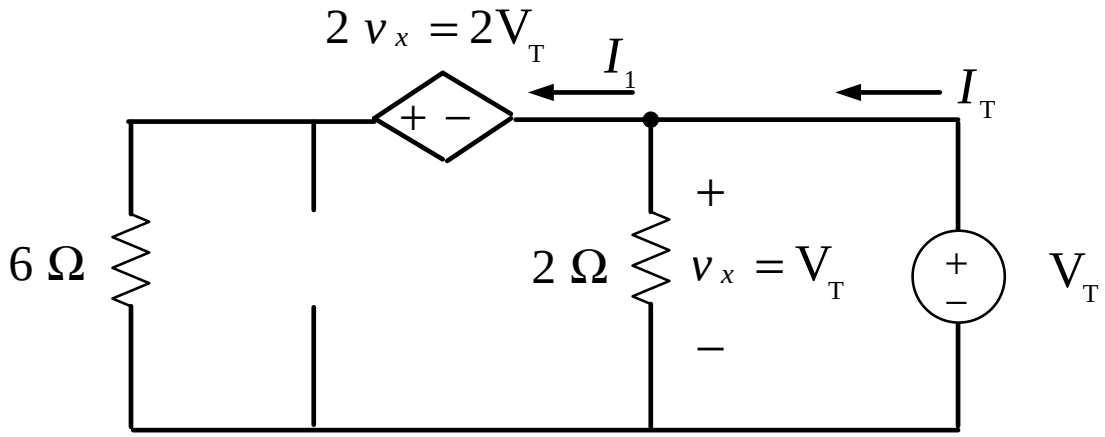


Shorting a and b

$\Rightarrow\ v_x = 0\ \text{V} \quad \Rightarrow\ 2v_x = 0\ \text{V} \quad \Rightarrow\ v_{6\Omega} = 0\ \text{V} \quad \Rightarrow\ I_{sc} = 10\ \text{A}$

$$\Rightarrow\ R_{TH} = \frac{v_{oc}}{I_{sc}} = \frac{10}{10} = 1\Omega$$

Method II : using $R_{TH} = \dfrac{V_T}{I_T}$



KVL $\quad -V_T - 2V_T + 6I_1 = 0 \text{ V} \quad \Rightarrow \; I_1 = \dfrac{V_T}{2}$

KCL $\; I_T = \dfrac{V_T}{2} + I_1 = \dfrac{V_T}{2} + \dfrac{V_T}{2} = V_T$

$$\Rightarrow \quad R_{TH} = \frac{V_T}{I_T} = 1\Omega$$

(b) The resistor that will absorb the maximum power is

$$R_{\mathrm{L}} = R_{\mathrm{TH}} = 1\Omega$$

$$P_{\max} = \frac{V_{\mathrm{oc}}^2}{4R_{\mathrm{TH}}} = \frac{10^2}{4(1)} = 25 \text{ W}$$