Pr. R. Chedid   EECE 210   Spring 200

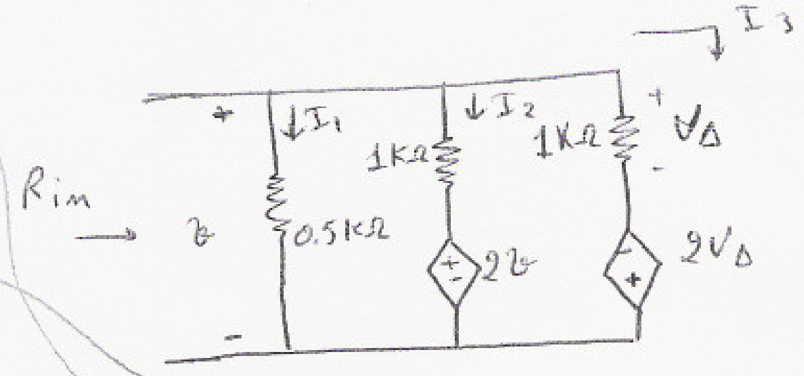
Solution - Quiz 1

Problem 1:

$I_2 = \frac{v - 2v}{1} = -v$

$I_3 = \frac{v + 2V_\Delta}{1}$, or $V_\Delta = 1 I_3$

$\Rightarrow I_3 = v + 2 I_3 \Rightarrow I_3 = \frac{v}{-1}$

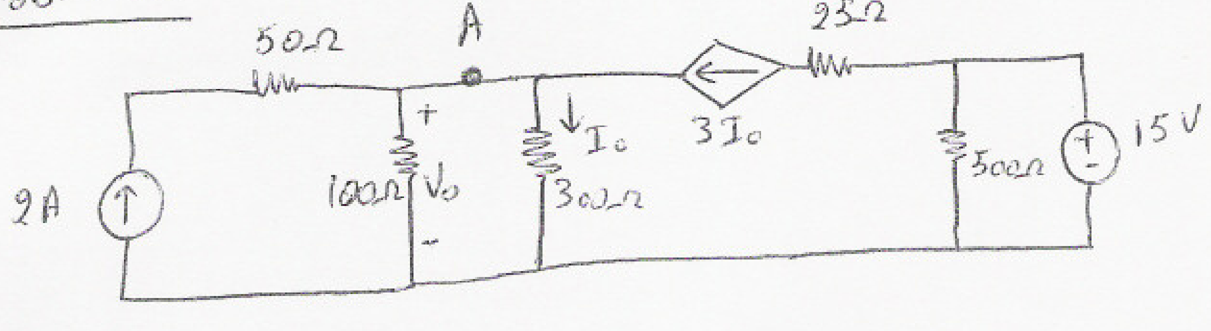


$I = I_1 + I_2 + I_3 = \frac{v}{1}\left[2 + (1-2) - \frac{1}{1}\right]$

1KΩ

$\Rightarrow \frac{v}{I} = \frac{1}{0} \Rightarrow R_{in} \Longrightarrow$ inf. (∞)

Problem 2:



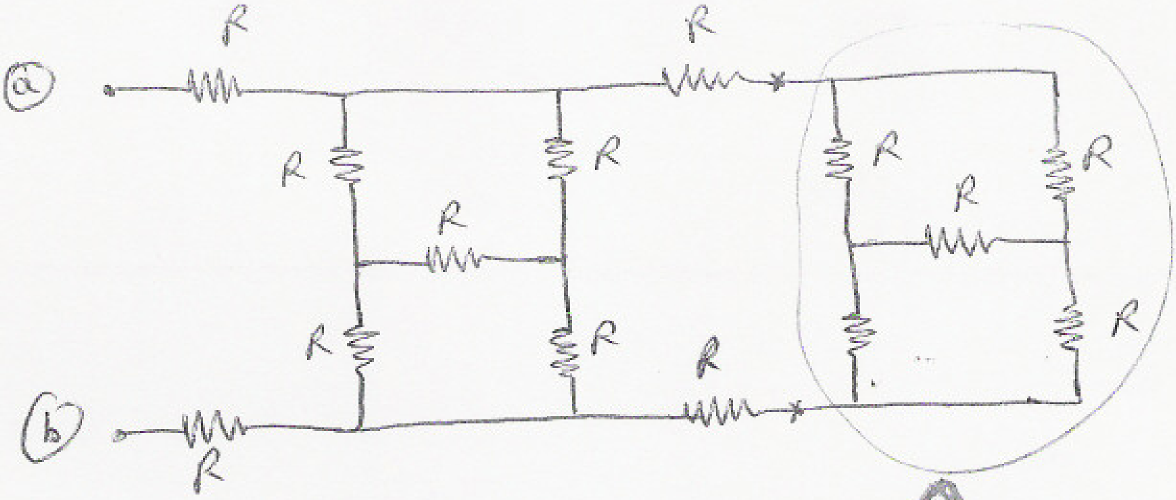
On node A:

$2 + 3I_0 = I_0 + \frac{V_0}{100}$ & $V_0 = 300 I_0$

$\Rightarrow 2 + \cancel{3I_0} = I_0 + 3I_0 \Rightarrow I_0 = 2A$

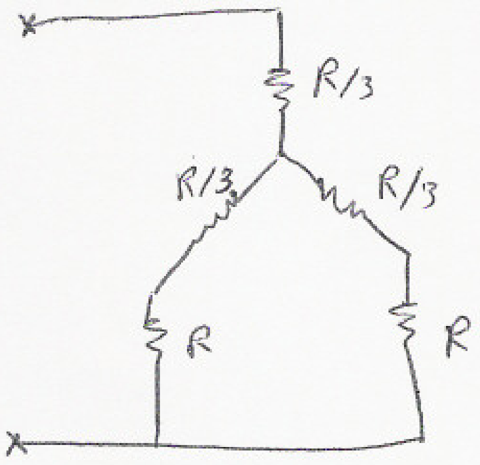
Problem 5:

R = 100Ω.

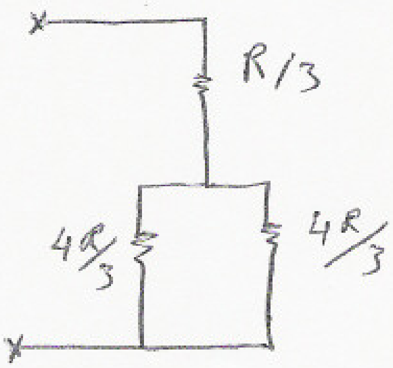


Using Δ-Y

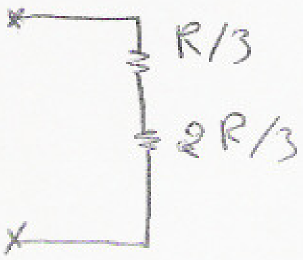
(i)



(ii)

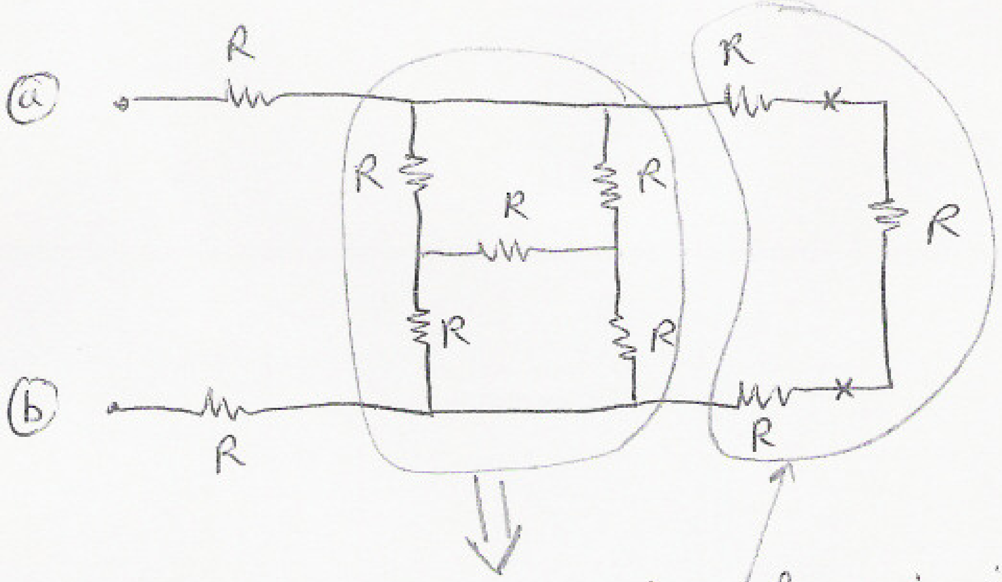


(iii)

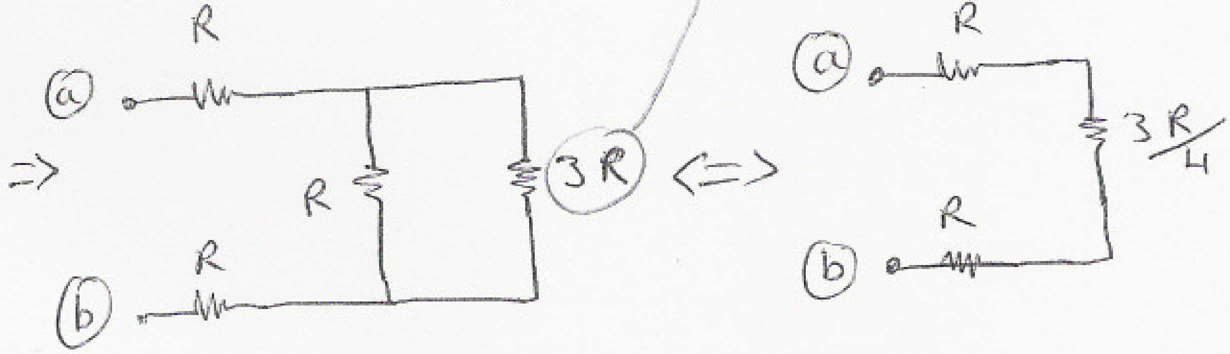


(iv)

The circuit will be:

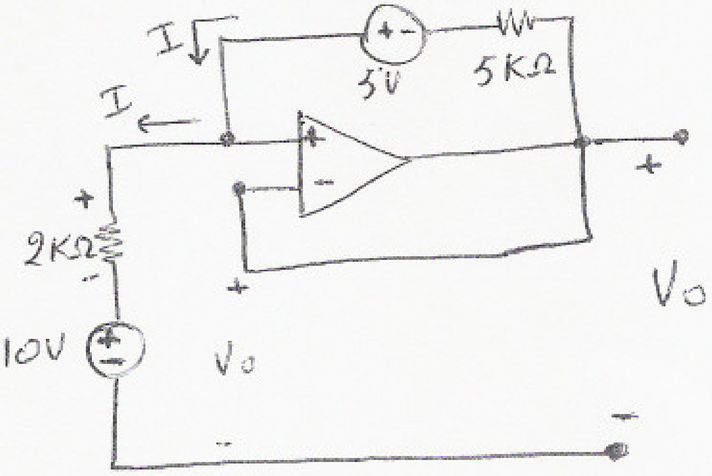


Same procedure from i – ii – iii → iv



if R = 100Ω ⇒ $R_{ab} = 275\ \Omega$.

Problem 4:



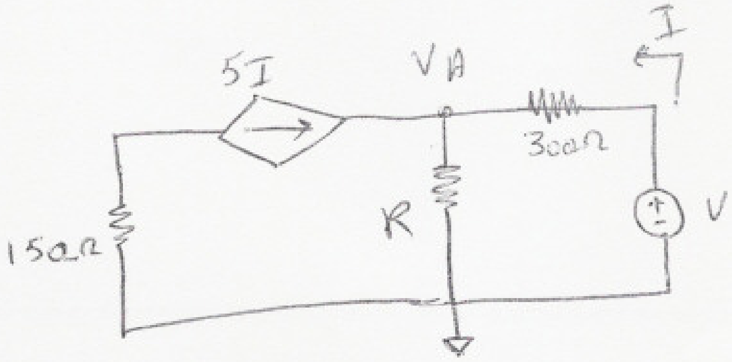
$V_o = V_p = V_n$

$I = \frac{5V}{5K\Omega} = 1\, mA$

$V_o - I(2) = 10$

$\Rightarrow V_o = 10 + 2 = 12\ V$

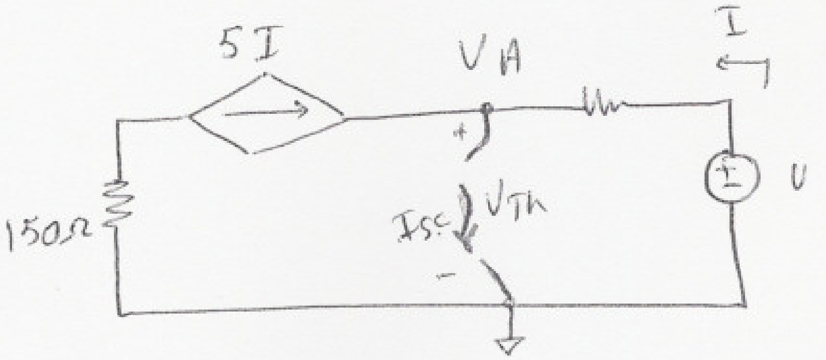
Problem 5:



V_{Th} is obtained by removing R

On node A $\quad 5I = I \Rightarrow I = 0$

$\Rightarrow V_{Th} = V$

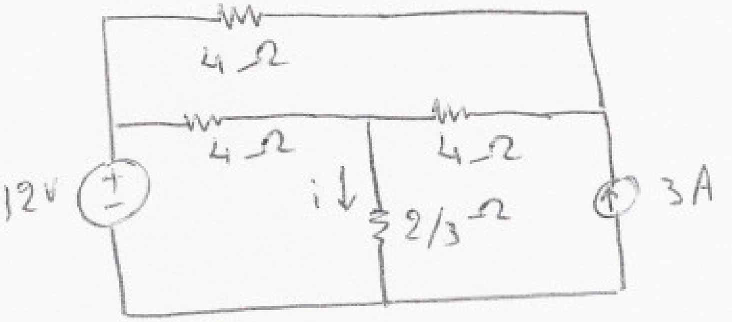


Producing a short circuit between A & the ground,

$I_{sc} = I + 5I = 6I \quad \& \quad I = \frac{V}{300}$

$\Rightarrow I_{sc} = \frac{6V}{300} \Rightarrow R_{Th} = \frac{300}{6} = 50\,\Omega.$

Problem 6:



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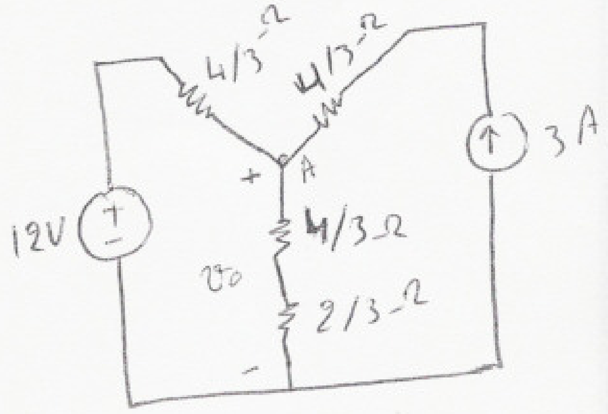
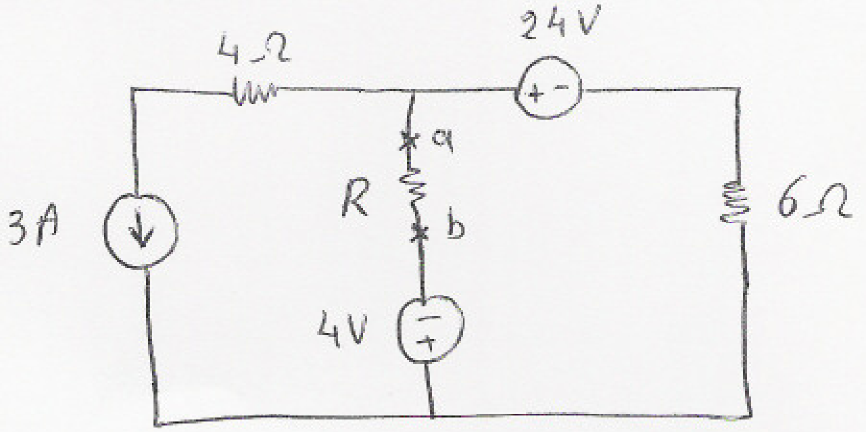


On node A:

$$\frac{v_o - 12}{4/3} + \frac{v_o}{2} - 3 = 0 \Rightarrow v_o = 9.6$$

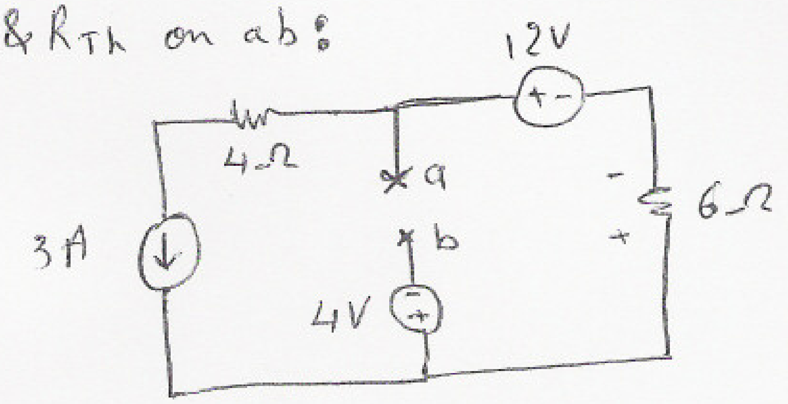
$$\Rightarrow i = \frac{9.6}{2} = 4.8\,A.$$

Problem 7:



To find max. Power delivered to R, we should find

h& R_{Th} on ab:



$v_{6\Omega} = 18V = 3 \times 6 = 18V$

by KVL:

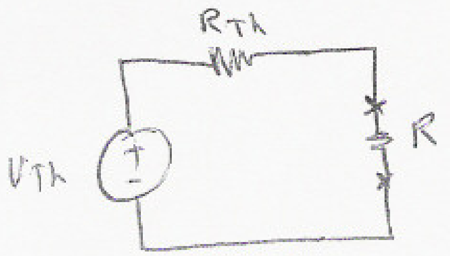
$v_{ab} - 4 + v_6 - 24 = 0$

$\Rightarrow v_{ab} = 10\Omega$

& $R_{Th} = 6\Omega$.

For max Power transfer, $R_{Th} \equiv R$

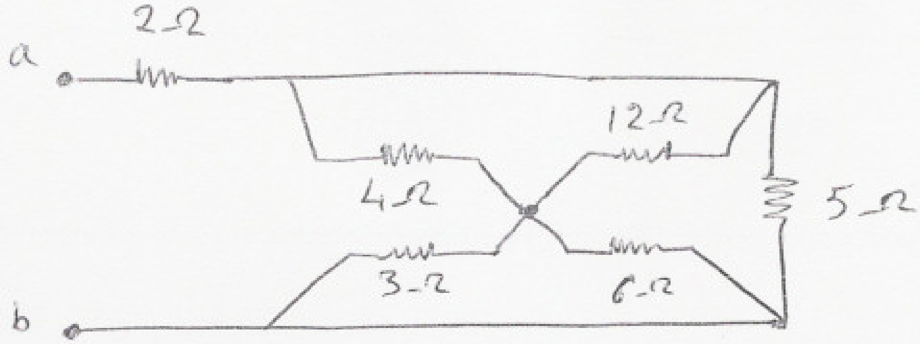
$\Rightarrow P_R = I^2 R$



$$\Rightarrow P_R = \left(\frac{V}{2R}\right)^2 R = \left(\frac{10}{12}\right)^2 \times 6$$

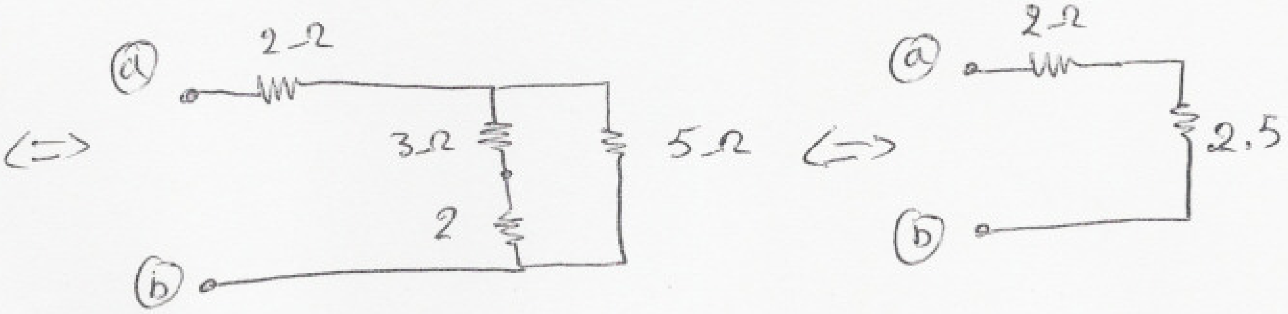
$$= 4.166\,W.$$

Problem 8:



(4Ω) & (12Ω) are in parallel

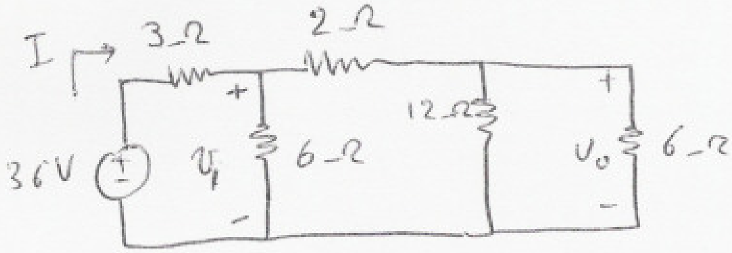
(3Ω) & (6Ω) are in parallel



$\Rightarrow R_{ab} = 4.5\Omega$

Problem 9:

due to 36V only, the circuit will reduce to:



$(12 \parallel 6) = \frac{6 \times 12}{18} = 4\Omega$

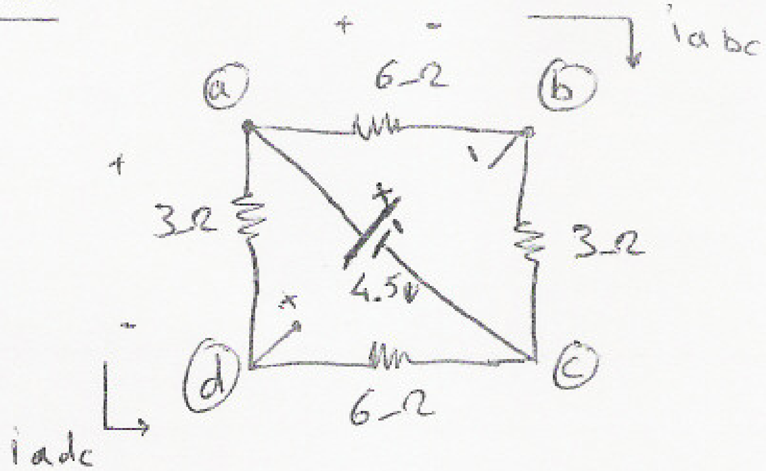
4 & 2 are in series $= 4 + 2 = 6\Omega$

(6 & 6 are $\parallel$) $= 3$

3 & 3 are in series $\Rightarrow v_1 = \frac{3 \times 36}{6} = 18v$

$\Rightarrow v_0 = \frac{4}{6} \times 18 = 12V$

Problem 10:



$i_{abc} = \frac{4.5}{9} = 0.5$

$i_{adc} = \frac{4.5}{9} = 0.5$

$V_{ad} = 3 \times 0.5 = 1.5$ V

$V_{ab} = 6 \times 0.5 = 3$ V

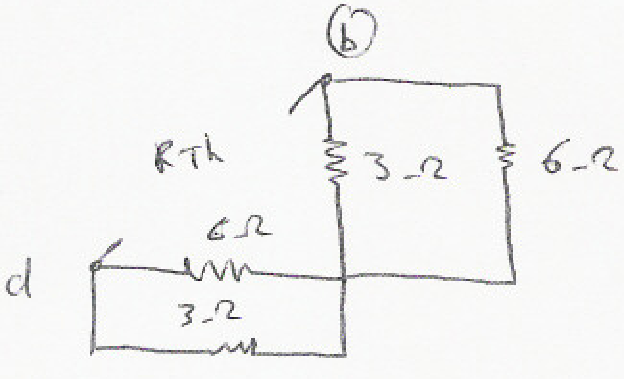
KVL on (a b d): $V_{ab} - V_{Th} - V_{ad} = 0$

$\Rightarrow V_{Th} = 1.5$V

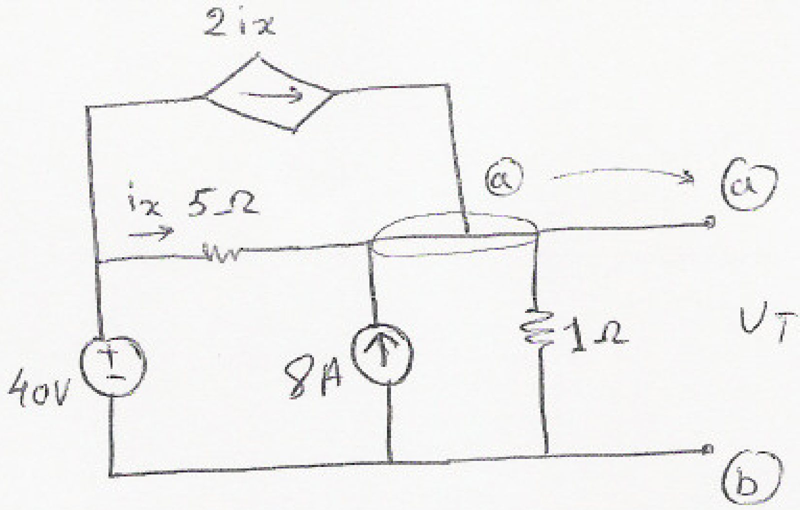
Problem 11:

$R_{Th} = 2\left(\frac{18}{9}\right)$

$= 4\Omega$



Problem 12:



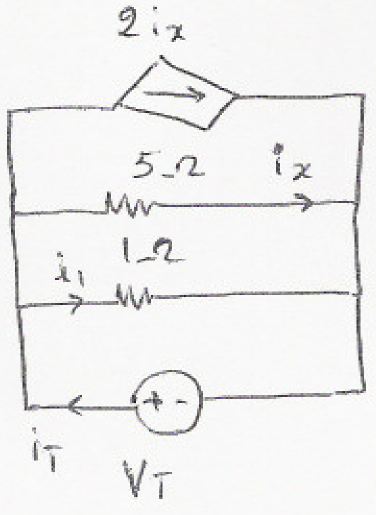
Node voltage method on ⓐ:

$$\frac{V_{Th}}{1} - 8 + \frac{V_{Th} - 40}{5} - 2i_x = 0$$

& $i_x = \frac{40 - V_{Th}}{5}$

$\Rightarrow V_{Th} = 20$ V.

Problem 13:



we must inject current into this circuit to find R_{Th}

$$R_{Th} = \frac{V_T}{i_T}$$

$$i_T = i_1 + i_x + 2i_x$$

$$= \frac{V_T}{1} + \frac{V_T}{5} + \frac{2V_T}{5} = \frac{8V_T}{5}.$$

$$\Rightarrow R_{Th} = \frac{V_T}{i_T} = \frac{5}{8} = 0.6\,\Omega$$