AMERICAN UNIVERSITY OF BEIRUT
FACULTY OF ENGINEERING AND ARCH,
EECE210- FALL 2005
Quiz 1 Solutions

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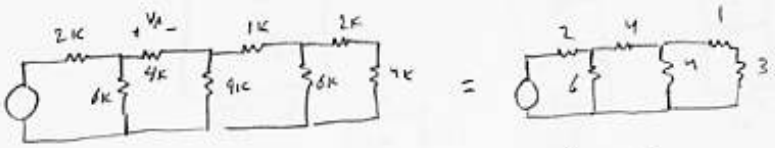
EECE 210 - FALL 05

QUIZ 1 SOLUTIONS

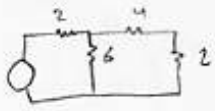
KARAMEH

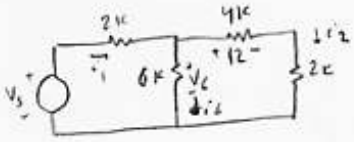
PROBLEM 1

REDRAW:



$((((2+4)\,//\,6)+1)\,//\,4 = 2k\Omega$ =





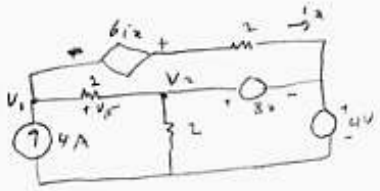
$4i_2 = 12V \Rightarrow i_2 = 3mA \Rightarrow V_6 = 12 + 2000 i_2 = 12 + 6 = 18V$

$\Rightarrow i_6 = \frac{18}{6K} = 3mA$

$\Rightarrow i_1 = i_6 + i_2 = 6mA$

$\therefore V_s = 2000 i_1 + V_6 = 2 + 6 + 18 = 30V$

PROBLEM 2



MANY WAYS TO SOLVE. TRY NODAL:

$V_2 = 12V$; $\frac{V_1 - V_2}{2} + \frac{V_1 + 6i_x - 4}{2} - 4 = 0$ ... ①

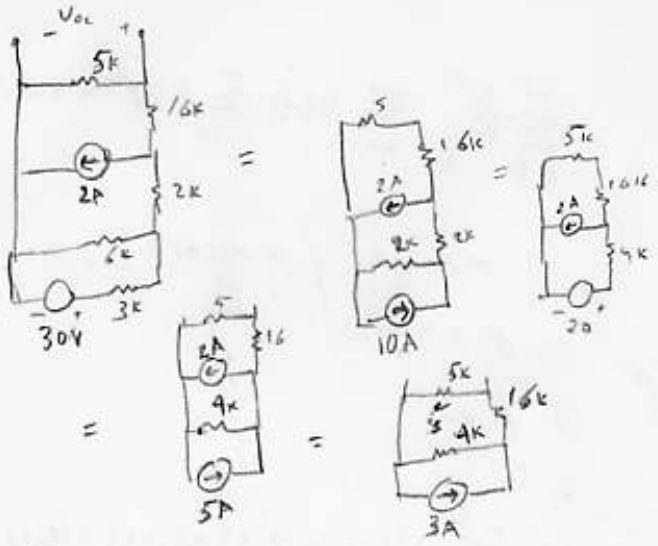
$i_x = \frac{V_1 + 6i_x - 4}{2} \Rightarrow i_x = \frac{-V_1 + 4}{4}$

back into ① $\Rightarrow \frac{V_1}{2} - \frac{12}{2} + 1 - \frac{V_1}{4} - 4 = 0 \Rightarrow \frac{V_1}{4} - 5 = 0 \Rightarrow V_1 = 36$

$\Rightarrow V_x = V_1 - V_2 = 36 - 12 = 24V$

PROBLEM 3

a) Find $V_{TH} = V_{OC} = ?$



$$I_5 = \frac{4+3}{4+5||6} = \frac{4+3}{25} = \frac{12}{25}\,A$$

$$\Rightarrow V_{OC} = \frac{12}{25} \times 5 = \frac{12}{5} = 2.4\,V$$

$$R_{TH} = 5\,||\,20 = \frac{5 \cdot 20}{25} = 4\,K\Omega$$

$$V_R = \left(\frac{2.4}{R+4000}\right) \cdot R$$

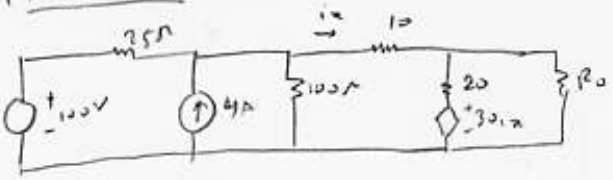
b)

P_{max} when $R = R_{TH} = 4\,K\Omega$

$$\Rightarrow V_R = \frac{2.4}{8} \cdot 4 = 1.2\,V$$

$$\therefore P_{max} = \frac{(1.2)^2}{4K} = 0.36\,mW$$

PROBLEM 4



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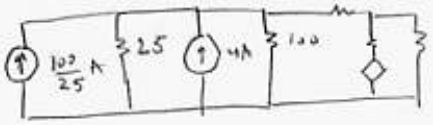

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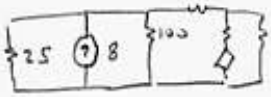

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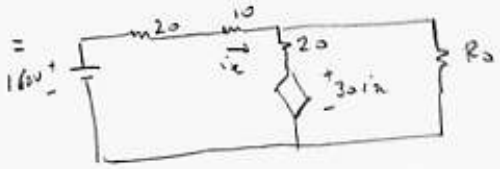
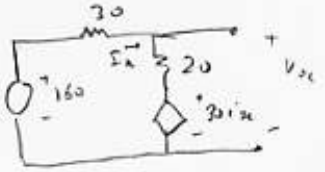
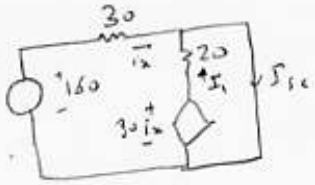


Let's find Thevenin equivalent



$V_{oc} = 20\,i_x + 30\,i_x = 50\,i_x$

$i_x = \frac{160 - 30\,i_x}{50} \Rightarrow i_x = 2\text{A} \Rightarrow V_{oc} = V_{Th} = 100$ Volts



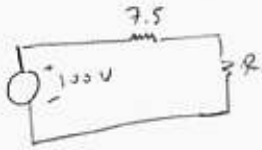
$I_{sc} = I_1 + i_x$

$30\,i_x = 20\,I_1 \Rightarrow I_1 = \frac{3}{2}\,i_x$

$\Rightarrow I_{sc} = \frac{3}{2}\,i_x$

$i_x = \frac{160}{30} = \frac{16}{3}$ A $\Rightarrow I_{sc} = \frac{3}{2}\,i_x + i_x = \frac{5}{2}\,i_x = \frac{16.5}{6}$ A

$\therefore R_{Th} = \frac{V_{oc}}{I_{sc}} = \frac{100}{\frac{16.5}{6}} = \frac{120}{16} = 7.5\Omega$



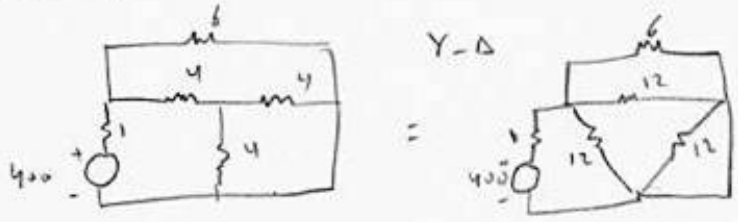
Power in $R_o = \frac{V_{R_o}^2}{R_o} = \left(\frac{100}{R_o + 7.5}\right)^2 \cdot \frac{1}{R_o}$

$\Rightarrow 250 = R_o\left(\frac{100}{R_o + 7.5}\right)^2 \Rightarrow R_o^2 + 15R_o + (7.5)^2 = 40R_o$

$\Rightarrow R_o - 25R_o + (7.5)^2 = 0$

$\Rightarrow R_o = 2.5$ or $R_o = 22.5\Omega$

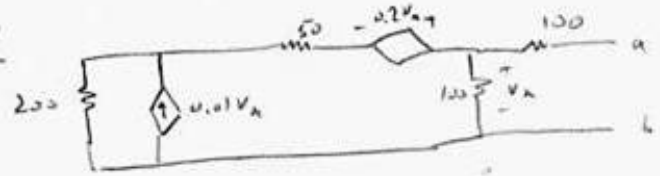
PROBLEM 5

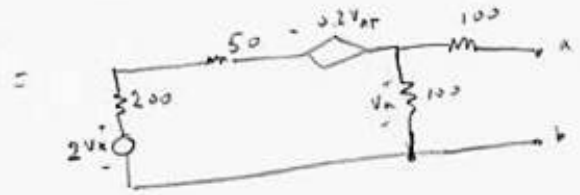


12 // 12

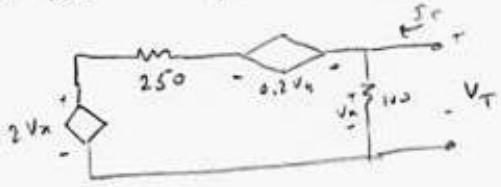
$\Rightarrow i_x = -\frac{400}{4} = -100\ A$

PROBLEM 6





Take out the 100 Ω resistor a & b for the moment, add it later



Find $\frac{V_T}{I_T}$

Nodal:

$$\frac{V_T}{100} - I_T + \frac{V_T - 2.2V_T}{250} = 0 \Rightarrow 2.5V_T - 1.2V_T = 250I_T$$

$$\Rightarrow \frac{V_T}{I_T} = \frac{250}{1.3} = 192.3\ \Omega$$

$$\Rightarrow R_{Th} = \frac{V_T}{I_T} + 100 = \underline{292.3\ \Omega}$$

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