Name _____

EE 2240

**Exam #1**

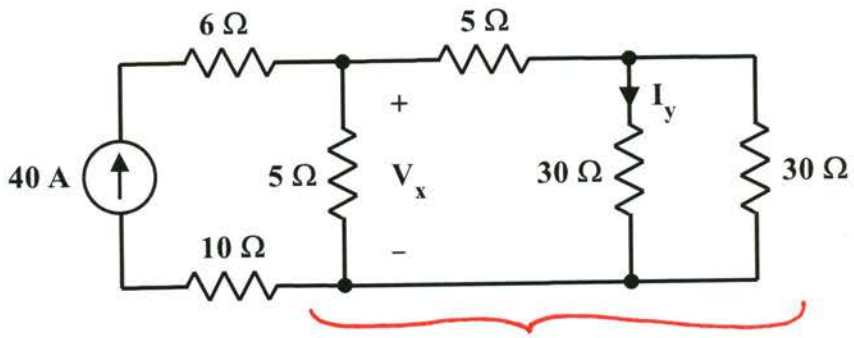
Friday, February 03, 2017

LIBR B07/B16 and TAB 115, 9:00AM – 9:50AM

[closed book – one two-sided 8½"×11" page of notes and calculator allowed, nothing else]

Work must be shown in a neat and orderly fashion if you expect to receive partial credit.

1. Determine the value of $V_x$ and the value of $I_y$.




$R_{eq} = 5\Omega \| [5\Omega + (30\Omega \| 30\Omega)]$

$= 5\Omega \| [5\Omega + 15\Omega]$

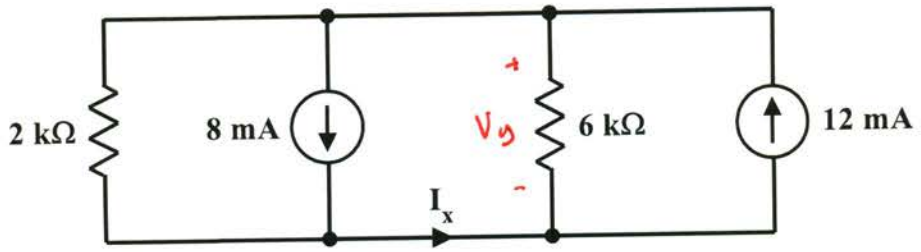
$= 5\Omega \| 20\Omega$

$= 4\Omega$

$V_x = 40A \times R_{eq} = 160\,V$

$I_y = \frac{1}{2} \cdot \frac{V_x}{20\Omega} = 4\,A$

2. Determine the value of $I_x$ and the amount of power absorbed by the 2 kΩ resistor.

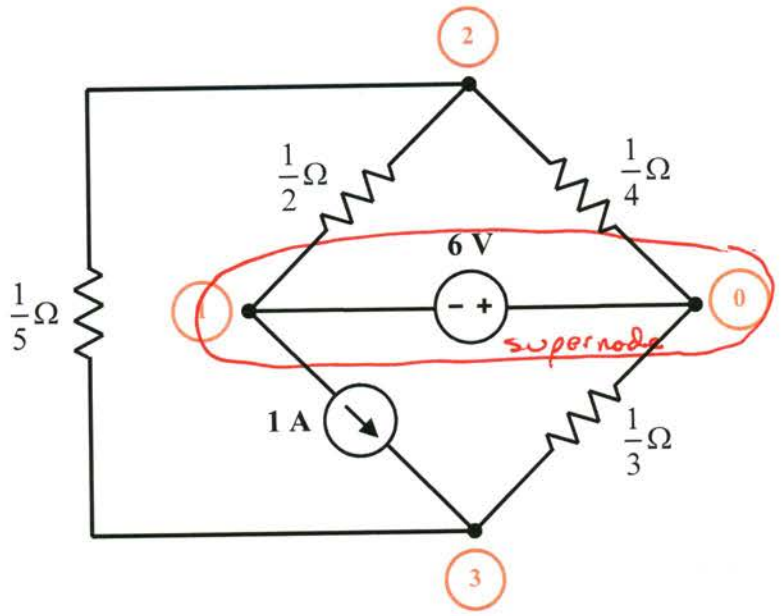



$$V_y = (2k\Omega \| 6k\Omega) \cdot (12mA - 8mA)$$
$$= 6V$$

$$\Sigma_x = 12mA - \frac{V_y}{6k\Omega} = 12mA - \frac{6V}{6k\Omega} = 11mA$$

$$P_{2k\Omega} = \frac{V_y^2}{2k\Omega} = \frac{(6V)^2}{2k\Omega} = 18mW$$

3. Use the method discussed in class to determine a set of node equations describing the circuit shown, and express them in the standard matrix form. Use the node labels that are already assigned. ***Do not attempt to solve the equations.***




$V_1 = -6\,V$ (constraint equation from the supernode)

$\frac{V_2 - V_3}{(\frac{1}{5})} + \frac{V_2 - V_1}{(\frac{1}{2})} + \frac{V_2}{(\frac{1}{4})} = 0$ (KCL at node 2)

$\frac{V_3 - V_2}{(\frac{1}{5})} - 1 + \frac{V_3}{(\frac{1}{3})} = 0$ (KCL at node 3)

In matrix form:

$$\begin{bmatrix} 1 & 0 & 0 \\ -2 & 11 & -5 \\ 0 & -5 & 8 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix} = \begin{bmatrix} -6 \\ 0 \\ 1 \end{bmatrix}$$

4. Solve for the value of $z$. Check your work; there will be very little partial credit on this problem.

$$\begin{bmatrix} 1 & 0 & 0 \\ -2 & 11 & 5 \\ 0 & -5 & 8 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ -2 \\ -113 \end{bmatrix}$$

From rows 1 and 2:

$$11y + 5z = 0$$

Multiply this by 5:

$$55y + 25z = 0$$

Multiply the third row by 11:

$$-55y + 88z = -1243$$

Add these last two together:

$$113z = -1243$$

$$\Rightarrow \quad z = -11$$