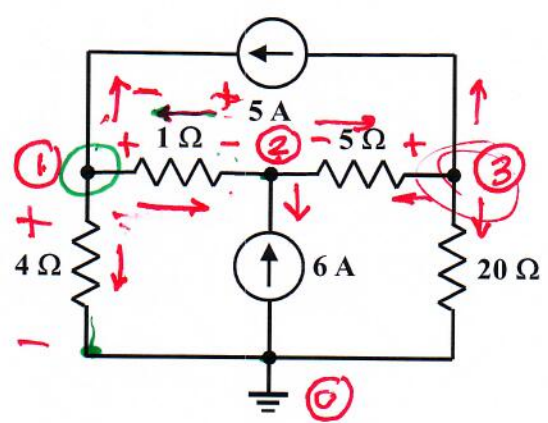


EE/EET 2240
Homework Problem #012

Develop node equations and express them in the matrix form discussed in class.



$$-V_1 + V_{12} + V_2 = 0 \quad (\text{KVL})$$

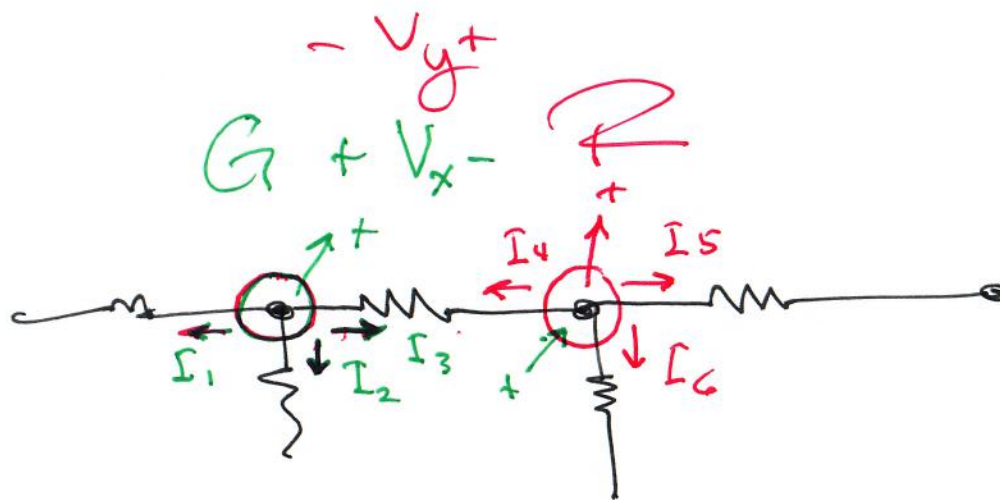
$$V_{12} = V_1 - V_2$$

$$\frac{V_1 - V_2}{1\Omega} = -\left(\frac{V_2 - V_1}{1\Omega}\right)$$

$$-5 + \frac{V_1 - V_2}{1\Omega} + \frac{V_1}{4} = 0 \quad (\text{KCL @ 1})$$

$$\frac{V_2 - V_1}{1\Omega} - 6 + \frac{V_2 - V_3}{5\Omega} = 0 \quad (\text{KCL @ 2})$$

$$5 + \frac{V_3 - V_2}{5\Omega} + \frac{V_3}{20\Omega} = 0 \quad (\text{KCL @ 3})$$



$$I_1 + I_2 + I_3 = 0$$

$$I_4 + I_5 + I_6 = 0$$

$$-I_4 - I_5 - I_6 = 0$$

$$0 = I_1 + I_2 + I_3$$

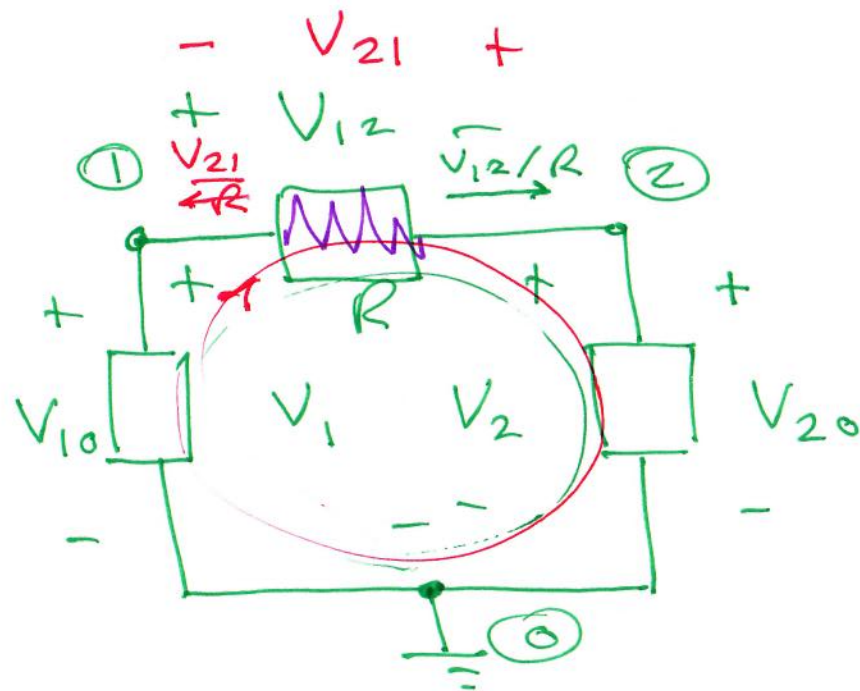
$$\underline{\underline{\hspace{2cm}}}$$

$$\uparrow -I_4$$

$$V_x = V_G - V_R$$

$$V_y = V_R - V_G$$

$$-V_y = V_x$$



$$-V_1 + V_{12} + V_2 = 0 \quad (\text{KVL})$$

$$V_{12} = V_1 - V_2$$

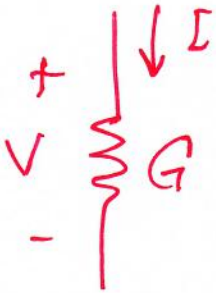
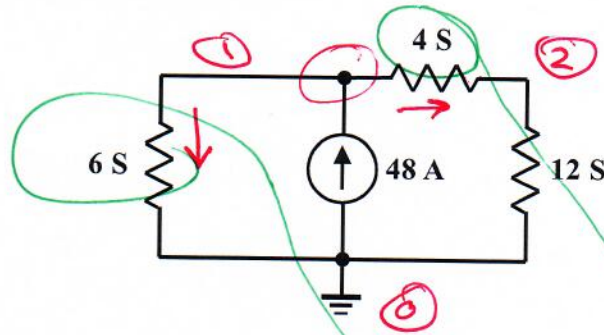
$$-V_1 - V_{21} + V_2 = 0 \quad (\text{KVL}) \textcircled{R}$$

$$-V_2 + V_{21} + V_1 = 0 \quad (\text{KVL}) \textcircled{B}$$

$$V_{21} = V_2 - V_1$$

EE/EET 2240
Homework Problem #011

Develop node equations and express them in the matrix form discussed in class. Note that the resistors are specified in conductance units.



$$I = G V$$

↑
1/R

$$6 V_1 + 4 (V_1 - V_2) - 48 = 0$$

$$-48 = 0$$

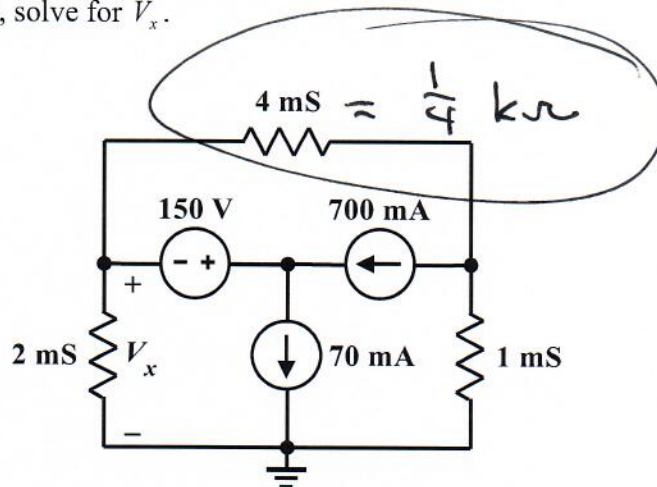
$$4 (V_2 - V_1) + 12 V_2 = 0$$

$$\frac{V_2}{(1/12)} = 12 V_2$$

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Homework Problem #013

Develop node equations and express them in the matrix form discussed in class. Then, using a method of your choosing, solve for V_x .



$$1 \text{ k}\Omega \Leftrightarrow \frac{1}{1000} = 1 \text{ mS}$$

$$G = 4 \text{ mS}$$

$$R = \frac{1}{G} = \frac{1}{4 \times 10^{-3} \text{ S}} = \frac{1}{4} \text{ k}\Omega$$

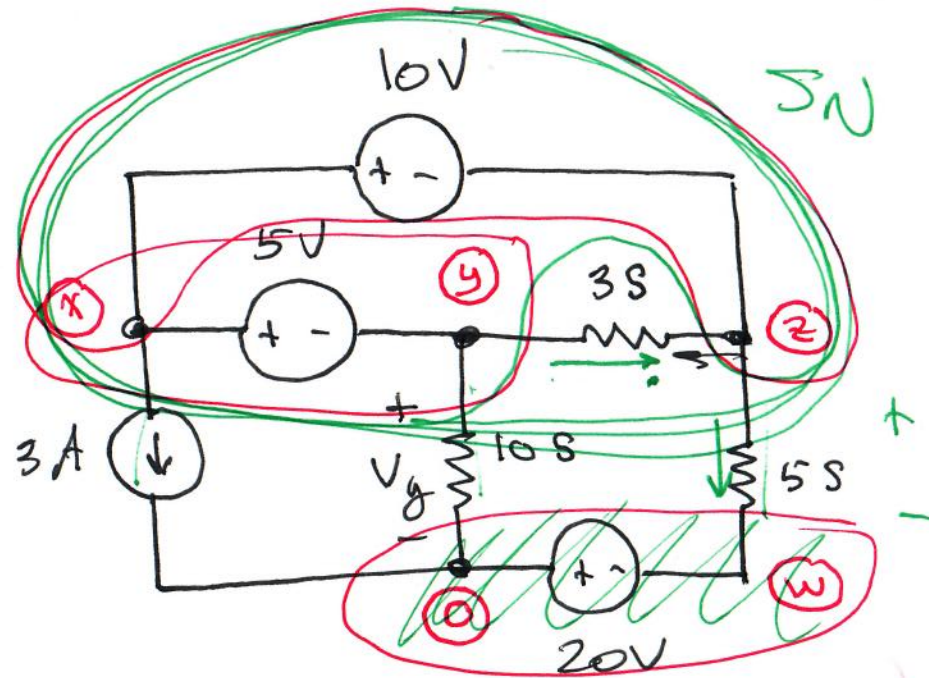
$$\text{Eq 1} \quad 3V_1 + 4V_2 + 2V_3 = 7$$

$$\text{Eq 2} \quad V_1 - 2V_2 + 6V_3 = 0$$

$$\text{Eq 3} \quad -V_1 + 6V_2 - 12V_3 = 5$$

~~$V_1 \quad V_2 \quad V_3$~~

$$\begin{array}{l} \text{Eq 1} \\ \text{Eq 2} \\ \text{Eq 3} \end{array} \left[\begin{array}{c|c|c} 3 & 4 & 2 \\ \hline 1 & -2 & 6 \\ \hline -1 & 6 & -12 \end{array} \right] \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix} = \begin{bmatrix} 7 \\ 0 \\ 5 \end{bmatrix}$$



Find V_y .

$$V_w = -20$$

$$V_x - V_z = 10$$

$$V_x - V_y = 5$$

$$3 + 10V_y + 5(V_z - V_w) = 0 \quad (\text{KCL for SN})$$

$$+ 3(V_y - V_z) + 3(V_z - V_y)$$

$$V_o - V_w = 20$$

↑
≡ 0

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & -1 & 0 \\ -5 & 0 & 0 & 5 \end{bmatrix} \begin{bmatrix} v_w \\ v_x \\ v_y \\ v_z \end{bmatrix} = \begin{bmatrix} -20 \\ 10 \\ 5 \\ -3 \end{bmatrix}$$