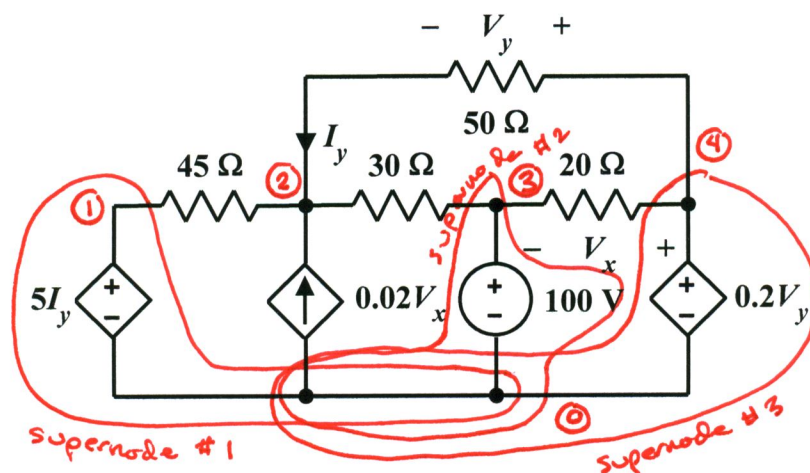# Problem #07

Use the nodal analysis method to determine V_x and I_y.

$V_1 = 5 I_y$ (constraint equation for supernode #1)

$U_3 = 100 V$ (constraint equation for supernode #2)

$V_4 = 0.2 V_y$ (constraint equation for supernode #3)

$\dfrac{V_2 - V_1}{45 \Omega} - 0.02 V_x + \dfrac{V_2 - V_3}{30 \Omega} + \dfrac{V_2 - V_4}{50 \Omega} = 0$ (KCL at node 2)

$V_x = V_4 - V_3$ (control variable definition)

$V_y = V_4 - V_2$ (control variable definition)

$I_y = \dfrac{V_4 - V_2}{50 \Omega}$ (control variable definition)

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & -5 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & -0.2 & 0 \\ -1/45 & 17/225 & -1/30 & -1/50 & -0.02 & 0 & 0 \\ 0 & 0 & 1 & -1 & 1 & 0 & 0 \\ 0 & 1 & 0 & -1 & 0 & 1 & 0 \\ 0 & 1/50 & 0 & -1/50 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_x \\ V_y \\ I_y \end{bmatrix} = \begin{bmatrix} 0 \\ 100 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$V_x = -103.77 \ V$, $I_y = -0.3774 \ A$