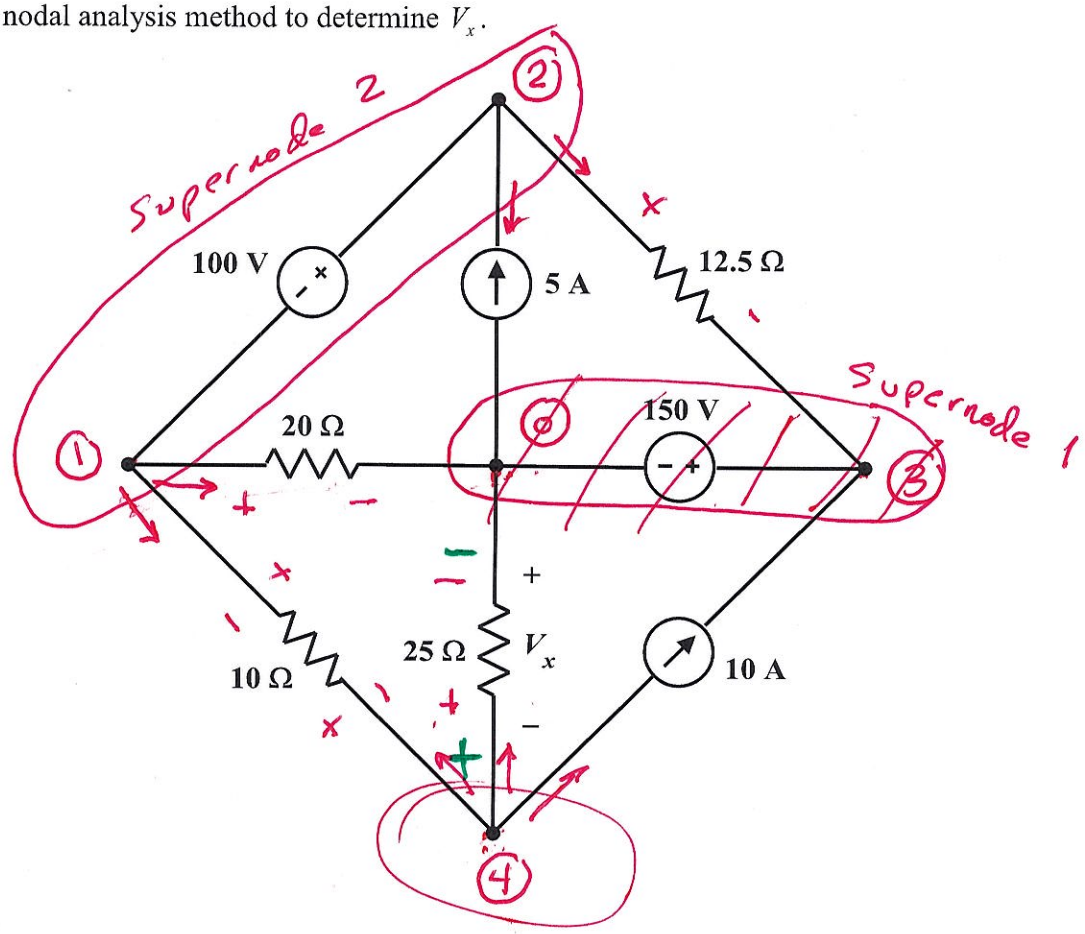
Use the nodal analysis method to determine V_x.



$V_3 = 150$ (constraint, supernode 1)

$V_2 - V_1 = 100$ (constraint, supernode 2)

$$\frac{V_2 - V_3}{12.5} - 5 + \frac{V_1}{20} + \frac{V_1 - V_4}{10} = 0$$ (KCL for supernode 2)

$$10 + \frac{V_4}{25} + \frac{V_4 - V_1}{10} = 0$$ (KCL for node 4)

$V_x = -V_4$

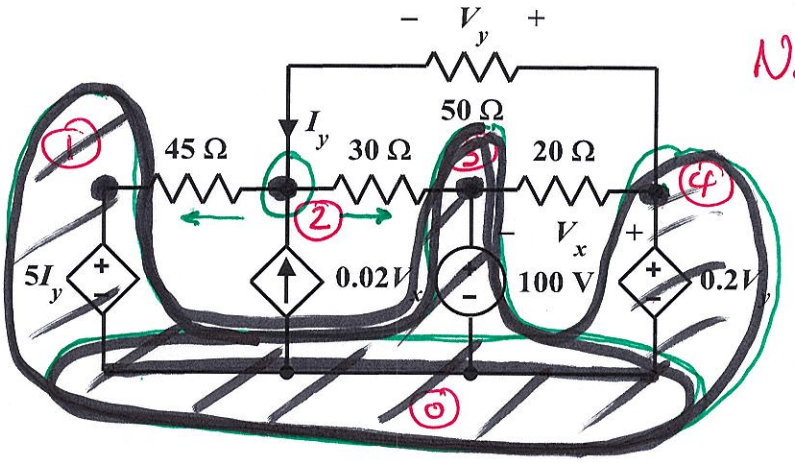
$$\begin{bmatrix} 0 & 0 & 1 & 0 \\ -1 & 1 & 0 & 0 \\ 5/20 & 1/12.5 & -1/12.5 & -4/10 \\ -1/10 & 0 & 0 & 7/50 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{bmatrix} = \begin{bmatrix} 150 \\ 100 \\ 5 \\ -10 \end{bmatrix}$$

Practice Problem 6 on Nodal Analysis

Practice Problem 7

Nodal Analysis

Use the nodal analysis method to determine V_x and I_y.



$V_1 = 5I_y$

$V_4 = 0.2V_y$

$V_3 = 100$

$I_y + 0.02V_x = \left(\frac{V_2 - V_3}{30}\right) + \left(\frac{V_2 - V_1}{45}\right) = 0$

$V_y = V_4 - V_2$

$V_x = V_4 - V_3$

$I_y = \frac{V_4 - V_2}{50}$

$$
\begin{array}{c}
\begin{matrix} V_1 & V_2 & V_3 & V_4 & V_x & V_y & I_y \end{matrix} \\
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 & -5 \\
0 & 0 & 0 & 1 & 0 & -0.2 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 \\
1/45 & -1/18 & 1/30 & 0 & 0.02 & 0 & 1 \\
0 & -1 & 0 & 1 & 0 & -1 & 0 \\
0 & 0 & 1 & -1 & 1 & 0 & 0 \\
0 & 1/50 & 0 & -1/50 & 0 & 0 & 1
\end{bmatrix}
\end{array}
\begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_x \\ V_y \\ I_y \end{bmatrix}
=
\begin{bmatrix} 0 \\ 0 \\ 100 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}
$$