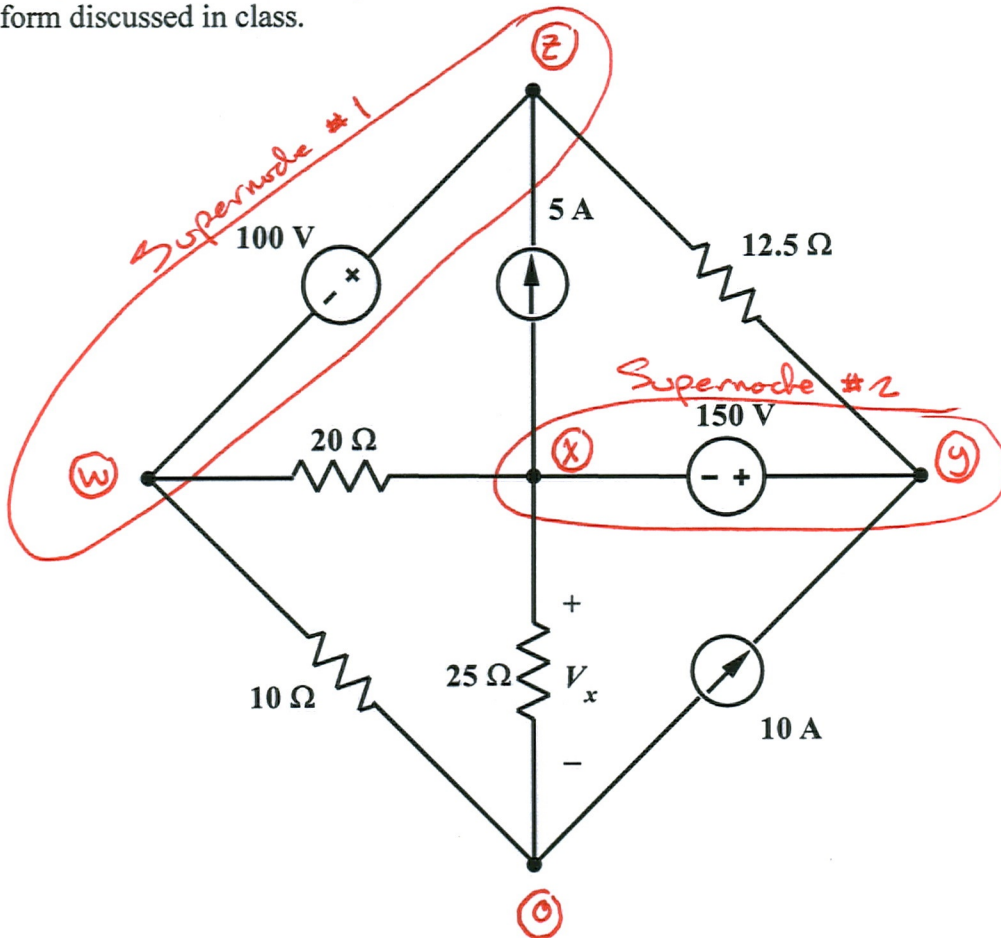


## Homework Problem #022

Write the equations needed to analyze this circuit by the nodal method, and write them in the matrix form discussed in class.



$$V_z - V_w = 100 \text{ V} \quad (\text{constraint \#1})$$

$$V_y - V_x = 150 \text{ V} \quad (\text{constraint \#2})$$

$$\frac{V_w}{10} + \frac{V_w - V_x}{20} - 5 + \frac{V_z - V_y}{12.5} = 0 \quad (\text{KCL for SN\#1})$$

$$\frac{V_y - V_z}{12.5} + 5 + \frac{V_x - V_w}{20} + \frac{V_x}{25} - 10 = 0 \quad (\text{KCL for SN\#2})$$

In matrix form:

$$\begin{bmatrix} -1 & 0 & 0 & 1 \\ 0 & -1 & 1 & 0 \\ 3/20 & -1/20 & -1/12.5 & 1/12.5 \\ -1/20 & 1/100 & 1/12.5 & -1/12.5 \end{bmatrix} \begin{bmatrix} V_w \\ V_x \\ V_y \\ V_z \end{bmatrix} = \begin{bmatrix} 100 \\ 150 \\ 5 \\ 5 \end{bmatrix}$$