

$$\text{KCL: } \frac{25 - v_o}{(120 + 5)} + 0.04 = \frac{v_o}{25}$$

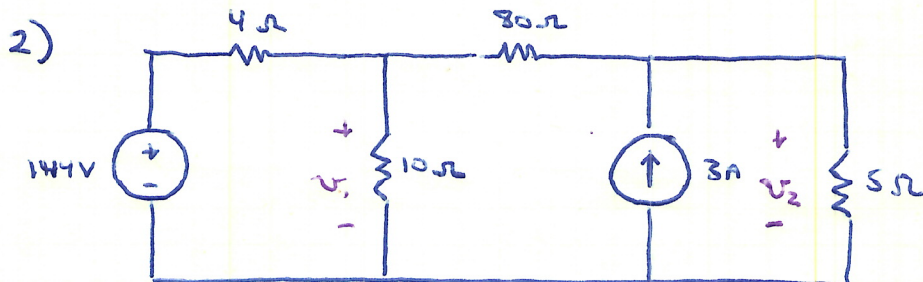
$$\left(\frac{1}{125} + \frac{1}{25}\right)v_o = 0.2 + 0.04$$

$$6v_o = 30$$

$$v_o = 5 \text{ V}$$

$$\text{POWER} = IV = \left(\frac{25 - 5}{(120 + 5)}\right)(25)$$

$$P = 4 \text{ W}$$



$$\text{KCL: } \frac{144 - v_1}{4} - \frac{v_1}{10} - \frac{v_1 - v_2}{80} = 0 \Rightarrow 29v_1 - v_2 = 2880$$

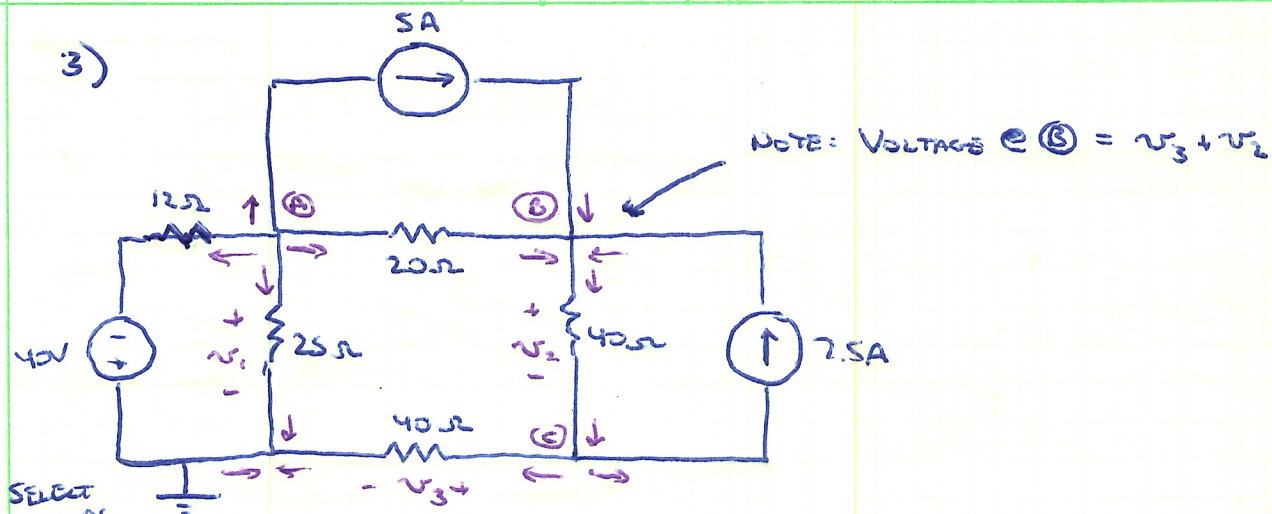
$$\frac{v_1 - v_2}{80} + 3 - \frac{v_2}{5} = 0 \Rightarrow -v_1 + 17v_2 = 240$$

$$\begin{bmatrix} 29 & -1 & | & 2880 \\ -1 & 17 & | & 240 \end{bmatrix} \Rightarrow \begin{bmatrix} 1 & 0 & | & 100 \\ 0 & 1 & | & 20 \end{bmatrix}$$

$$v_1 = 100 \text{ V}$$

$$v_2 = 20 \text{ V}$$

3)



KCL: (A) $\frac{v_1 + 40}{12} + \frac{v_1}{25} + \frac{v_1 - (v_2 + v_3)}{20} + 5 = 0$

(B) $\frac{v_1 - (v_2 + v_3)}{20} + 5 + 7.5 = \frac{v_2}{40}$

(C) $\frac{v_2}{40} = \frac{v_3}{40} + 7.5$

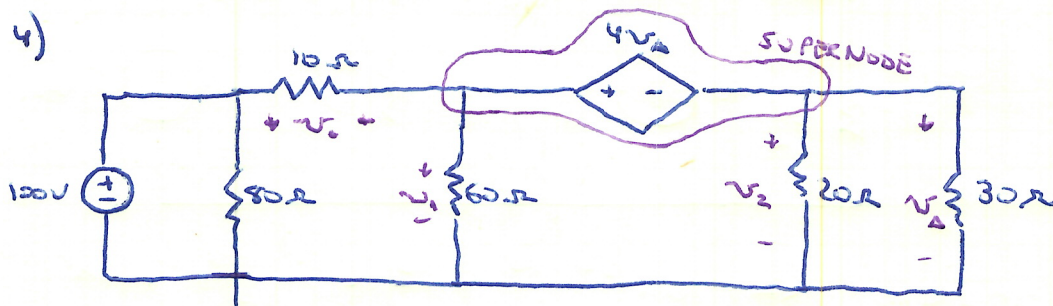
$$\begin{bmatrix} 0.173 & -0.05 & -0.05 & -8.333 \\ 0.05 & -0.075 & -0.05 & -12.50 \\ 0 & 0.025 & -0.025 & 7.50 \end{bmatrix}$$



$$\begin{bmatrix} 1 & 0 & 0 & -10 \\ 0 & 1 & 0 & 216 \\ 0 & 0 & 1 & -84 \end{bmatrix} \Rightarrow$$

$$\begin{matrix} v_1 = -10V \\ v_2 = 216V \\ v_3 = -84V \end{matrix}$$

4)



SUPERNODE: $\frac{100 - v_1}{10} - \frac{v_1}{60} - \frac{v_2}{20} - \frac{v_\Delta}{30} = 0$

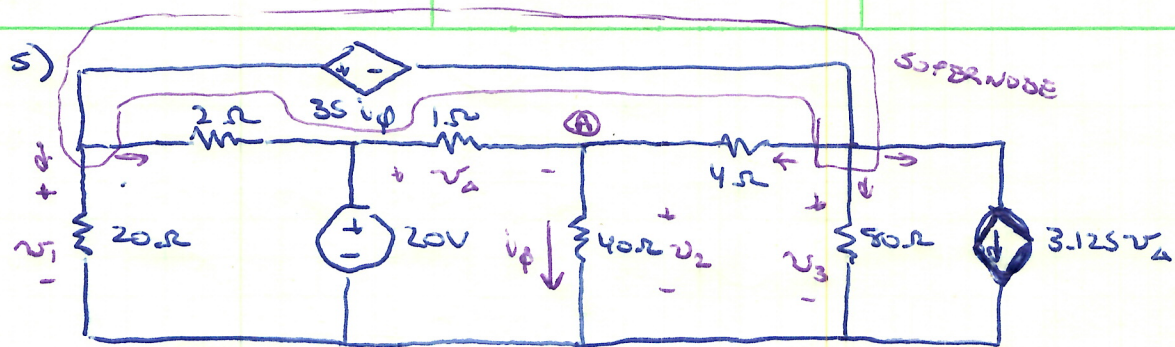
DEPENDANT SOURCE: $v_1 - v_2 = 4v_\Delta = 4v_2$ because $v_2 = v_\Delta$

$$\frac{v_1}{10} + \frac{v_1}{60} + \frac{v_2}{20} + \frac{v_2}{30} = 10$$

$$\begin{cases} 7v_1 + 5v_2 = 600 \\ v_1 = 5v_2 \end{cases}$$

$$8v_1 = 600 \Rightarrow v_1 = 75V \\ v_2 = 15V$$

$$v_3 = 100 - v_1 \\ \boxed{v_3 = 25V}$$



$$\text{SUPERNODE: } \frac{v_1}{20} + \left(\frac{v_1 - 20}{2} \right) + \left(\frac{v_3 - v_2}{4} \right) + \frac{v_3}{80} + 3.125v_\Delta = 0$$

$$\text{NODE A: } \frac{20 - v_2}{1} + \frac{v_3 - v_2}{4} = \frac{v_2}{40}$$

$$\text{CONSTRAINTS: } v_\Delta = 20 - v_2$$

$$v_1 - 35i_\phi - v_3 = 0$$

$$i_\phi = \frac{v_2}{40}$$

THUS:

$$\text{SUPERNODE: } \left(\frac{1}{20} + \frac{1}{2} \right) v_1 - \left(\frac{1}{4} + 3.125 \right) v_2 + \left(\frac{1}{4} + \frac{1}{80} \right) v_3 = 10 - 3.125(20)$$

$$\text{NODE A: } \left(\frac{1}{4} + \frac{1}{40} + 1 \right) v_2 - \frac{1}{4} v_3 = 20$$

$$v_1 - \left(\frac{35}{40} \right) v_2 - v_3 = 0$$

$$\left[\begin{array}{ccc|c} 0.55 & -3.375 & 0.2625 & -52.5 \\ 0 & 1.275 & -0.25 & 20 \\ 1 & -0.875 & -1 & 0 \end{array} \right]$$

↓

$$\left[\begin{array}{ccc|c} 1 & 0 & 0 & -20.25 \\ 0 & 1 & 0 & 10 \\ 0 & 0 & 1 & -29 \end{array} \right]$$

$$v_1 = -20.25V$$

$$v_2 = 10V$$

$$v_3 = -29V$$

$$v_\Delta = 20 - v_2 = 10V$$

$$i_\phi = \frac{v_2}{40} = 0.25A$$