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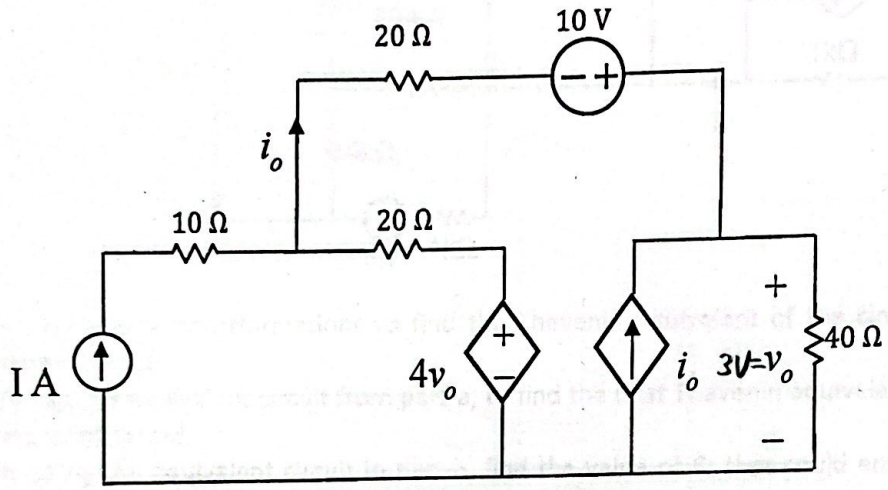
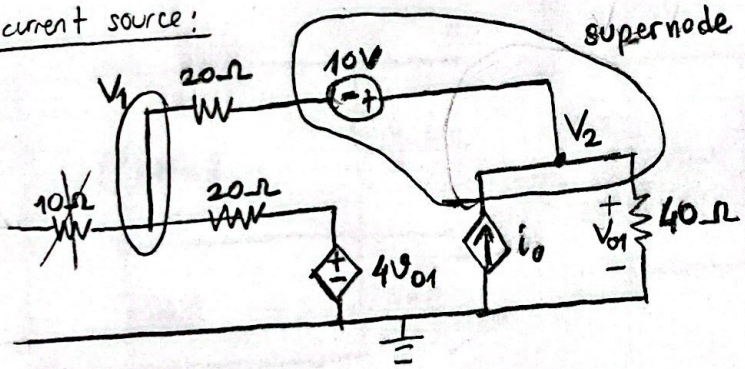
Question 2 (30 pts)

In the circuit shown below, the independent current source magnitude I is not known. However, the output voltage v_o across the 40 Ω resistor is measured as 3 V. Find the corresponding output voltage v_o when the independent current source magnitude becomes $2I$ amperes.
Hint: Superposition principle might be helpful.



Kill current source!



KCL¹ $\frac{V_1}{10} + \frac{V_1 - 4v_{01}}{20} + \frac{V_1 - (V_2 - 10)}{20} = 0$

KCL² $\frac{V_2 - 10 - V_1}{20} + \frac{V_2}{40} = i_o$

const $\frac{V_2}{40} = V_{01}$, const $\frac{V_1 - V_2 + 10}{20} = i_o$

$$\begin{bmatrix} \frac{1}{10} & \frac{-11}{200} & \frac{-1}{2} \\ \frac{-1}{10} & \frac{1}{8} & \frac{1}{2} \end{bmatrix} \rightarrow \begin{bmatrix} 1/10 & -11/200 & -1/2 \\ 0 & \frac{14}{200} & 0 \end{bmatrix} \Rightarrow \begin{matrix} V_2 = 0\ V \\ V_1 = -5V \\ V_{01} = 0\ V \end{matrix}$$

$V_o' = V_o + V_{01}$

$= 3\ V$