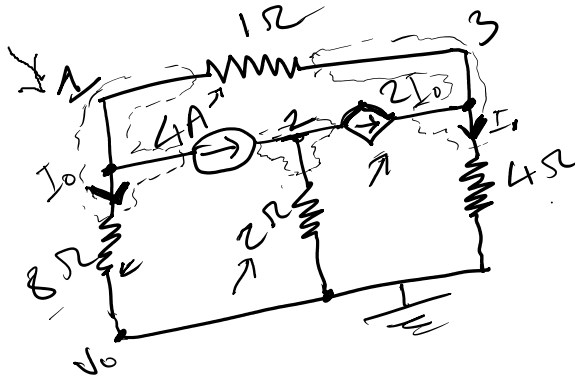


Nodal AnalysisEx. 3.10

$$I_o = \frac{\Delta V}{R} = \frac{V_1 - 0}{8} = \frac{V_1}{8}$$

Node 1 → $V_1 \left(\frac{1}{8} + \frac{1}{1} \right) - \frac{V_3}{1} + 4 = 0 \quad \text{--- (i)}$

Node 2 → $\frac{V_2}{2} + 2I_o - 4 = 0$

$$\frac{V_2}{2} + \frac{V_1}{4} - 4 = 0 \quad \text{--- (ii)}$$

Node 3 → $V_3 \left(\frac{1}{4} + \frac{1}{1} \right) - \frac{V_1}{1} - 2 \cdot \frac{V_1}{8} = 0$

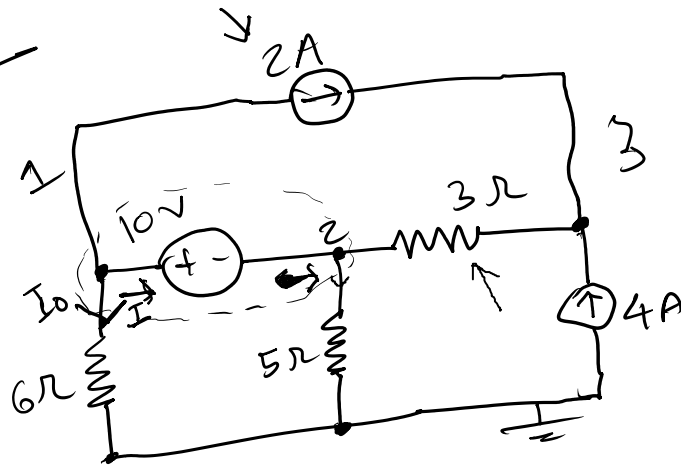
$$\Rightarrow V_3 \left(\frac{1}{4} + 1 \right) - V_1 \left(1 + \frac{1}{4} \right) = 0 \quad \text{--- (iii)}$$

Solving (i), (ii), (iii),

$$V_1 = 16 \text{ V}$$

$$I_o = \frac{16}{8} = \boxed{2 \text{ A}}$$

3.15



SuperNode → Node 1 & Node 2

$$V_1 - V_2 = 10 \text{ V} \quad \text{--- (i)}$$

$$V_1 \left(\frac{1}{6} \right) + 2 + V_2 \left(\frac{1}{5} + \frac{1}{3} \right) - \frac{V_3}{3} = 0 \quad \text{--- (ii)}$$

Node 3

$$V_3 \left(\frac{1}{3} \right) - V_2 \left(\frac{1}{3} \right) - 2 - 4 = 0$$

$$\Rightarrow V_3/3 - V_2/3 - 6 = 0 \quad \text{--- (iii)}$$

Solving (i), (ii), (iii),

$$V_1 \rightarrow 102 \text{ V}$$

V_2
 V_3

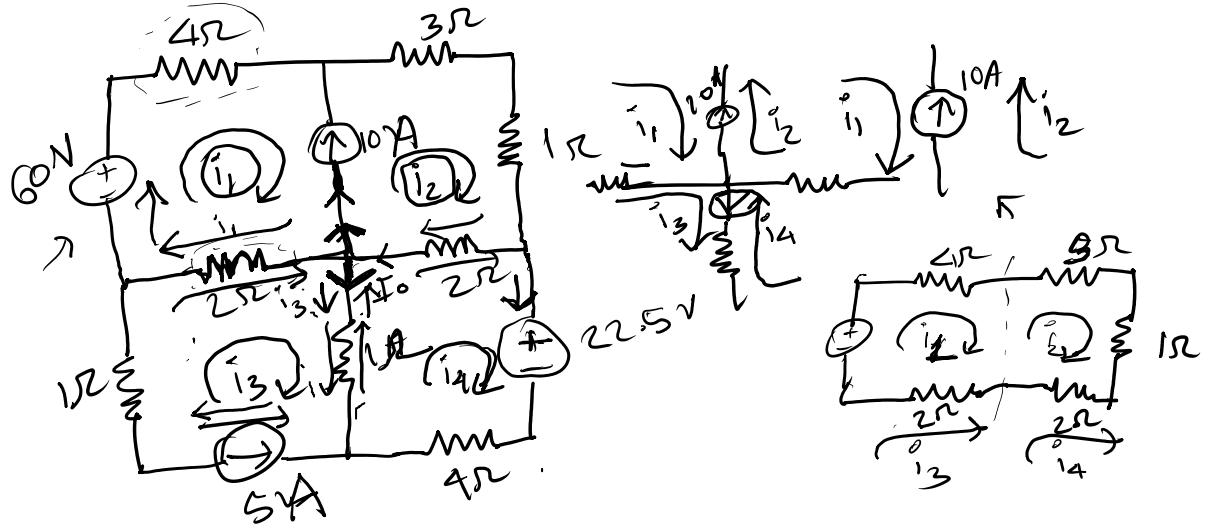
$$I_0 = \frac{V_1}{6} = 2 \text{ A}$$

$$P_{6\Omega} = I_0^2 R = 2^2 \times 6 = \boxed{24 \text{ W}}$$

$$P_{3\Omega} = (\Delta V)^2 / R = \frac{(V_2 - V_3)^2}{3}$$

Mesh Analysis

3.38



SuperMesh → Loop 1-2

$$i_2 - i_1 = 10 \quad \text{--- (i)}$$

$$-60 + 4i_1 + 5i_2 + i_2 + 2i_2 - 2i_4 + 2i_1 - 2i_3 = 0$$

$$6i_1 + 6i_2 - 2i_3 - 2i_4 = 60 \quad \text{--- (ii)}$$

Loop-3

$$i_3 = -5 \quad \text{--- (iii)}$$

Loop-4

$$2i_4 - 2i_2 + 22.5 + 4i_4 + i_4 - i_3 = 0$$

$$\Rightarrow 7i_4 - 2i_2 - i_3 = -22.5 \quad \text{--- (iv)}$$

$$I_o = ?$$

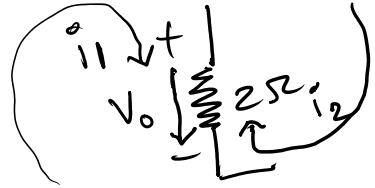
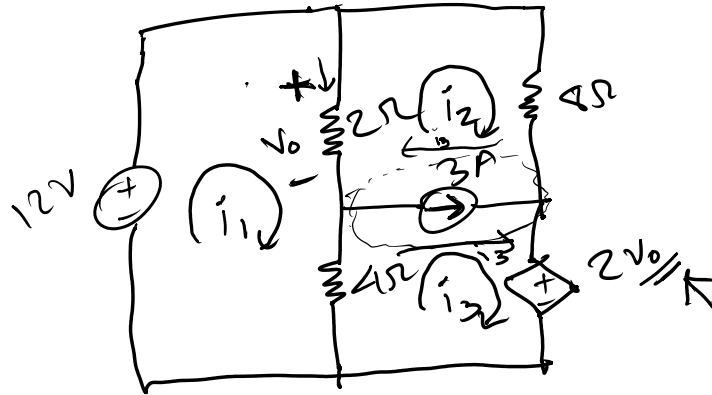
Solving Eqn. (i) - (iv) ---

$$\begin{aligned} i_1 &= 5A \\ i_3 &= \underline{\underline{3A}} \end{aligned} \qquad \begin{aligned} i_2 &= -2A \\ i_4 &= \underline{\underline{10A}} \end{aligned}$$

$$\begin{aligned} I_o &= i_3 - i_4 = (3 - 10)A \\ &= -7A \end{aligned}$$

3.52

i_1
 i_2
 i_3



$$V_o = (i_1 - i_2) \cdot 2 = 2i_1 - 2i_2 \quad \text{--- (0)}$$

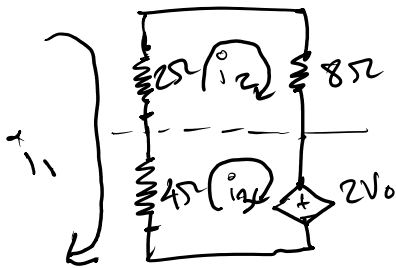
Loop 1

$$-12 + 2i_1 + 4i_1 - 2i_2 - 4i_3 = 0$$

$$\Rightarrow \boxed{6i_1 - 2i_2 - 4i_3 = 12} \quad \text{--- (i)}$$

Supermesh

$$\boxed{i_3 - i_2 = 3} \quad \text{--- (ii)}$$

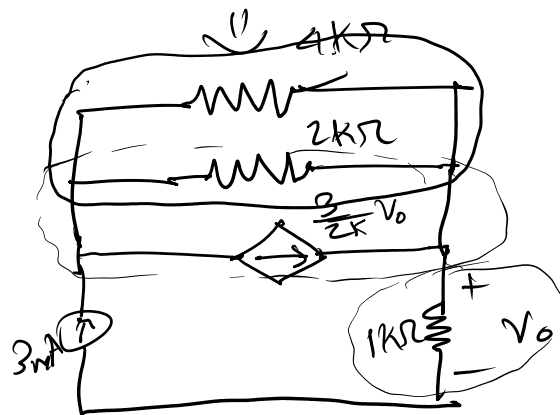
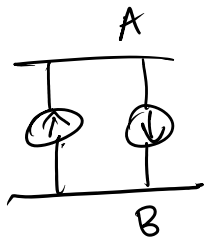
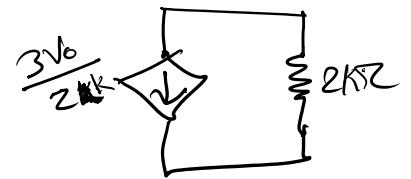
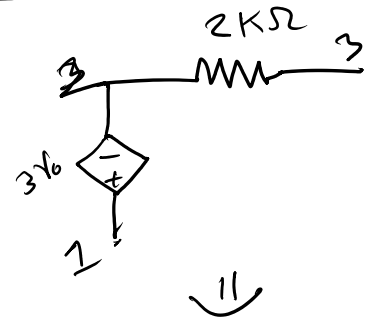
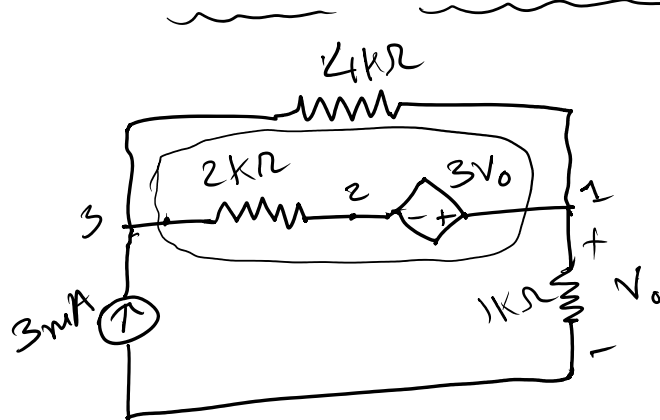


$$\Rightarrow 2i_2 - 2i_1 + 8i_2 + 4i_3 - 4i_1 + 2V_o = 0$$

$$\Rightarrow 2i_2 - 2i_1 + 8i_2 + 4i_3 - 4i_1 + 2(2i_1 - 2i_2) = 0$$

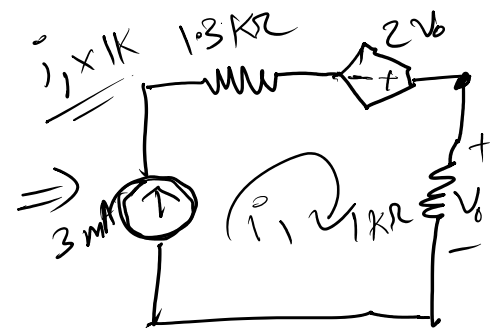
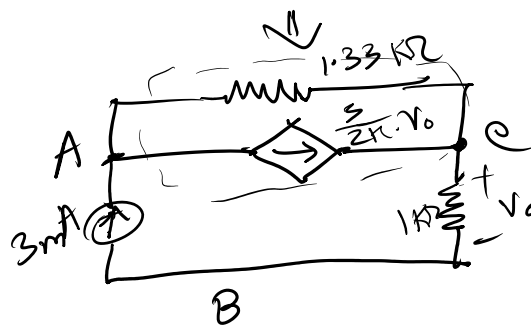
$$\Rightarrow \boxed{-2i_1 + 6i_2 + 4i_3 = 0} \quad \text{--- (iii)}$$

Source Transformation



$$1.33 \text{ k}\Omega \left(\frac{1}{4\text{k}} + \frac{1}{2\text{k}} \right)^{-1}$$

$$V = IR = \frac{4}{3} \times \frac{3}{6} = 2$$



$$3\text{mA} = 13\text{mA} \times 1\text{k}\Omega$$

$$= \boxed{3\text{V}} \quad (\text{Ans.})$$