



Step-2: $i_x = \frac{V_1 - V_0}{6} = \frac{V_1}{6}$

$$V_5 - V_4 = 8 \quad \text{--- (i)}$$

$$V_2 - V_3 = 16 \quad \text{--- (ii)}$$

$$V_3 - V_5 = 4i_x$$

$$\therefore V_3 - V_5 = 4 \cdot \frac{V_1}{6}$$

$$\frac{2}{3}V_1 - V_3 + V_5 = 0 \quad \text{--- (iii)}$$

At node 1:

$$V_1 \left(\frac{1}{6} + \frac{1}{3} + \frac{1}{2} \right) - \frac{V_5}{3} - \frac{V_2}{2} = 0$$

$$V_1 - \frac{V_2}{2} - \frac{V_5}{3} = 0 \quad \text{--- (iv)}$$

At Super node 2, 3, 4, 5

~~add~~

$$\frac{V_2 - V_1}{2} + \frac{V_3 - V_4}{2} + V_4 \left(\frac{1}{8} + \frac{1}{2} \right) - \frac{V_3}{2} + \frac{V_5 - V_1}{3} - 1 = 0$$

$$\frac{V_2}{2} - \frac{V_1}{2} + \frac{V_3}{2} - \frac{V_4}{2} + \frac{V_4}{8} + \frac{V_4}{2} - \frac{V_3}{2} + \frac{V_5}{3} - \frac{V_1}{3} = 1$$

$$\Rightarrow \frac{V_2}{2} - \frac{5}{6}V_1 + \frac{V_3}{2} + \frac{V_3}{2} - \frac{V_3}{2} + \frac{V_4}{8} + \frac{V_5}{3} = 1$$

$$\Rightarrow -\frac{5}{6}V_1 + \frac{V_2}{2} + 0V_3 + \frac{V_4}{8} + \frac{V_5}{3} = 1$$

$$\Rightarrow -\frac{5}{6}V_1 + \frac{V_2}{2} + 0 \cdot V_3 + \frac{V_4}{8} - 1 = 1$$

$$\Rightarrow -\frac{5}{6}V_1 + \frac{V_2}{2} + 0 \cdot V_3 + \frac{V_4}{8} = 2$$

$$V_1 = 12V, \quad V_2 = 24, \quad V_3 = 8, \quad V_5 = 0$$

$$\therefore V_5 - V_4 = 8$$

$$\therefore V_4 = -8V$$

$$\frac{V_1}{4} - \frac{V_3}{8} - \frac{V_4}{4} + \frac{V_5}{4} = -8$$

$$\frac{V_1}{4} - \frac{V_3}{8} - \frac{V_4}{4} + \frac{V_2 - 8}{4} = -8$$

$$\frac{V_1}{4} + \frac{V_2}{4} - \frac{V_3}{8} - \frac{V_4}{4} = -6 \quad \text{--- (V)}$$

Supernode 2, 3, 4, 5

$$\frac{V_2 - V_1}{2} + V_3 \left(\frac{1}{10} + \frac{1}{8} \right) - \frac{V_5}{10} + \frac{V_4 - V_5}{4} = 8$$

$$+ V_5 \left(\frac{1}{10} + \frac{1}{4} \right) - \frac{V_3}{10} - \frac{V_4}{4} = 0$$

$$\frac{V_2}{2} - \frac{V_1}{2} + \frac{V_3}{10} + \frac{V_4}{8} - \frac{V_5}{10} + \frac{V_4}{4} - \frac{V_5}{4} + \frac{V_5}{10} + \frac{V_5}{4}$$

$$- \frac{V_3}{10} - \frac{V_4}{4} = 8$$

$$-\frac{V_1}{2} + \frac{V_2}{2} + \frac{V_3}{8} = 8$$

$$V_1 = 16 \quad V_2 = 24 \quad V_3 = 32$$

$$V_4 = 48$$

$$V_5 = V_2 - 8$$

$$= 16V$$

$$\text{So, } i_x = \frac{V_1}{4} = \frac{16}{4} = 4A$$