P 4.4-13

$$V_2 - V_1 = 8 \text{ V}$$

$$V_4 - V_3 = 16 \text{ V}$$

$$\left.\begin{aligned} I_x &= \frac{V_2 - V_3}{10} + \frac{V_1 - V_3}{5} \\ V_5 &= 4 i_x \rightarrow i_x = \frac{V_5}{4} \end{aligned}\right\} \Longrightarrow \frac{V_5}{4} = \frac{2V_1 + V_2 - 3V_2}{10} \quad (1)$$

$$\frac{V_1 - V_5}{2} + \frac{V_1 - V_3}{5} + \frac{V_2 - V_3}{10} + \frac{V_2 - V_4}{4} = 0$$

$$\Rightarrow 21V_2 - 11V_3 - 10V_5 = -32 \quad (2)$$

$$\frac{V_4 - V_2}{2} - 2 + \frac{V_3 - V_2}{10} + \frac{V_3 - V_1}{5} + \frac{V_3}{8} = 0$$

$$\Rightarrow -22V_2 + 27V_3 = -16$$

$$-64 = 8V_2 + 4V_2 - 12V_3 - 10V_3 \quad (3)$$

$$\Rightarrow \begin{bmatrix} 12 & -12 & -10 \\ -22 & 27 & 0 \\ 21 & -11 & -10 \end{bmatrix} \begin{bmatrix} V_2 \\ V_3 \\ V_5 \end{bmatrix} = \begin{bmatrix} -64 \\ -16 \\ -32 \end{bmatrix}$$

$$\Rightarrow \begin{cases} V_1 = 11.32 \text{ V} \\ V_2 = 3.32 \text{ V} \\ V_3 = 2.11 \text{ V} \\ V_4 = 18.11 \text{ V} \\ V_5 = 7.85 \text{ V} \end{cases}$$