

$$\frac{V_x - V_1}{4} - 12 = 0 \Rightarrow V_x - V_1 = 48$$

$$\frac{V_1 - V_x}{4} + \frac{V_1}{10} + \frac{V_1 - V_2 - 20}{5} = 0 \Rightarrow 5V_1 - 5V_x + 2V_1 + 4V_1 - 4V_2 - 80 = 0$$

$$11V_1 - 4V_2 - 5V_x = 80$$

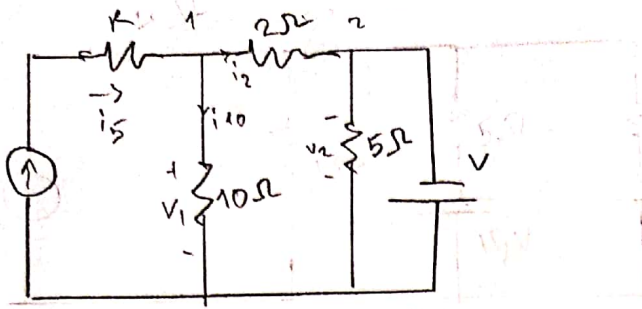
$$V_2 = \frac{3V_1}{2} - 80 = \frac{3V_1 - 160}{2}$$

$$\frac{-15 + V_2}{5} + \frac{V_2 + 20 - V_1}{5} + \frac{10 + V_2}{5} = 0$$

$$3V_2 - V_1 + 15 = 0 \Rightarrow 3V_2 - V_1 = -15$$

$$\frac{9V_1}{2} - 240 - V_1 = -15 \Rightarrow \frac{7V_1}{2} = 225 \Rightarrow V_1 = \frac{450}{7}$$

2)



$$V = I \cdot R$$

$$20 = I \cdot 10$$

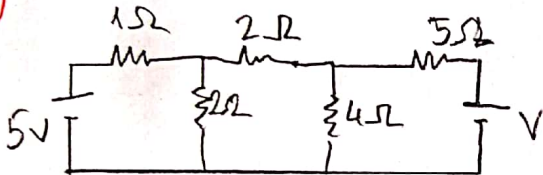
$$I = 2A$$

$$i_2 = 6A - 2A = 4A$$

$$V = I R \Rightarrow V = 4 \cdot 2 = 8V$$

$$\sum V = 0 \Rightarrow 20 - 8 + V = 0 \Rightarrow V = -12V$$

3)



$$5 - I_1 - 2I_1 + 2I_2 = 0 \Rightarrow 3I_1 - 2I_2 = 5$$

$$-3I_2 - 4I_2 + 4I_3 - 2(I_2 - I_4) = 0 \Rightarrow 2I_1 - 9I_2 + 4I_3 = 0 \Rightarrow 2I_1 - 9I_2 = 0$$

$$-9I_2 + 2I_1 = 0$$

$$-2I_2 + 3I_1 = 5$$

$$I_1 = \frac{45}{23}$$

$$I_2 = \frac{10}{23}$$

$$V - 0.5 - 4 \cdot \frac{10}{23} = 0 \Rightarrow$$

$$V = \frac{40}{23} V$$