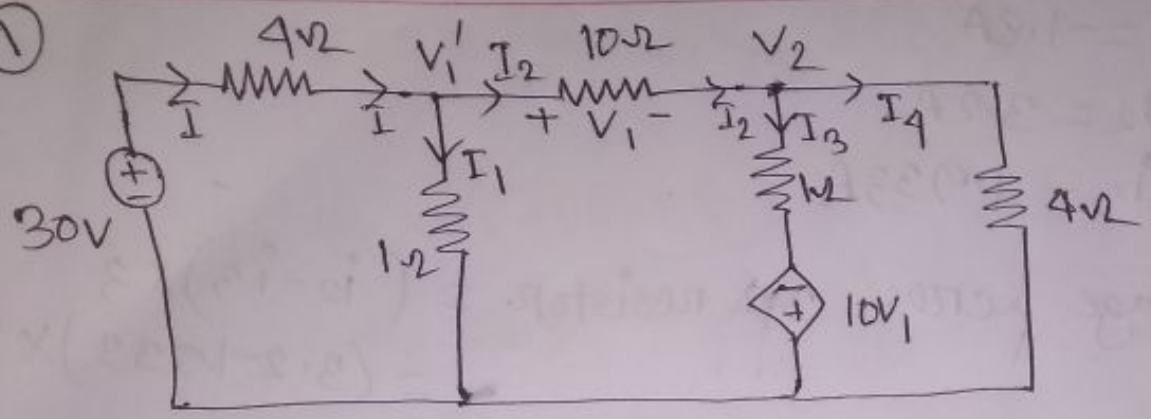
2/9/16
2.5

201-DA

(1)



KCL @ node 1

$$I = I_1 + I_2$$

$$\Rightarrow \frac{30 - V_1'}{4} = \frac{V_1'}{1} + \frac{V_1' - V_2}{10}$$

$$\Rightarrow \frac{30 - V_1'}{4} - V_1' - \frac{V_1' - V_2}{10} = 0$$

$$\Rightarrow \frac{150 - 5V_1' - 20V_1' - 2V_1' + 2V_2}{20} = 0$$

$$\Rightarrow -27V_1' + 2V_2 + 150 = 0 \longrightarrow (i)$$

KCL @ node 2

$$\frac{V_1' - V_2}{10} - \frac{(V_2 + 10V_1)}{1} - \frac{V_2}{4} = 0$$

$$\Rightarrow \frac{V_1' - V_2}{10} - (V_2 + 10(V_1' - V_2)) - \frac{V_2}{4} = 0$$

$$\Rightarrow \frac{V_1' - V_2}{10} - V_2 - 10V_1' + 10V_2 - \frac{V_2}{4} = 0$$

$$\Rightarrow \frac{2V_1' - 2V_2 - 20V_2 - 200V_1' + 200V_2 - 5V_2}{20} = 0$$

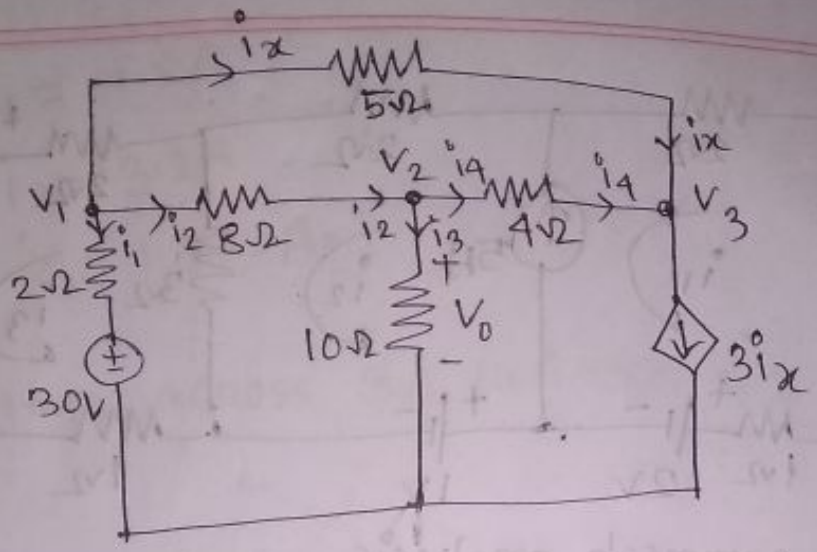
$$\Rightarrow -198V_1' + 173V_2 = 0 \longrightarrow (ii)$$

$\therefore V_1' = 6.1V \quad V_2 = 6.95V$

$$\therefore I = \frac{30 - V_1'}{4} = \frac{30 - 6.1}{4} = 5.975A$$

An

2



2|2,8,5
1,4,5

2|8,10,4
2|4,5,2
2,5,1

KCL @ node 1 $i_1 + i_2 + i_x = 0$

$\Rightarrow \frac{V_1 - 30}{2} + \frac{V_1 - V_2}{8} + \frac{V_1 - V_3}{5} = 0$

$\Rightarrow \frac{20V_1 - 600 + 5V_1 - 5V_2 + 8V_1 - 8V_3}{40} = 0$

$\Rightarrow 33V_1 - 5V_2 - 8V_3 = 600 \longrightarrow (i)$

KCL @ node 2 $i_2 - i_3 - i_4 = 0$

$\Rightarrow \frac{V_1 - V_2}{8} - \frac{V_2}{10} - \frac{V_2 - V_3}{4} = 0$

$\Rightarrow \frac{5V_1 - 5V_2 - 4V_2 - 10V_2 + 10V_3}{40} = 0$

$\Rightarrow 5V_1 - 19V_2 + 10V_3 = 0 \longrightarrow (ii)$

KCL @ node 3 $i_4 + i_x - 3i_x = 0$

$\Rightarrow \frac{V_2 - V_3}{4} + \frac{V_1 - V_3}{5} - 3\cdot\frac{V_1 - V_3}{5} = 0$

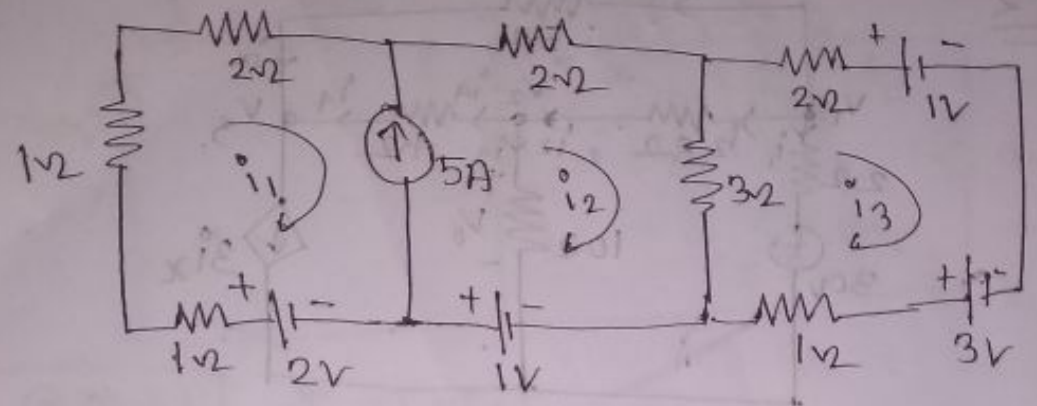
$\Rightarrow \frac{5V_2 - 5V_3 + 4V_1 - 4V_3 - 12V_1 + 12V_3}{20} = 0$

$\Rightarrow -8V_1 + 5V_2 + 3V_3 = 0 \longrightarrow (iii)$

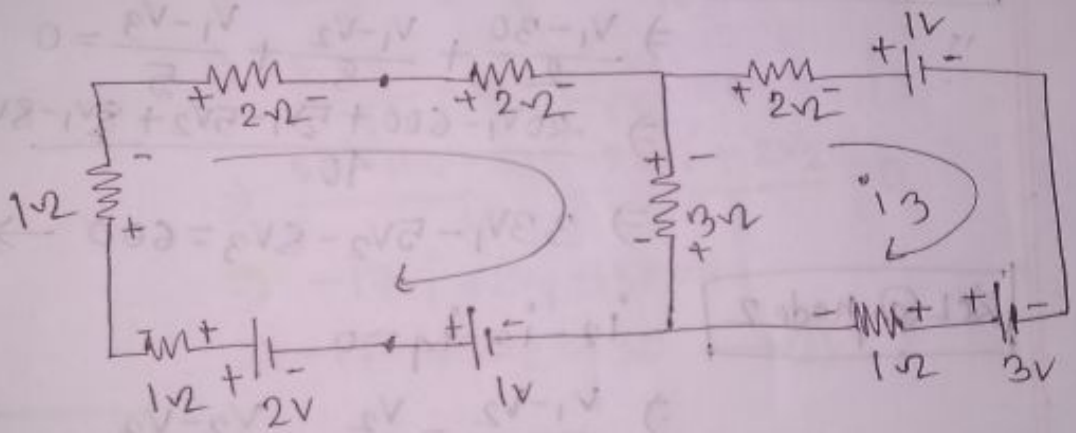
$\therefore V_1 = 31.5V \quad V_2 = 27.94 \quad V_3 = 37.35V \quad \therefore V_0 = V_2 - 0 = 27.94$

Ans

3



Using supermesh analysis, $i_2 - i_1 = 5 \rightarrow (1)$



Applying KVL to supermesh,

$$1i_1 + 2i_1 + 2i_2 + 3(i_2 - i_3) - 1 - 2 + 1i_1 = 0$$

$$\Rightarrow 4i_1 + 2i_2 + 3i_2 - 3i_3 - 3 = 0$$

$$\Rightarrow 4i_1 + 5i_2 - 3i_3 = 3 \rightarrow (11)$$

Applying KVL to mesh3

$$2i_3 + 1 - 3 + i_3 + 3(i_3 - i_2) = 0$$

$$\Rightarrow 3i_3 - 2 + 3i_3 - 3i_2 = 0$$

$$\Rightarrow -3i_2 + 6i_3 = 2 \rightarrow (111)$$

$i_1 = -1.8A$

$i_2 = 3.2A$

$i_3 = 1.933A$

Voltage across 3Ω resistor $= (i_2 - i_3) \times 3$

$= (3.2 - 1.933) \times 3$

$= 3.8V$ Ans: