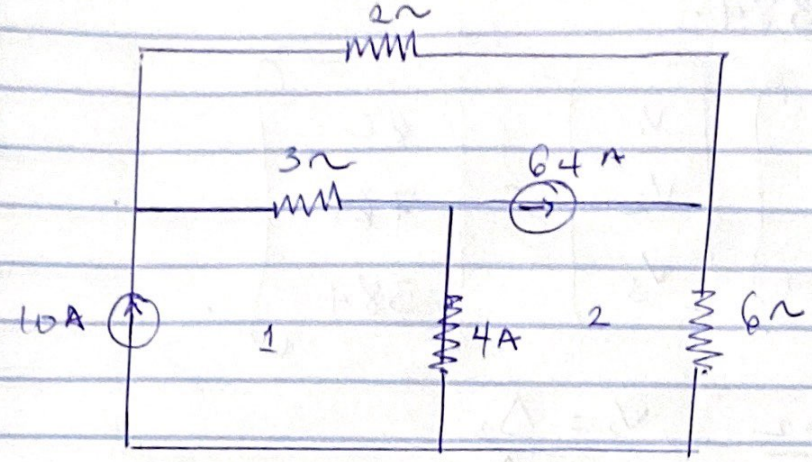
Bakare sharafadeen omogbolahan.
17/Engo2/014
EEE 322 CIRCUIT THEORY II
ELECT/ELECT.



At node 1, KCL

$10 = i_1 + i_2 = \frac{V_1 - V_3}{2} + \frac{V_1 - V_2}{3}$

$60 = 2(V_1 - V_2) + 3(V_1 - V_3)$

$60 = 5V_1 - 2V_2 - 3V_3$ --- (i).

At node 2, KCL

$i_2 = i_3 + 64$

$64 = i_2 - i_3$

$64 = \frac{V_1 - V_2}{3} - \left[\frac{V_2 - 0}{4}\right]$

$768 = 4(V_1 - V_2) - 3V_2$

$768 = 4V_1 - 7V_2$ ---- (ii).

At node 3, KCL

$64 + i_1 = i_3$

$64 = i_3 - i_1$

$64 = \frac{V_3 - 0}{6} - \frac{(V_1 - V_2)}{2}$

$384 = V_3 - -3(V_1 - V_3)$

$384 = -3V_1 + 4V_3$ -- (iii).

Using crammers rule to solve the matrix.

$$5V_1 - 2V_2 - 3V_3 = 60$$
$$4V_1 - 7V_2 = 768$$
$$-3V_1 + 0 + 4V_3 = 384.$$

$$\begin{bmatrix} 5 & -2 & -3 \\ 4 & -7 & 0 \\ -3 & 0 & 4 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix} = \begin{bmatrix} 60 \\ 768 \\ 384 \end{bmatrix}.$$

$$V_1 = \frac{\Delta_1}{\Delta}, \quad V_2 = \frac{\Delta_2}{\Delta}, \quad V_3 = \frac{\Delta_3}{\Delta}.$$

$$\Delta = \begin{vmatrix} 5 & -2 & -3 \\ 4 & -7 & 0 \\ -3 & 0 & 4 \end{vmatrix} =$$

$$+5\begin{vmatrix} -7 & 0 \\ 0 & 4 \end{vmatrix} + 2\begin{vmatrix} 4 & 0 \\ -3 & 4 \end{vmatrix} - 3\begin{vmatrix} 4 & -7 \\ 3 & 0 \end{vmatrix}.$$

$$5(-28) + 2[16 - 0] - 3[0 + 21]$$

$$\Delta = -45 //.$$

$$\Delta_1 = \begin{vmatrix} 60 & -2 & -3 \\ 768 & -7 & 0 \\ 384 & 0 & 4 \end{vmatrix}$$

$$\Delta_1 = 60\begin{vmatrix} -7 & 0 \\ 0 & 4 \end{vmatrix} + 2\begin{vmatrix} 768 & 0 \\ 384 & 4 \end{vmatrix} - 3\begin{vmatrix} 768 & -7 \\ 384 & 0 \end{vmatrix}$$

$$\Delta_1 = -3600 //.$$

$$\Delta_2 = \begin{vmatrix} 5 & 60 & -3 \\ 4 & 768 & 0 \\ -3 & 384 & 4 \end{vmatrix}$$

$$\Delta_2 = 5\begin{vmatrix} 768 & 0 \\ 384 & 4 \end{vmatrix} - 60\begin{vmatrix} 4 & 0 \\ -3 & 4 \end{vmatrix} -3\begin{vmatrix} 4 & 768 \\ -3 & 384 \end{vmatrix}.$$

$$\Delta_2 = 2800.$$

$$\Delta_3 = \begin{vmatrix} 5 & -2 & 60 \\ 4 & -7 & 768 \\ -3 & 0 & 384 \end{vmatrix}.$$

$$\Delta_3 = 5\begin{vmatrix} -7 & 768 \\ 0 & 384 \end{vmatrix} + 2\begin{vmatrix} 4 & 768 \\ -3 & 384 \end{vmatrix} + 60\begin{vmatrix} 4 & -7 \\ -3 & 0 \end{vmatrix}$$

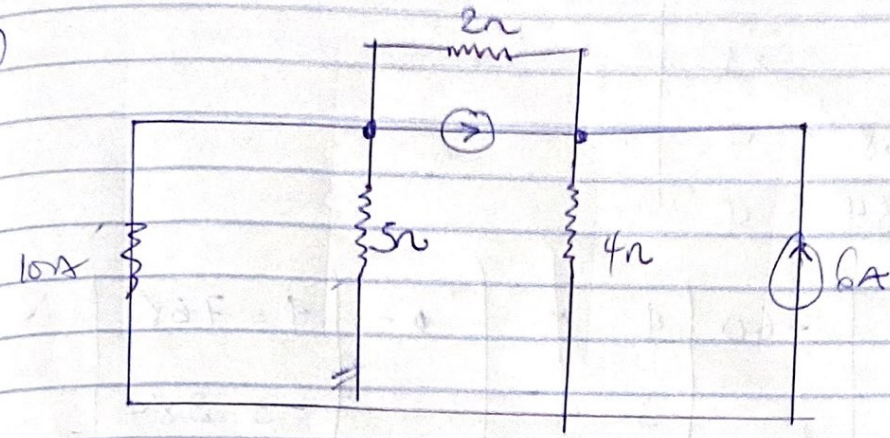
$$\Delta_3 = -7020.$$

$$V_1 = \frac{\Delta_1}{\Delta} = \frac{-3600}{-45} = 80V$$

$$V_2 = \frac{\Delta_2}{\Delta} = \frac{2800}{45} = -64v$$

$$V_3 = \frac{\Delta_3}{\Delta} = \frac{-7020}{-45} = 156V.$$

(2)



At node 1, using KCL

$i_1 = i_2 + i_3 + i_4$

$\frac{0 - V_1}{10\Omega} = \frac{V_1 - V_2}{2} + 12 + \frac{V_1 - 0}{5}$

$-V_1 = 5(V_1 - V_2) + 120 + 2V_1$

$120 = -8V_1 + 5V_2$ ---- (i)

At node 2

$i_5 + i_2 + i_3 = i_6$

$12 + \frac{V_1 - V_2}{2} + 6 = \frac{V_2 - 0}{6}$

$96 + 4(V_1 - V_2) + 48 = 2V_2$

$144 = -4V_1 + 6V_2$ ---- (2)

$120 = -8V_1 + 5V_2$

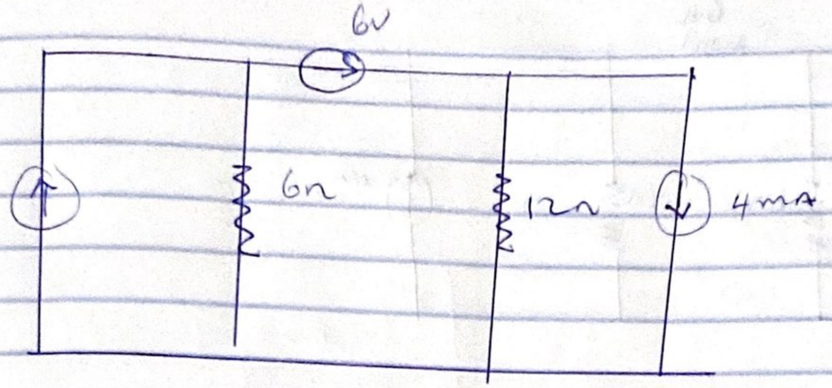
$144 - 4V_1 + 6V_2$

$V_1 = 0, \quad V_2 = 24V$

$i_2 = \frac{V_1 - V_3}{2} = 12A$ $\quad i_6 = \frac{V_2 - 0}{4} = \frac{24}{4} = 8A$

$i_1 = \frac{0 - V_1}{10} = -0/10 = 0A$ $\quad i_4 = \frac{V_1 - 0}{5} = 0/5 = 0A$

4



$V_1 - V_2 = 6V$ --- (1).

At node 1

$6mA = i_1 + i_2$

$6\times10^{-3} = V_1/6 + V_1 - V_2$

$36\times10^{-3} = V_1 + 6(V_1 - V_2)$

$36\times10^{-3} = 7V_1 - 6V_2$ - 2

At node 2

$i_2 = i_3 + i_4$

$V_1 - V_2 = V_1/12 + 4\times10^{-3}$

$12(V_1 - V_2) = V_2 + (4\times10^{-3})\times 16.$

$12(V_2 - V) = V_2 + 48\times10^{-3}$

$48\times10^{-3} = 12V_1 - 13V_2$ -- (3)

Solving v_1 & v_3 simultaneously.

$V_1 = 0.0095V$ $\quad V_2 = 0.005$

$V_1 = 9.5mV$ $\quad V_2 = 5mV$

$i_1 = \frac{V_1}{6} = \frac{9.5\times10^{-3}}{6} = 1.583mA$ //

$i_4 = \frac{V_3}{12} = \frac{5.1\times10^{-3}}{12} = 0.425mA$ //