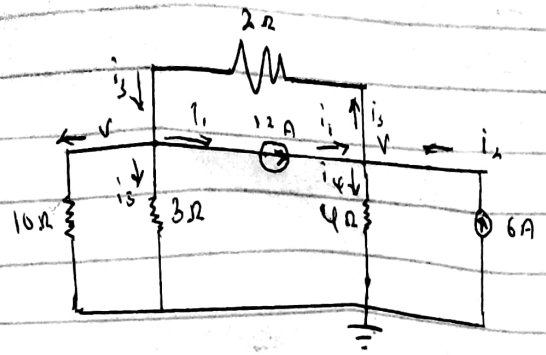
EMEROLE CHINAEME IKENNA
MECHATRONICS ENG

17/ENG05/012



at node V_1

$$i_3 = i_1 + i_5 + i_6 = 12 + i_5 + i_6$$

$$12 = 17 - 15 - 16$$

$$12 = \frac{V_2 - V_1}{2} - \left[\frac{V_1 - 0}{5}\right] - \left[\frac{V_1 - 0}{10}\right]$$

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

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

$$12 = \frac{5(V_2 - V_1) - 2(V_1) - V_1}{10}$$

$$120 = 5V_2 - 5V_1 - 2V_1 - V_1$$

$$120 = 5V_2 - 8V_1 \quad \text{--- (1)}$$

from node V_2

$$i_1 + i_2 + i_3 + i_4$$

$$12 + 6 = \frac{V_2 - V_1}{2} + \left[\frac{V_2}{4}\right]$$

$$18 = \frac{V_2 - V_1}{2} + \frac{V_2}{4}$$

$$18 = \frac{2(V_2 - V_1) + V_1}{4}$$

$$72 = 3V_2 - 2V_1 \quad \text{--- 2}$$

Using Simultaneous Equ

$120 = 5V_2 - 8V_1$ ---(2)

$72 = 3V_2 - 2V_1$ ---(1)

$240 = 10V_2 - 16V_1$

$576 = 24V_2 - 16V_1$

$-336 = -16V_2$

$V_2 = 24V$

from Equ (1)

$120 = 5(24) - 8V_1$

$120 = 120 - 8V$

$8V_1 = 120 - 120$

$V_1 = 0$

Current flowing through the 2Ω resistor

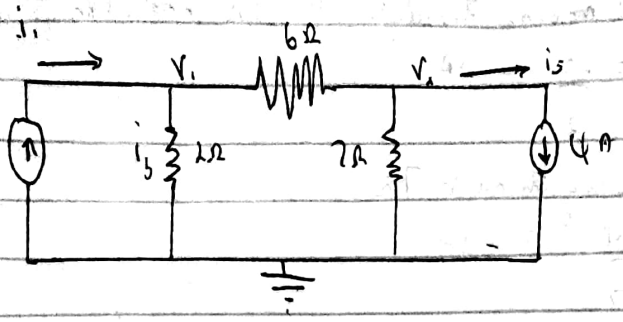
$= \frac{V_2 - V_1}{2} = \frac{24 - 0}{2} = 12A$

while the current flowing through the 4Ω resistor

$= \frac{V_1}{4} = \frac{24}{4} = 6A$

Since 10 V, being or then current through the 10Ω & 5Ω resistor, both equal to zero (0)

~~AT Node~~



At node 1

$i_1 = i_2 + i_3$

$1 = \left[\frac{V_1 - V_2}{6}\right] + \left[\frac{V_1 - 0}{2}\right]$

$1 = \frac{V_1 - V_2}{6} + \frac{V_1}{2}$

$1 = \frac{V_1 - V_2 + 3V_1}{6}$

$6 = 4V_1 - V_2 \quad --(1)$

At node 2

$i_3 + i_4 = i_5$

$\left[\frac{V_1 - V_2}{6}\right] = \left[\frac{V_2}{7}\right] + 4$

$\frac{V_1 - V_2}{6} - \frac{V_2}{7} = 4$

$\frac{7(V_1 - V_2) - 6V_2}{42} = 4$

$108 = 7V_1 - 13V_2 \quad ---(2)$

Solving Simultaneously

$V_1 = -2V$ & $V_2 = -14V$

from this Current moving through the 6Ω

$= V_1 - V_2$

$= \frac{-2 - 14}{6} = -\frac{16}{6} = -2.67A$

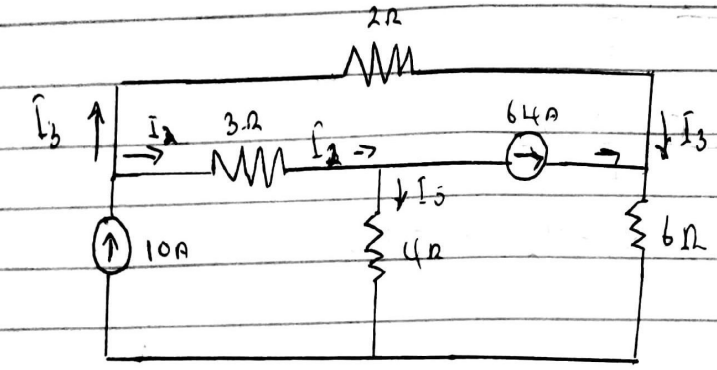
From this current moving through the 2Ω resistor

$= \frac{V_1}{2} = \frac{2}{2} = 1A$

Current moving through 7Ω

$\frac{V_2}{7} = \frac{-14}{7} = -2A$

Q_2



$I_1 = I_2 + I_3$

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

$10 = (V_1 - V_2)2 + (V_1 - V_3)3$

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

$60 = 5V_1 - 2V_2 - 3V_3 \quad --(1)$

from node 2

$I_2 = I_3 + I_4$

$\frac{V_1 - V_2}{3} = \frac{V_2}{4} + 64$

$$\frac{V_1 - V_2}{3} + \frac{V_3}{4} = 6\psi$$

$$\frac{4V_1 - 4V_2 - 3V_2}{12} = 6\psi$$

$$\frac{4V_1 - 7V_2}{12} = 6\psi$$

$$4V_1 - 7V_2 = 768$$

from node 3

$$I_4 + I_5 = I_6$$

$$6\psi + \frac{V_1 - V_3}{2} = \frac{V_3}{6}$$

$$6\psi = \frac{V_3}{6} - \frac{(V_1 - V_3)}{2}$$

$$6\psi = \frac{V_3 - 3V_1 + 3V_3}{6}$$

$$384 = 4V_3 - 3V_1 \quad \ldots (3)$$

$$60 = 5V_1 - 2V_2 - 3V_3$$

$$768 = 4V_1 - 7V_2 + 0V_3$$

$$384 = -3V_1 + 0V_2 + 4V_3$$

Solve Simultaneously

$V_1 = 80V$ $\quad V_2 = -64V$ $\quad V_3 = 156V$