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Matric : 17/ENG02/048
Dept : Computer Engineering

$$V_2 = \Delta_2 \begin{vmatrix} 5 & 60 & -3 \\ 4 & 768 & 0 \\ -3 & 380 & 4 \end{vmatrix}$$

$= 5[1768 \times 4] - 0] - 4[V_0 \times 4] - [384\ 3] - 3\{0 - [768 - 3.7]$

$= 2880$

$$V_2 = \frac{\Delta_2}{\Delta} = \frac{2880}{-45} = -64V$$

$$V_3 = \begin{vmatrix} 5 & -2 & 60 \\ 4 & -7 & 768 \\ -3 & 6 & 384 \end{vmatrix}$$

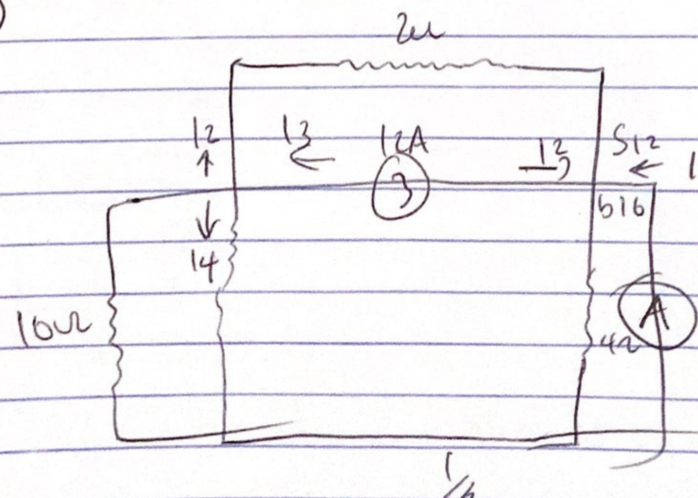
$= 5\ [[-7 \times 384] - 0] - 4(<-2 \times 384] - 0) - 3[-2 \times 768 - [-7 \times 60])$

$= -7020$

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

$\therefore V_1 = 580V \quad V_2 = -64V \quad V_3 = 156V$

2)



Node KCL

$I_1 = I_2 + I_3 + I_4$

$$\frac{V_0 - V_1}{10} = \frac{V_1 - V_2}{2} + 12 + \frac{V_1 - V_2}{5}$$

$0 - V_2 = 5[V_1 - V_2] + 120 + 2[V_1 - 0]$

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

$120 = -8V + 5V_2$ --- (1)

Node 2

$I_3 + I_2 + I_5 = I_6$

$$12 + \frac{V_1 - V_2}{2} + 6 = \frac{V_2 - 0}{4}$$

$96 + 4[V_1 - V_2] + 48 = 2[V_2]$

$144 + 4V_1 - 4V_2 = 2V_2$

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

Using Elimination method

$120 = -8V_1 + 5V_2$ ... (1) x4

$144 = -4V + 6V_2$ ... (2) x8

$-480 = 32V_1 - 20V_2$ ... (I)

$-1152 = 32V_1 - 48V_2$ ... (II)

Sub (-) eqn 3 from 2

$-672 = 0 - 28V_2$

$-672 = -28V_2$

$$V_2 = \frac{-672}{-28}$$

$V_2 = 24V$

$144 = -4v_1 + 6v_2$

$v_1 = \frac{144 - 6(24)}{-4}$

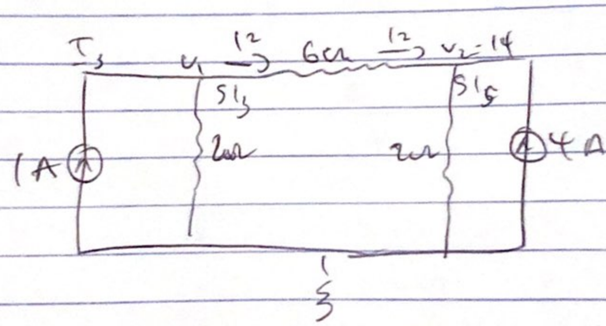
$v_1 = \frac{144 - 144}{-4}$ $v_1 = 0$

$V_? = 0_v$ $V_2 = 24V$

$I_1 = 0A$; $i_2 = 0A$; $I_2 = 6A$ $i_4 = 12A$

2) obtain v_1 and v_2 and the currents for the rest

(2)



Node

$I_1 = I_2 + I_3$

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

$6 = v_1 - v_2 + 3v_1$

$6 = 4v_1 - v_2$ — (1)

Node (2)

$i_2 = i_4 + i_5$

$\frac{v_1 - v_2}{6} = 24 + \frac{v_2}{7}$

$7(v_1 - v_2) = 168 + 6v_2$

$168 = 7v_1 - 13v_2$ — 2

From equ (1)

$v_2 = 4v_1 - 6$

Sub $v_2 = 4v_1 - 6$ Into equ (2)

$168 = 7v_1 - (3(4v_1 - 6))$

$168 = 7v_1 - 52v_1 + 78$

$90 = -45v_1$

$v_1 = 90/-45$

$v_1 = -2V$

Sub $v_1 = -2$ Into equ (1)

$6 = 4(-2) - v_2$

$6 = -8 - v_2$

$v_2 = -8 - 6$

$v_2 = -14V$

$v_1 = -2VS \quad v_2 = -148$

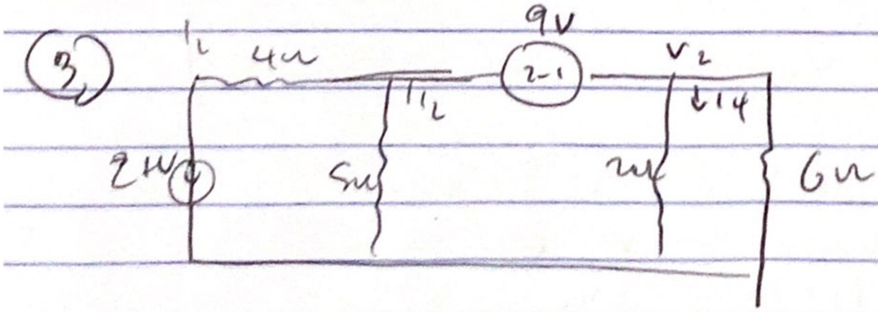
Currents through Sensor

$i_2 = \frac{v_1 - v_2}{6} = \frac{-2+14}{6} = 2A$

$I_3 = \frac{v}{2} = \frac{-2}{2} = -1A$

$I_3 = \frac{v_2}{7} = \frac{-14}{7} = -2A$

(3)



Find the current through the 3Ω & 2Ω Resistance

Using KCL Nod 1

$I_1 + I_2 + I_3 + I_4 = 0$

$\frac{V_1 - V_2}{4} + \frac{V_1}{3} + \frac{V_2}{6} + \frac{V_2}{2}$

$7V_1 + 8V_2 - 63 = 0$ —(1)

Taking kve for loop

$-V_1 - 9 + V_2 = 0$

$-V_1 + V_2 = 9$ -- (ii)

$7V_1 + 8V_2 = 63$ —(1) ×7

$-V_1 + V_2 = 9$ ×7

$+ 7V + 8V_2 = 63$

$7V_1 + 7V_2 = 63$

$11V_2 = 126$

from equ 2 $-V_1 + V_2 = 9$

$V_2 = 9 + V_1$ put In equ (1)

$7V_1 + 8[9 + V_1] = 63$

$7V_1 + 72 + 8V_1 = 63$

$7V_1 + 72 + 8V_1 = 63$

$15V_1 = 63 - 72$

$15V_1 = -9$

$V_1 = -9/15$

$V_1 = -0.6V$

sub $V_1 = 0.61$ in equ (1)

$-[-0.6] + V_2 = 9$

$0.6 + V_2 = 9$

$V_2 = 9 - 0.6 = 8.4V$

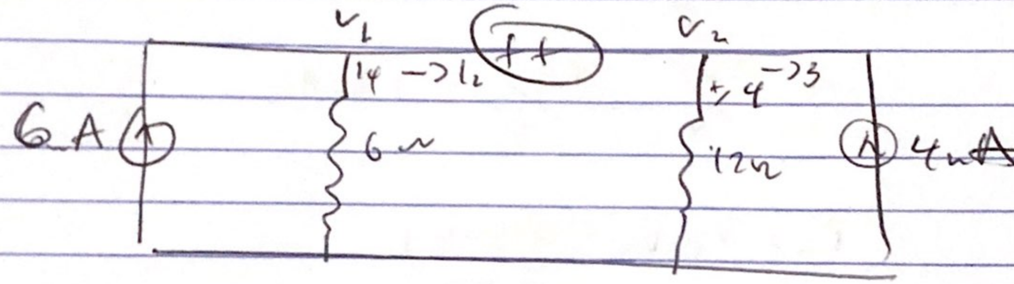
$V_1 = 0.6V \quad V_2 = 8.4V$

Current through 3Ω and 2Ω

$I_2 = V_1/3 = -0.6/3 = 0.2A$ at 3Ω

$I_4 = V_c/4 = 8.4/4 = 4.2A$ at 2Ω

4)



Find the and calc the voltage and the current for the 6Ω and 1Ω resistor

Take $V_1 - V_2 = 6V \Rightarrow I_2$

At Node 1, using KCL

$6mA = I_1 + I_2$

$6mA = \frac{V_1 - 0}{6} + [V_1 - V_2]$

$36 = V_1 + 6[V_1 + V_2]$

$36 = V_1 + 6V_1 = 6V_2$

$36 = 7V_1 - 6V_2 \quad -(1)$

At Node 2

$I_2 = I_3 + I4$

$V_1 - V_2 = 4mA + \frac{V_2 - 0}{12}$

$12(V_1 - V_2) = 48 + V_2$

$48 = 12V_1 - 12V_2 - V_2$

$48 = 12V_1 - 13V_2 \quad \ldots (2)$

Solving V_1 and V_2 Simultaneously we have

$V_1 = 9.5V$

$V_2 = 5.1V$

Current through the 6Ω resistor

$i_1 = V_1/6 = 9.5/6 = 1.58\,AJ$

$i_2 = V_1 - V_2 = 9.5 - 5.1$

$= 4.4m$

Current through 12Ω

$I4 = V_2/12 = \frac{5.1}{12} = 0.43A$

$V_1 = 9.5V$ $\quad$ $V_2 = 5.1V$

$I1 = 1.58U$ $\quad$ $I4 = 0.43A$