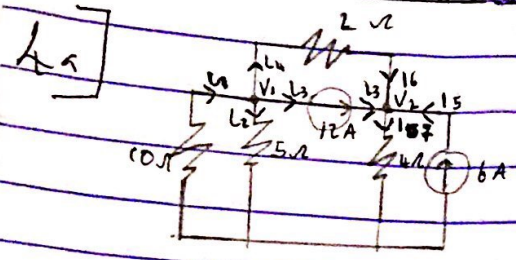
OYELEYE IYINOLUWA EMMANUEL

COMPUTER ENGR. EEE 322 18/ENG02/1106.

4.



$I_4 = I_6$

Node 1

$I_1 + I_2 + I_3 + I_4 = 0$

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

$\frac{V_1 + 2V_1 + 120 + 5V_1 - 5V_2}{10} = 0$

$\frac{8V_1 - 5V_2 + 120}{10} = 0$

$8V_1 - 5V_2 + 120 = 0$

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

Node 2

$I_3 + I_5 + I_6 = I_7 \quad (I_7 + I_4) \qquad I_3 + I_5 + I_6 = I_7$

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

$\frac{V_1 - V_2 + 24 + 12}{2} = \frac{V_2}{4}$

$\frac{V_1 - V_2 + 36}{2} = \frac{V_2}{4}$

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

$4V_1 - 6V_2 = -144 \quad -(2)$

$8V_1 - 5V_2 = -120 \quad -(1) \quad \times 6$

$4V_1 - 6V_2 = -144 \quad -(11) \quad \times 5$

$48V_1 - 30V_2 = -720$

$20V_1 - 30V_2 = -720$

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$48V_1 - 20V_1 = -720 = (-720)$

$28V_1 = 0$

$V_1 = 0$

In eq.

$8V_1 - 5V_2 = -120$

Sub $V_1 = 0$ into eq (1)

$8(0) - 5V_2 = -120$

$\frac{-5V_2}{-5} = \frac{+120}{+5}$

$V_2 = 24$

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

Current flowing through resistors

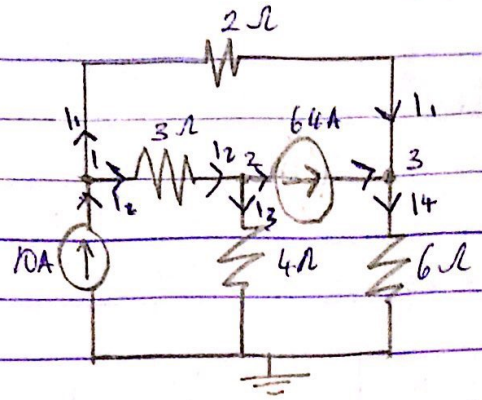
$10\Omega : \frac{V_1}{10} = \frac{0}{10} = 0A$

$5\Omega : \frac{V_1}{5} = \frac{0}{5} = 0A$

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

$4\Omega : \frac{V_2}{4} = \frac{24}{4} = 6A$

6)



Node 1 $\quad 10 = I_1 + I_2$

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

$$10 = \frac{3V_1 - 3V_3 + 2V_1 - 2V_2}{6}$$

$$60 = 5V_1 - 2V_2 - 3V_3 \quad \text{—— (i)}$$

Node 2 $\quad 64 + I_3 = I_2$

$$\frac{64 + V_2}{1} = \frac{V_1 - V_2}{3}$$

$$\frac{256 + V_2}{4} = \frac{V_1 - V_2}{3}$$

$$768 + 3V_2 = 4V_1 - 4V_2$$

$$768 = 4V_1 - 7V_2 \quad \text{—— (ii)}$$

Node 3 $\quad 64 + I_1 = I_4$

$$64 + \frac{V_1 - V_3}{2} = \frac{V_3}{6}$$

$$2 \times \frac{128 + V_1 - V_3}{2} = \frac{V_3}{6} \times 2$$

$$384 + 3V_1 - 3V_3 = V_3$$

$$3V_1 - 4V_3 = -384 \quad \text{—— (iii)}$$

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Using Cramer's rule

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

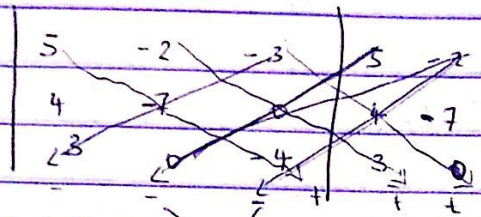
$4V_1 - 7V_2 + 0 = 768$

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

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

$$V_1 = \frac{\Delta_1}{\Delta} \qquad V_2 = \frac{\Delta_2}{\Delta} \qquad V_3 = \frac{\Delta_3}{\Delta}$$

$\Delta =$



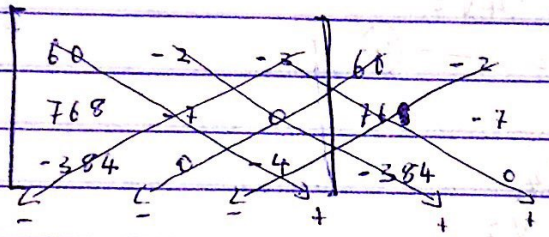
$(+140 + 0 + 0) - (32 + 0 + 63)$

$+140 - (+95)$

~~$-140 + 31$~~ $+140 - 95$

~~109~~ $\Delta = 45$

$\Delta_1 =$

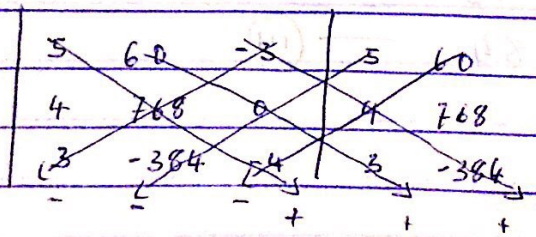


$(1680 + 0 + 0) - (6144 + 0 - 8064)$

$1680 - (-1920)$

$\Delta_1 = 3600$

$\Delta_2 =$



$(-15360 + 0 + 4608) - (-9600 + 0 - 6912)$

$-10752 - (-7872)$

$-10752 + 7872$

$\Delta_2 = -2880$

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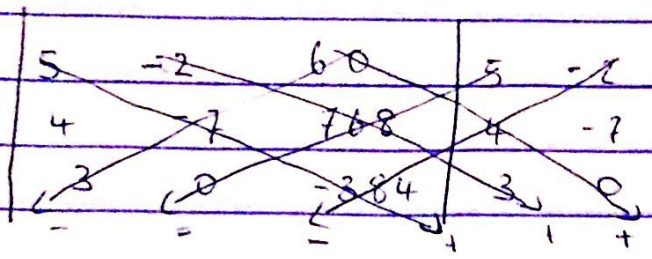
$\Delta_3 =$ 

$(13440 - 4608 + 0) - (3072 + 0 - 1260)$

$8832 - (1812)$

$\Delta_3 = 7020$

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

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

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