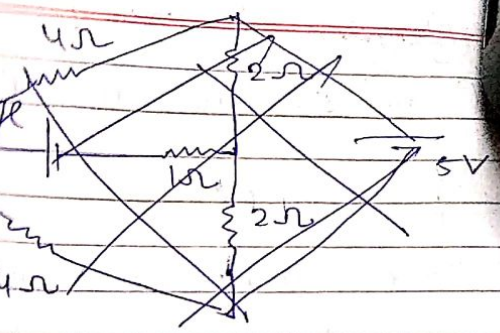
(1) Kirchoff's first law / Junction Rule /

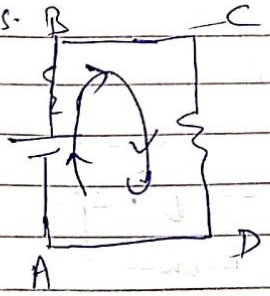
→ ΣI(entering) $= \Sigma I$(leaving) $\xrightarrow{KCL}$ → Consⁿ of charge

(2) Kirchoff's 2nd law / Loop Rule / KVL



The algebraic sum of change in Pot. around a closed loop is zero.

→ True for closed lops.



Pot. diff. does not depend on both.
but depends on intial & final pt.

so $\Delta V = V_A - V_A = 0$.

$\Sigma \Delta V = 0$ → closed lop

→ Based on Conservation of energy.

$\Delta V = \frac{W_{ext}}{q} = 0 \Rightarrow W_{ext} = 0$

$\Delta W = W_{ext} = 0$ → Principle of Consⁿ of energy

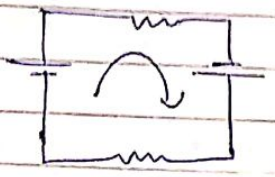
How to apply Kirchoff laws ?

(1) Draw current from one known cell. Follow KCL for distribution of current.

(2) Choosing a loop.

i) Should be closed loop/loops. (Can involve any no. of cells, resistors, etc).

(3) Dirn of lwp → path

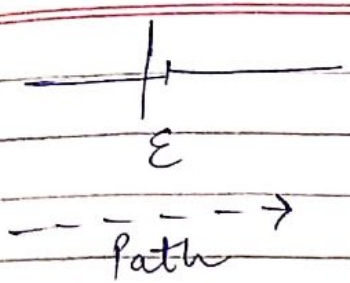


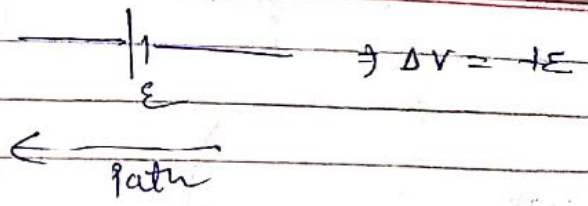
→ take CW or ACW one/both.

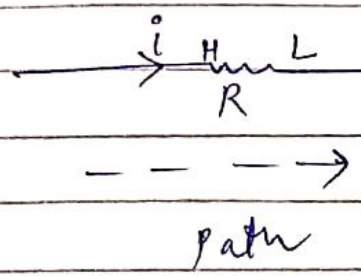
(4) Potential drop / Potential gain

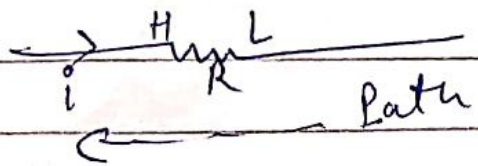
Higher Pot. → low pot. ⇒ Pot. drop ⇒ $\Delta V = -ve$

Lower → Higher ⇒ Pot. gain ⇒ $\Delta V = +ve$









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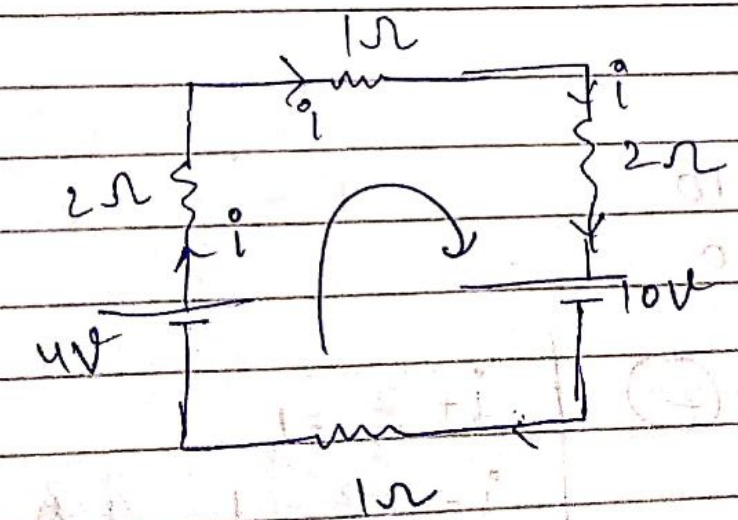
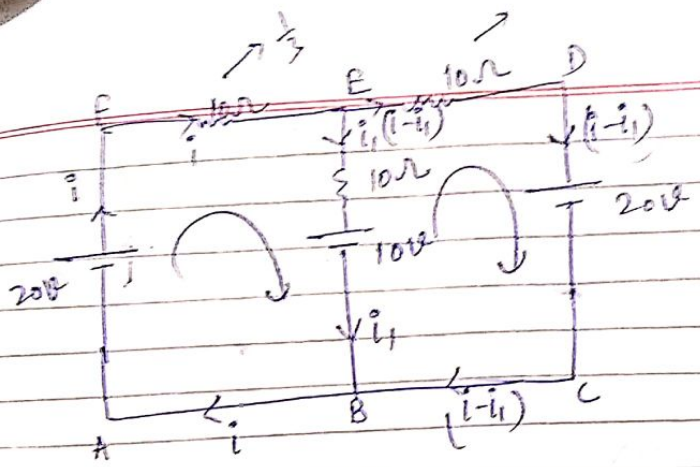


Current in each resistor?

$2i + 1i + 2i + 1i = -10 + 4$

$6i = -6$

$i = \frac{-6}{6} = -1\,A.$



ABEFA

$10i + 10i_1 = 20 - 10 = 10$

$\Rightarrow i + i_1 = 1$ — (1)

BCDEB

$-10i_1 + 10(i - i_1) = -20 + 10$

$-10i_1 + 10i - 10i_1 = -10$

$10i - 20i_1 = -10$

$-i + 2i_1 = 1$ — (2)

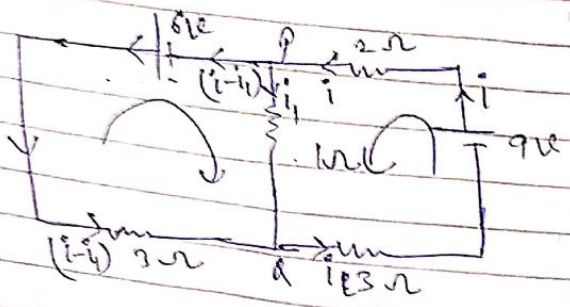
$\Rightarrow 3i_1 = 2 \Rightarrow i_1 = \frac{2}{3}$.

$i + \frac{2}{3} = 1$

$i = 1 - \frac{2}{3} = \frac{1}{3}$ Ans

1. work

#



Find I in 1Ω resista

$-3(i-i_1)+1i_1 = -6$

$-3i+3i_1+i_1 = -6$

$-3i+4i_1 = -6$ — (1)

$2i+1i_1+3i = 9$

$5i+i_1 = 9$

$20i+4i_1 = 36$ — (2)

$-3i+4i_1 = -6$

$+ \quad - \quad +$

$23i = 42$

$i = \frac{42}{23}$.

$\frac{-3\times 42+4i}{23}$

$\frac{5\times 42}{23}+i_1 = 9$

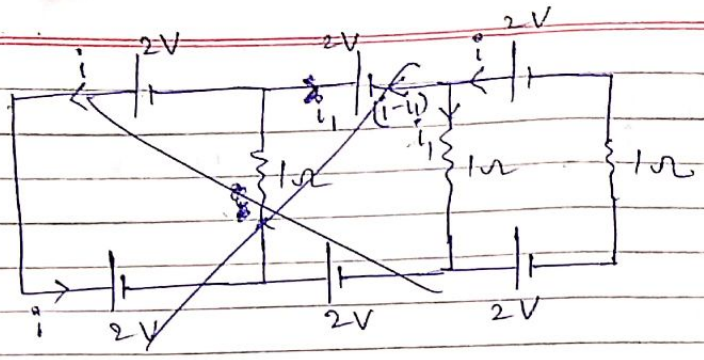
$i_1 = 9 - \frac{210}{23}$

$= \frac{207-210}{23} = \frac{-3}{23}$ Amp

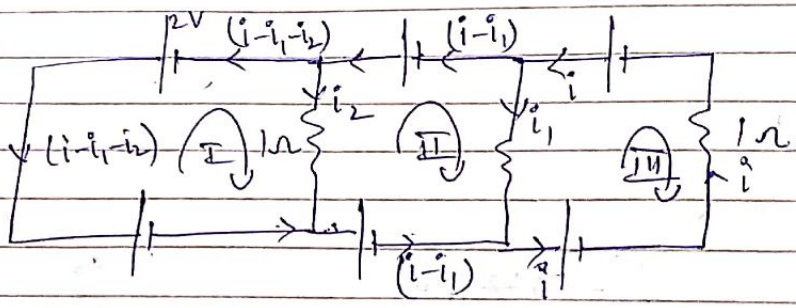
$\Rightarrow 0.13$ Amp (Q to P).

23 × 9 = 207

#



Current in each resis



$i_2 = 2 - 2$

$\boxed{i_2 = 0}$

$i_1 - i_2 = -2 + 2$

$i_1 - i_2 = 0$

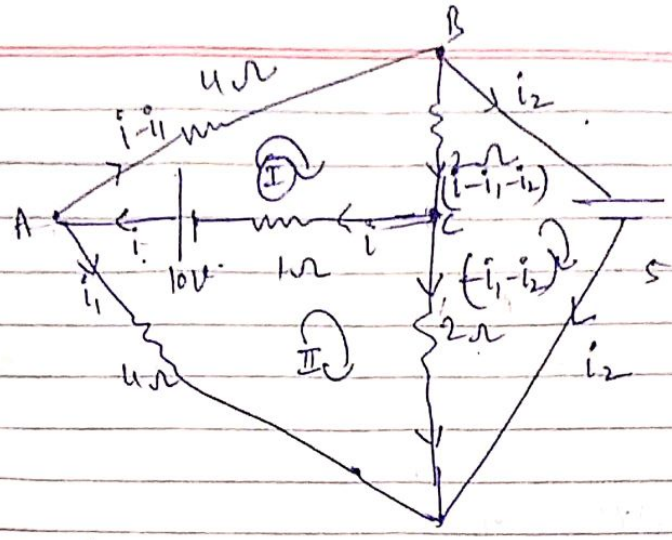
$i_1 = i_2 = 0$

$i - i_1 = -2 + 2$

$i = 0$

0 Amp.

$i - i_1 = \frac{20}{8} - \frac{15}{8} = \frac{5}{8}$



I $\Rightarrow$ $4(i-i_1)+2(i-i_1-i_2)+i = 10 \Rightarrow 7i-6i_1-2i_2 = 10$ (3)

II $\Rightarrow$ $-i-2(i_1+i_2)-4i_1 = -10$

$i+2(i_1+i_2)+4i_1 = 10$

$i+6i_1+2i_2 = 10$ -(1)

III $-2(-i_1-i_2)-2(i-i_1-i_2) = -5$

$2(i_1+i_2)-2(i-i_1-i_2) = -5$

$4i_1+4i_2-2i = -5$ -(2)

(1) $\Rightarrow 6i_1+2i_2 = 10-\frac{20}{8} = \frac{60}{8}$

(2) $\Rightarrow 4i_1+4i_2 = -5+2\times\frac{20}{8}$

$= 0$

$i_1+i_2 = 0 \Rightarrow i_1 = -i_2$

$6i_1-2i_1 = \frac{60}{8} = 4i_1 = \frac{60}{8}$

$i_1 = \frac{60}{8\times4} = \frac{15}{8}$

$i+6i_1+2i_2 = 10$

$8i = 20$

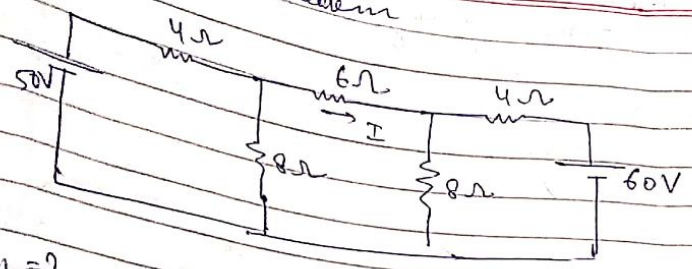
$i = \frac{20}{8}$ A.

(1) $\times 2 = 2i+12i_1+4i_2 = 20$

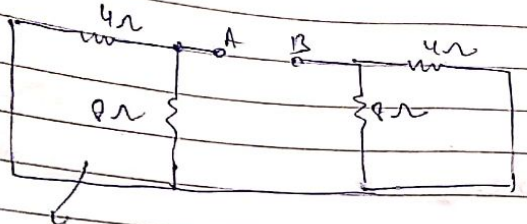
(2) $\Rightarrow -2i+4i_1+4i_2 = -5$

$16i_1+8i_2 = 15$

Find I by Th. theorem



$R_{th} = ?$



$R_1 = \frac{4 \times 8}{4+8}$, $R_2 = \frac{4 \times 8}{4+8}$

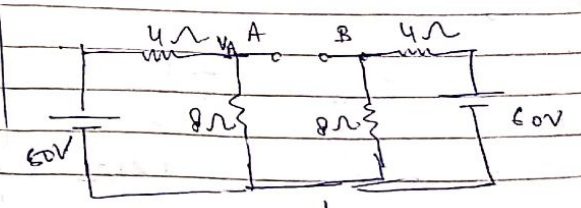
$= \frac{32}{12}$ $= \frac{32}{12}$

$R_{th} = R_1 + R_2$

$= 5.33\,\Omega$

$I_{th} = \frac{V_{th}}{R_{th}+R_L}$

$V_{th} = ?$



$\frac{V_A - 50}{4} + \frac{V_A}{8} = 0$ | $\frac{V_B}{8} + \frac{V_B - 60}{4} = 0$

$2V_A - 100 + V_A = 0$ $V_B + 2V_B - 120 = 0$

$3V_A - 100 = 0$ $3V_B = 120$

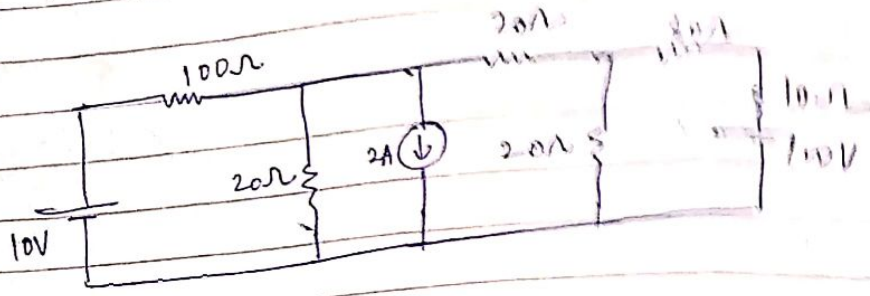
$V_A = \frac{100}{3} V = 33.3V$ $V_B = 40V$.

$V_{AB} = V_A - V_B = 33.3 - 40 = V_{th}$

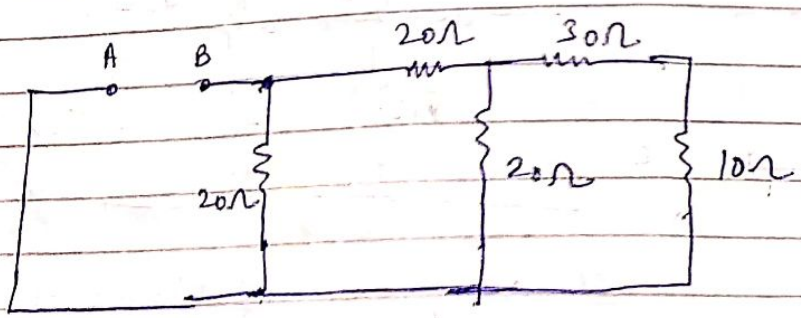
$= -6.67V$

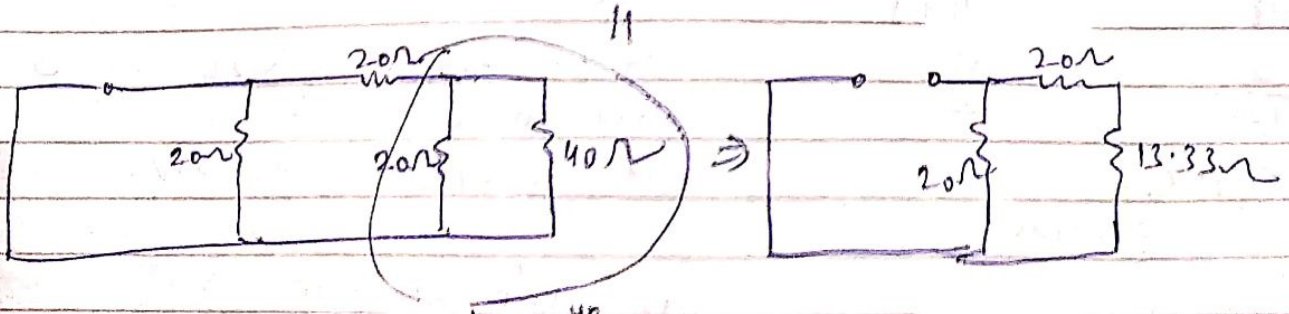
$I_{th} = \frac{-6.67}{5.33 + 6}$

Find current flowing through 4Ω resistor by using Thevenin theorem.



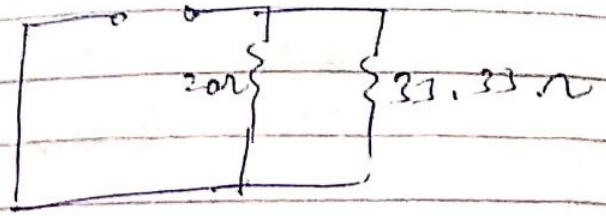
(1) $R_{th} = ?$





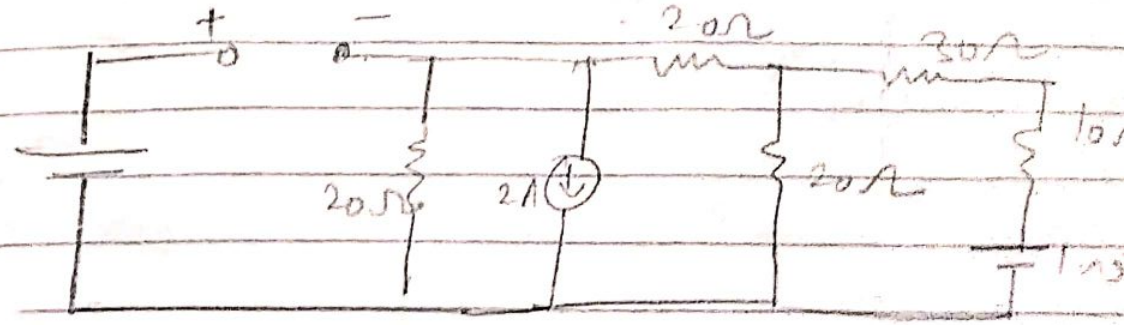
$\frac{20 \times 40}{20+40} = \frac{800}{60} = \frac{40}{3} = 13.33$

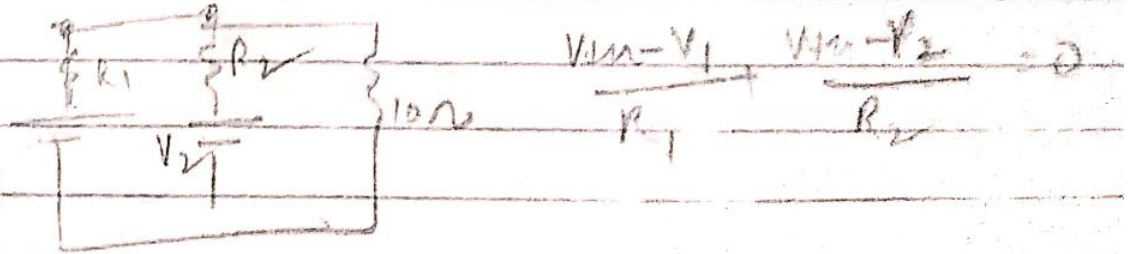
1)



$$\Rightarrow R_{th} = \frac{20 \times 33.33}{20 + 33.33} = 12.5\,\Omega$$

2)





$$\frac{V_{th} - V_1}{R_1} + \frac{V_{th} - V_2}{R_2} = 0$$