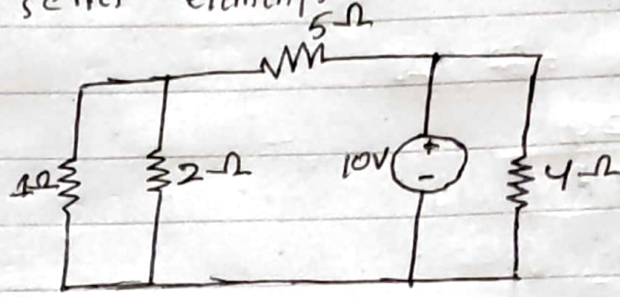
Practice Problem (2-4):-

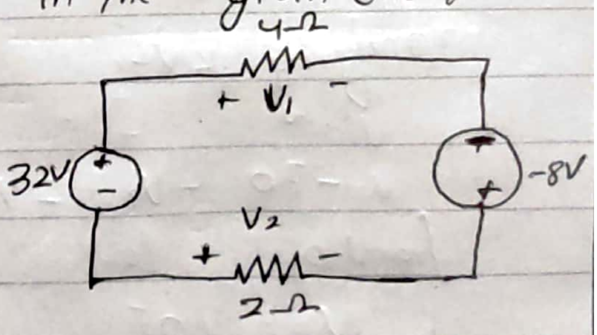
Identify the number of branches and nodes in given Circuit. Also Identify the parallel and series elements.



There are 5 elements in circuit, hence the circuit has 5 branches 1Ω, 2Ω, 5Ω, 10V, 4Ω. The circuit has 3 nodes. The 1Ω and 2Ω resistors are in parallel. The 4Ω resistor and 10-V source are also in parallel.

Practice problem (2-5):-

Find V_1 and V_2 in the given Circuit



solution

Applying KVL,

$$-32 + V_1 - (-8) - V_2 = 0$$

$$V_1 + 8 = 32 + V_2 \quad \text{— (i)}$$

Scanned with CamScanner

from ohm law.

$V_1 = 4I$

$V_2 = -2I$

eq (i) become

$4I + 8 = 32 - 2I$

$6I = 24$

$\boxed{I = 4A}$

$\therefore V_1 = 4I$

$V_1 = 4(4)$

$\boxed{V_1 = 16V}$

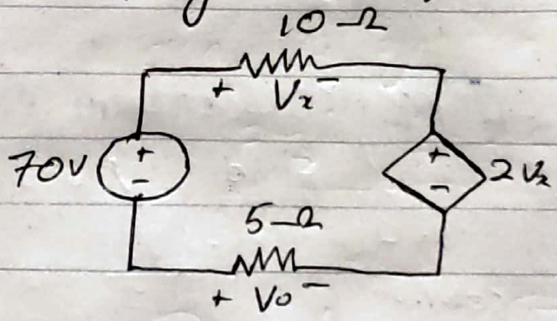
$\therefore V_2 = -2I$

$V_2 = -2(4)$

$\boxed{V_2 = -8V}$

Practice problem (2-6):

find V_x and V_o in the given Circuit



Solution.

Applying KVL,

$-70 + V_x + 2V_x - V_o = 0$ — (i)

from ohm's low

$V_x = 10I$, $V_o = -5I$

eq (i) become.

$$-70 + 10I + 2(10I) - (-5I) = 0$$

$$-70 + 10I + 20I + 5I = 0$$

$$35I = 70$$

$$I = \frac{70}{35}$$

$$\boxed{I = 2A}$$

$\therefore V_x = 10I$ $\therefore V_o = -5I$

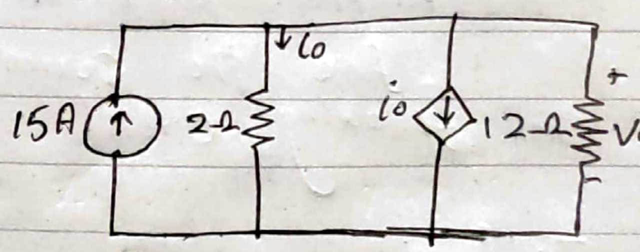
$V_x = 10(2)$ $V_o = -5(2)$

$\boxed{V_x = 20V}$ $\boxed{V_o = -10V}$

Practice problem (2.7):-

find V_o and i_o in the given circuit

solution.



Applying KCL.

$$15 - i_o - i_o - \frac{V_o}{12} = 0 \quad \text{(i)}$$

voltage is same so, from Ohms law

$$V_o = 2i_o$$

(i) become $\Rightarrow$ $15 - i_o - i_o - \frac{2i_o}{12} = 0$

$$15 - 2i_o - \frac{2i_o}{6} = 0$$

$$\frac{90 - 12i_o - i_o}{6} = 0$$

$$90 - 13i_o = 0$$

$$90 = 13i_o$$

$$i_o = 90/13$$

$$\boxed{i_o = 6.92\,A}$$

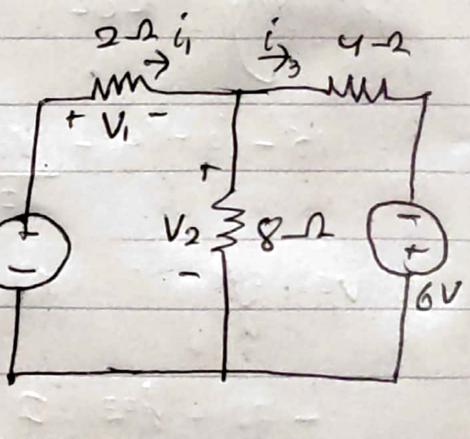
$$V_o = 2i_o$$

$$= 2(6.92)$$

$$\boxed{V_o = 13.84\,V}$$

Practice problem (2.8) =

find the current and voltages in the following circuit



To find.

$V_1 = ?$, $I_1 = ?$

$V_2 = ?$, $I_2 = ?$

$V_3 = ?$, $I_3 = ?$

solution

loop 1 according to KVL.

$10 + V_1 + V_2 = 0$ —— (i)

from ohm's low

$V_1 = 2I_1$, $V_2 = 8I_2$

(i) become

$$-10 + 2I_1 + 8I_2 = 0$$

$$I_1 = \frac{10 - 8I_2}{2} \quad \text{—— (I)}$$

Loop 2 according to KVL,

$$-V_2 + V_3 - 6 = 0 \quad \text{—— (ii)}$$

from ohm's low

$V_2 = 8I_2$, $V_3 = 4I_3$

(ii) becomes

$$-8I_2 + 4I_3 - 6 = 0$$

$$I_3 = \frac{6 + 8I_2}{4} \quad \text{—— (II)}$$

According to KCL on node (a),

$$I_1 - I_2 - I_3 = 0$$

putting values of I_1 and I_3

$$\left(\frac{10 - 8I_2}{2}\right) - I_2 - \left(\frac{6 + 8I_2}{4}\right) = 0$$

$$5 - 4I_2 - I_2 - \left(\frac{3 + 4I_2}{2}\right) = 0$$

Scanned with CamScanner

$$5 - 5I_2 - \left(\frac{3 + 4I_2}{2}\right) = 0$$

$$\frac{10 - 10I_2 - 3 - 4I_2}{2} = 0$$

$$\frac{7 - 14I_2}{2} = 0$$

$$7 - 14I_2 = 0$$

$$\boxed{I_2 = 500\ mA}$$

putting I_2 in (I),

$$I_1 = \frac{10 - 8(500 \times 10^{-3})}{2}$$

$$\boxed{I_1 = 3A}$$

putting I_2 in (II)

$$I_3 = \frac{6 + 8(500 \times 10^{-3})}{4}$$

$$\boxed{I_3 = 2.5A}$$

from ohms's law

$$V_1 = 2I_1 = 2(3) = \boxed{6V}$$

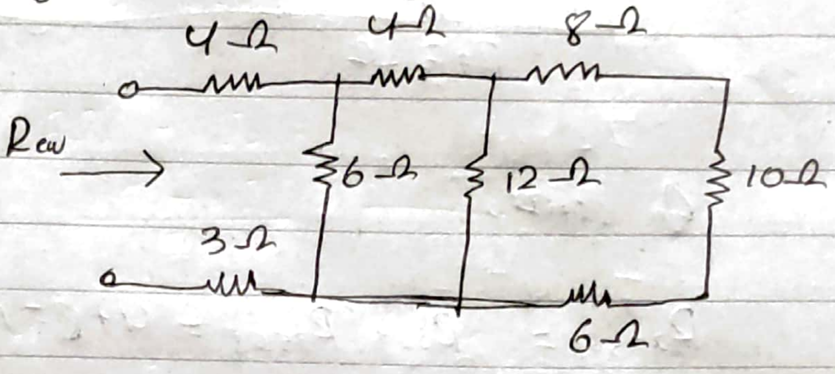
$$V_2 = 8I_2 = 8(500 \times 10^{-3}) = \boxed{4V}$$

$$V_3 = 4I_3 = 4(2.5) = \boxed{10V}$$

Scanned with CamScanner

Practice problem (2.9):

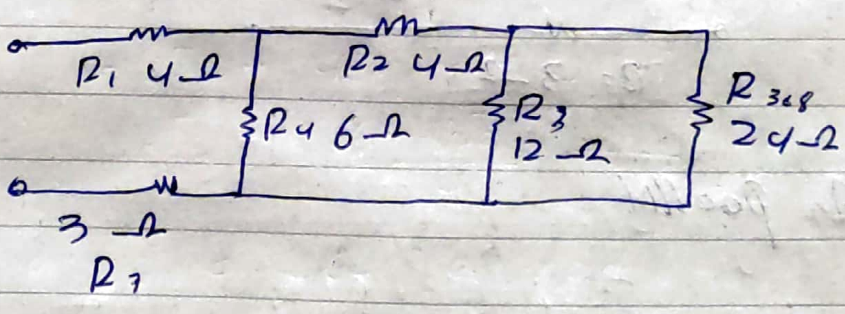
By combining resistors in given figure. find R_{eq}



<u>solution,</u>

In series

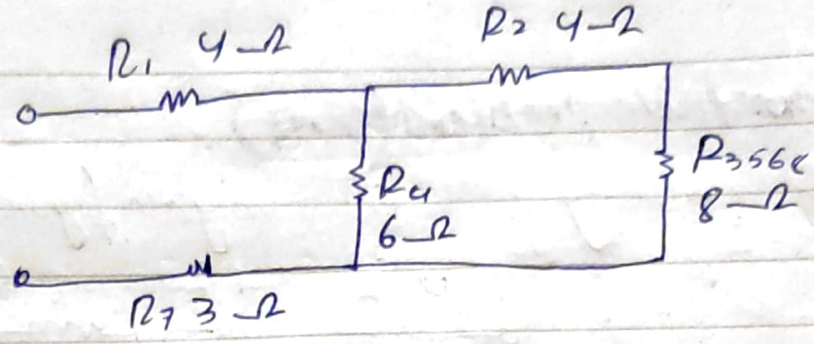
$R_{368} = R_3 + R_6 + R_8 = 8 + 10 + 6 = \boxed{24\,\Omega}$



In parallel,

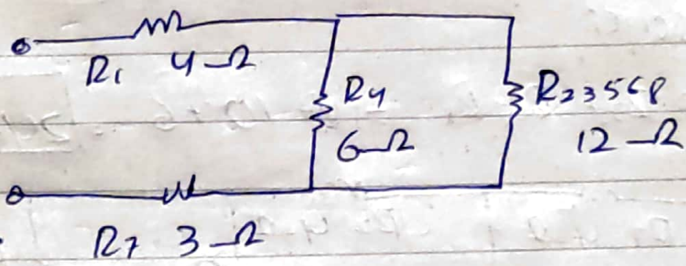
$$\frac{1}{R_{368}} = \frac{1}{R_3} + \frac{1}{368}$$

$$= \boxed{R_{3568} = 8\,\Omega}$$



In series

$$R_{23568} = R_2 + R_{3568} = 4+8 = 12\,\Omega$$

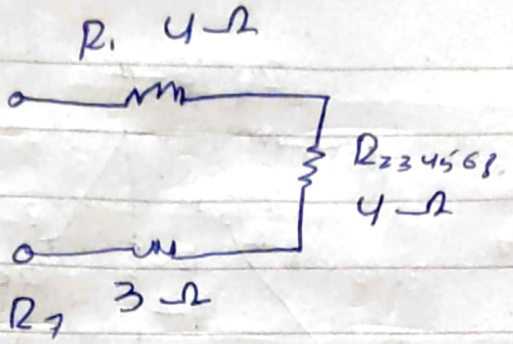


In parallel

$$\frac{1}{R_{234568}} = \frac{1}{R_4} + \frac{1}{R_{23568}}$$

$$= \frac{1}{6} + \frac{1}{12}$$

$$R_{234568} = 4\,\Omega$$



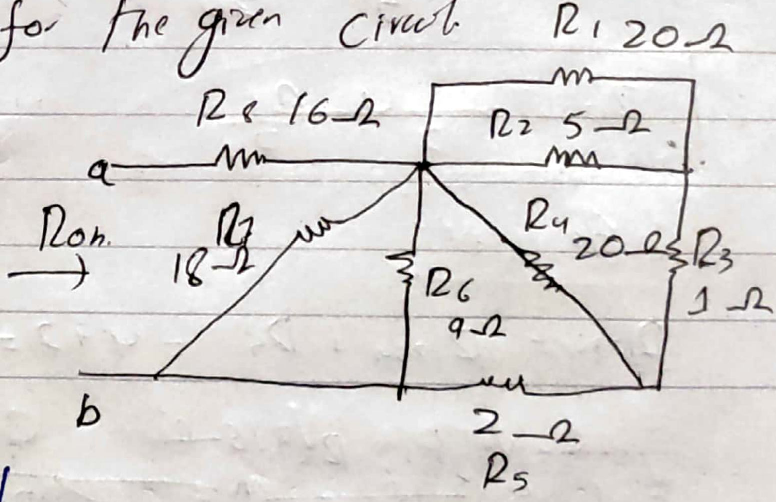
In series

$R_{12345678} = R_{eq} = R_1 + R_{234568} + R_7$

$R_{eq} = 4 + 4 + 3 = \boxed{11\ \Omega}$

Practice problem (2-10).

Find R_{ab} for the given circuit.



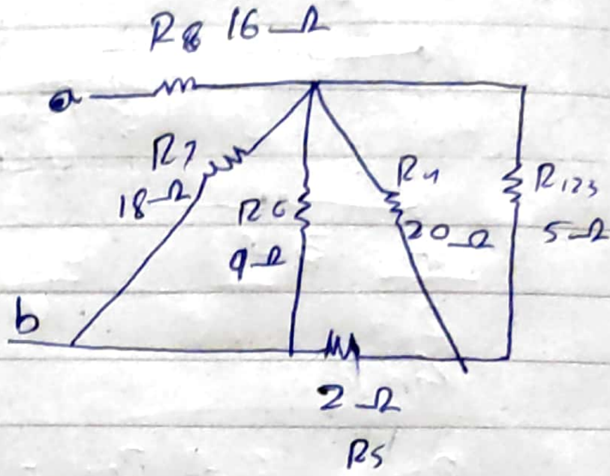
solution

In parallel

$$\frac{1}{R_{12}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R_{12}} = \frac{1}{20} + \frac{1}{5}$$

$R_{12} = 4\,\Omega$



• In series

$R_{123} = R_{12} + R_3 = 5\,\Omega$

In parallel

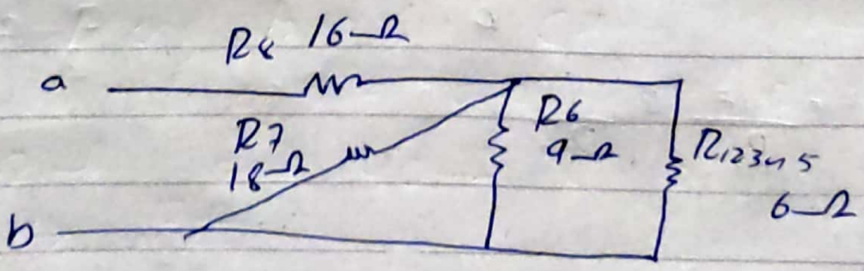
$$\frac{1}{R_{1234}} = \frac{1}{R_{123}} + \frac{1}{R_4}$$

$$= \frac{1}{5} + \frac{1}{20}$$

$R_{1234} = 4\,\Omega$

In series

$R_{1234} = R_{1234} + R_5 = 4 + 2 = 6\,\Omega$

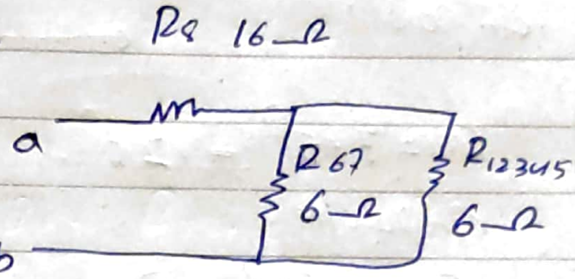


In parallel

$$\frac{1}{R_{67}} = \frac{1}{R_7} + \frac{1}{R_6}$$

$$\frac{1}{R_{67}} = \frac{1}{18} + \frac{1}{9}$$

$$\boxed{R_{67} = 6\,\Omega}$$



In parallel

$$\frac{1}{R_{1234567}} = \frac{1}{R_{67}} + \frac{1}{R_{12345}}$$

$$= \frac{1}{6} + \frac{1}{6}$$

$$\boxed{R_{1234567} = 3\,\Omega}$$

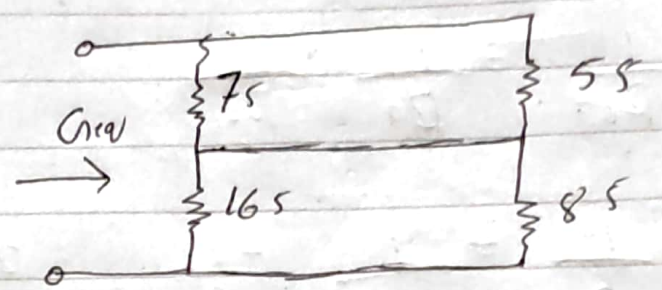
In series

$$R_{12345678} = R_{1234567} + R_8 = 3 + 16 = \boxed{19\,\Omega}$$

Practice problem (2-11)..

Calculate G_{eq} in the given circuit

solution,



In parallel,

$G_1 = 7+5 = 12S$

In parallel

$G_2 = 16+8 = 24S$

In series,

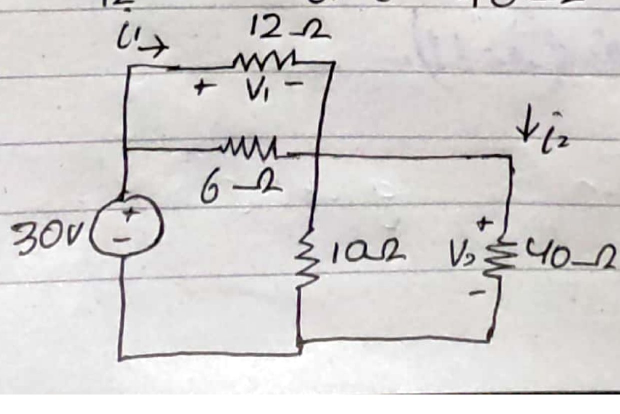
$$\frac{1}{G_{eq}} = \frac{1}{G_1} + \frac{1}{G_2}$$

$$= \frac{1}{12} + \frac{1}{24}$$

$$\boxed{G_{eq} = 8S}$$

Practice Problem:-(2.12)

find V_1 and V_2 in the circuit - Also calculate i_1 and i_2 and power dissipated in 12 Ω and 40 Ω Resistor



To find,

$V_1 = ?$, $V_2 = ?$

$i_1 = ?$, $i_2 = ?$

$P_{12} = ?$, $P_{40} = ?$

solution

In parallel,

$$\frac{1}{R_1} = \frac{1}{12} + \frac{1}{6}$$

$$\frac{1}{R_1} = \frac{1}{4}$$

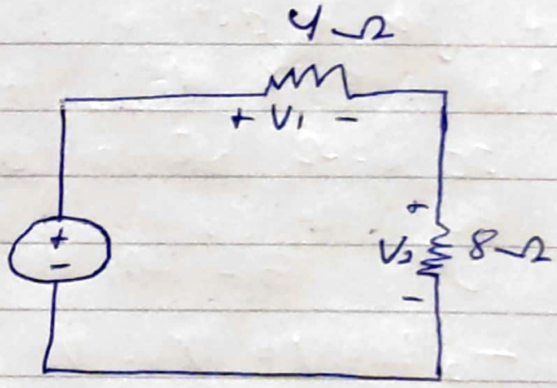
$$\boxed{R_1 = 4\,\Omega}$$

In parallel

$$\frac{1}{R_2} = \frac{1}{10} + \frac{1}{40}$$

$$= 1/8\,\Omega$$

$$\boxed{R_2 = 8\,\Omega}$$



$$V_1 = \frac{(4)(30)}{4+8} = \boxed{10\,V} \; ; \; V_2 = \frac{(8)(30)}{8+4} = \boxed{20V}$$

from Ohm's law,

$$i_1 = \frac{V_1}{R} = \frac{10}{12} = \boxed{833.83\ mA}$$

$$i_2 = \frac{V_2}{R} = \frac{20}{40} = \boxed{500\ mA}$$

$$P_{12} = i_1 V_1 = (833.83 \times 10^{-3})(10)$$

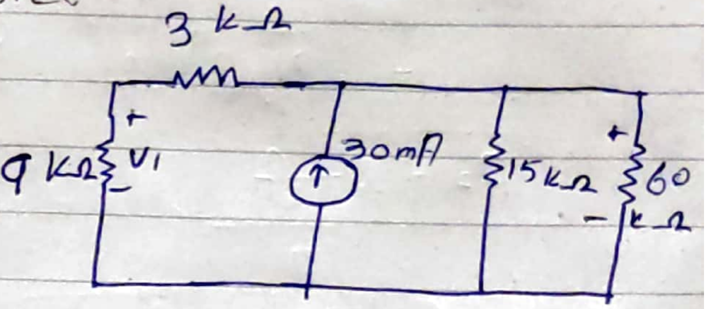
$$\boxed{P_{12} = 8.33\ W}$$

$$P_{40} = i_2 V_2 = (800 \times 10^{-3})(20)$$

$$\boxed{P_{40} = 10\ W}$$

Practice problem (12.13):-

for the given Circuit. find (a) V_1 and V_2, (b) Power dissipated in 3-k-Ω and 20 k-Ω resistor and (c) power supplied by the current source



To find,

a) $V_1 = ?$, $V_2 = ?$

b) $P_3 = ?$, $P_{15} = ?$

c) $P = ?$

solution

Applying KCL at node A.

$$30 = \frac{V_A}{3+9} + \frac{V_A}{15} + \frac{V_A}{60}$$

$$30 = \frac{5V_A + 4V_A + V_A}{60}$$

$$1800 = 10 V_A$$

$$180 = V_A$$

Let

$$V_2 = V_A$$

$$\boxed{V_2 = 180V.}$$

Applying voltage divide Rule for V_1

$$V_1 = \frac{R_1}{R_1 + R_2} \times V$$

$$= \frac{9}{9+3} \times 180$$

$$\boxed{V_1 = 135 V}$$

for power :- at 9k Ω Resisto.

$$P_9 = \frac{V^2}{R_9}$$

$$P_9 = \frac{(135)^2}{9000}$$

$$\boxed{P_9 = 2.025 \text{ watt}}$$

at 60 kΩ resistor

$$P_{60} = \frac{V_2^2}{R_{60}} = \frac{(180)^2}{60000}$$

$$\boxed{P_{60} = 0.54 \text{ watt}}$$

at 15 kΩ Resistor

$$P_{15} = \frac{V_2^2}{R_{15}} = \frac{180}{15000} = \boxed{2.16 \text{ watt}}$$

at 3k Ω resistor

$$V = V_2 - V_1$$

$$= 180 - 135$$

$$\boxed{V = 45V}$$

$$P_3 = \frac{V^2}{R} = \frac{(45)^2}{3000}$$

$$\boxed{P_3 = 0.675 \text{ watt}}$$

power for whole circul.

$P = VI$

$P = (180)(30 \times 10^{-3})$

$\boxed{P = 5.4 \text{ watt}}$