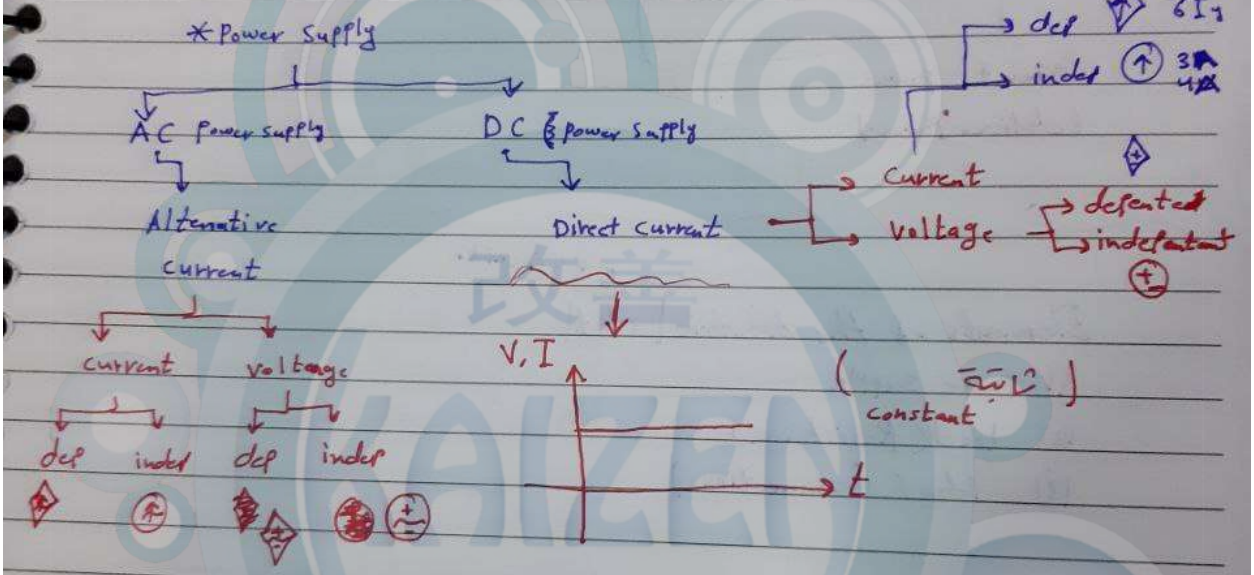
Weekly Notebook

ELECTRICAL

first semester
2021-2022

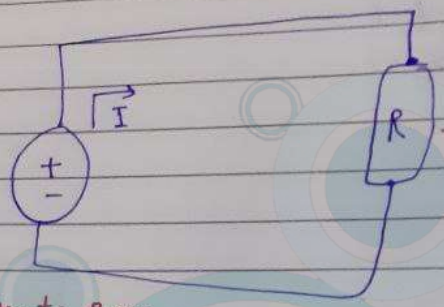
1. Power supply (مصدر الطاقة)
2. load (مستهلك الطاقة)
3. connections



DC - Power

the Value of

(ملخص ← هو المصدر الذي يبقى ثابتة مع الزمن)



consumed absorbs Power

Generats power
(deliver power)

Circuit

Elements of the Electric ckt

1. Power supply
2. load (Resistance)
3. ideal (connections)

⊠ independent ○ , Voltage ± , DC (nothing)

⊠ dependent ◇ , current ↑ , AC (~)

→ DC → (constant) لا تتغير مع الوقت

Ex:- Find power?? $t = 3ms$, $i = 5\cos 60\pi t$

$v = 3i$

Sol:- $P = i * V$

$= 5\cos 60\pi t * 3(5\cos 60\pi t)$

$= 75\cos^2 60\pi t$,

$= 75\cos^2(60\pi * 0.003)$

$= 53.467$ watt.

Rad حسبة بـ

Deg ولبس

* P = ⊟ (negative)
  ↳ Produced , generated , deliver

* P = ⊞ (Positive)
  ↳ consumed ,

$P = \frac{dw}{dt}$ $i = \frac{dq}{dt}$

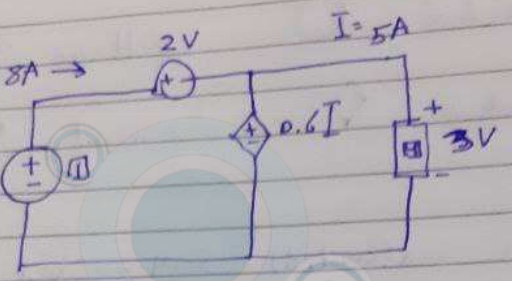
$P = IV$

$P = I^2R$

$P = \frac{V^2}{R}$

$W = Vq$

$V = \frac{dw}{dq}$



$P_3 = ??$, $I_3 = ??$ $V_3 = ??$

$P_1 = -8 * 5 = -40$ watt produced

$P_2 = 2 * 8 = 16$ watt consumed

$P_4 = 5 * 3 = 15$ watt consumed

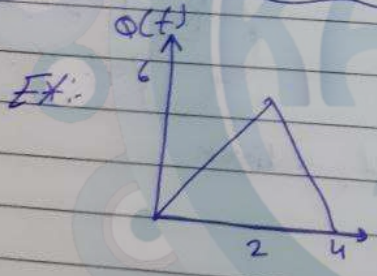
$P_3 = (15 + 16 - 40) * -1$

$P_3 = 9$ watt consumed

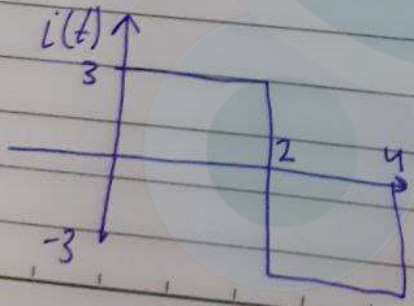
$I_3 = \frac{}{0.6 * 5} = 3A$

$I_3 = \frac{9}{3} = V_3 = 3$ volt

Ex:



find i(t)



slope (0-2)

$= \frac{6-0}{2-0} = 3A$

slope (2-4)

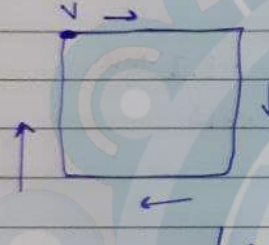
$= \frac{0-6}{4-2} = -3A$

(Positive) يعني ← داخلاً عندما يدخل التيار

* عندما يخرج التيار في المقاومة يعني نفقد

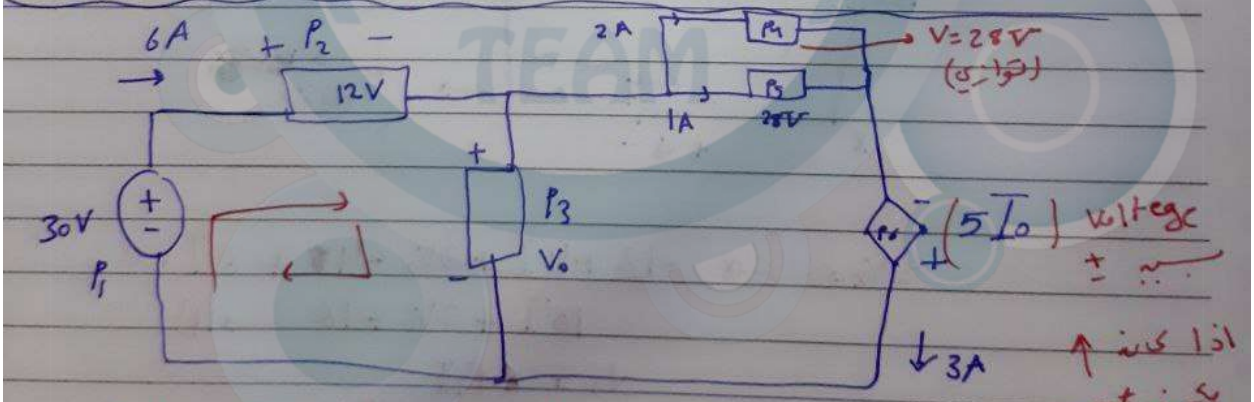
* العناصر المتوازية تكون $V_1 = V_2$

For Any close loop $V = 0$



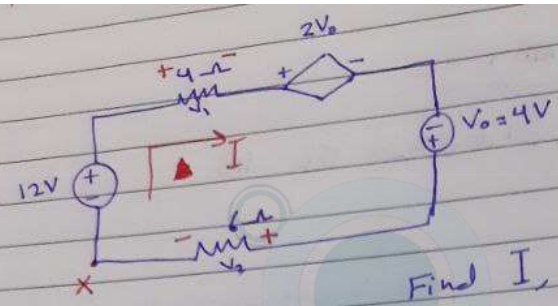
* اذا رجع على نفس النقطة يكون $V = 0$

* اذا يقوت من الموجبة موجبة واذا دخلة من السالبة سالبة



$V_o \Rightarrow \sum V = 0 \rightarrow -30 + 12 + V_o = 0$

$V_o = 18\,V$



Find I, V_1, V_2

$\Sigma V_x = 0$

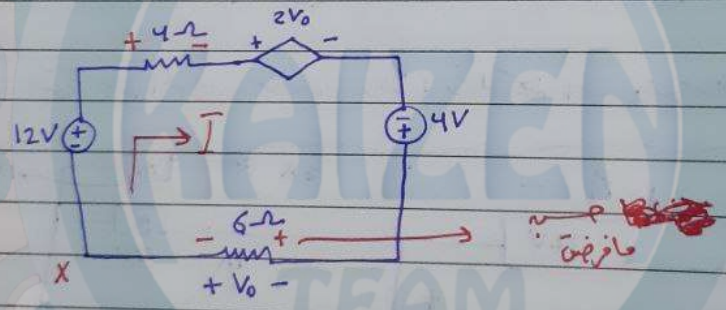
$\Rightarrow -12 + 4I + 2*(4) - 4 + 6I = 0$

$10I = 8$

$\boxed{I = 0.8\ A}$

$V_1 = 0.8 * 4 = \frac{16}{5} = 3.2$ volt

$V_2 = 0.8 * 6 = 4.8$ volt



$\Sigma V_x = 0 \rightarrow -12 + 4I + 2V_0 - 4 + 6I = 0$

$10I + 2V_0 = 16 \rightarrow (1)$

$V_0 = R I$

$V_0 = -6 * I$ (لأنه عكس اتجاه التيار)

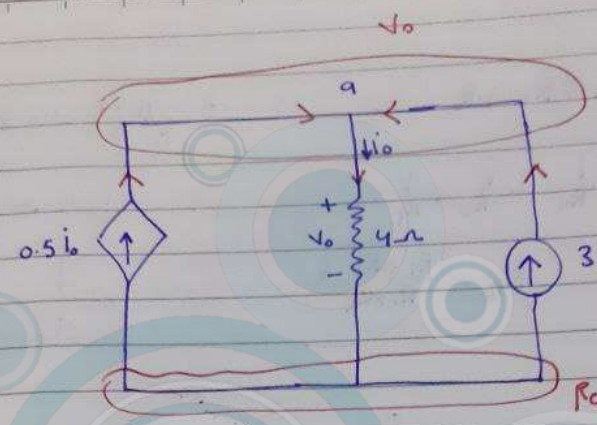
$10I + -12I = 16$

$\boxed{V_0 = 4\ volt}$

$-2I = 16$

$\boxed{I = -8\ A}$

Five Apple



Find current i_o and V_o ??

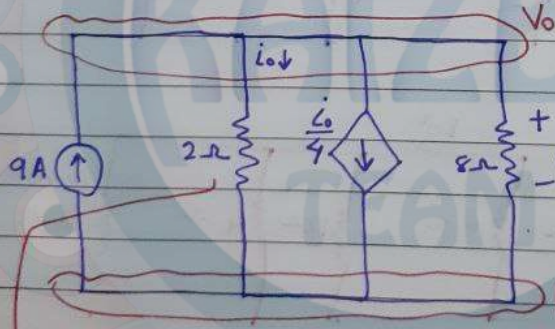
$$\Sigma I_{in} = \Sigma I_{out}$$

$$0.5 i_o + 3 = i_o$$

$$\boxed{i_o = 6A}$$

$$V_o = i_o * R$$

$$= 6 * 4 = 24 \text{ Volt}$$



Find i_o, V_o ??

$$\Sigma I_{in} = \Sigma I_{out}$$

$$9 = i_o + \frac{i_o}{4} + \frac{V_o}{8}$$

فرضنا V_o لأنه أكبر من الجهد

$$\boxed{V_o = 2i_o}$$

$$9 = i_o + \frac{i_o}{4} + \frac{i_o}{4} \Rightarrow \boxed{i_o = 6A}$$

$$\boxed{V_o = 12V}$$

في حالة التوالي :

$$R_{eq} = R_1 + R_2 + R_3 \dots$$

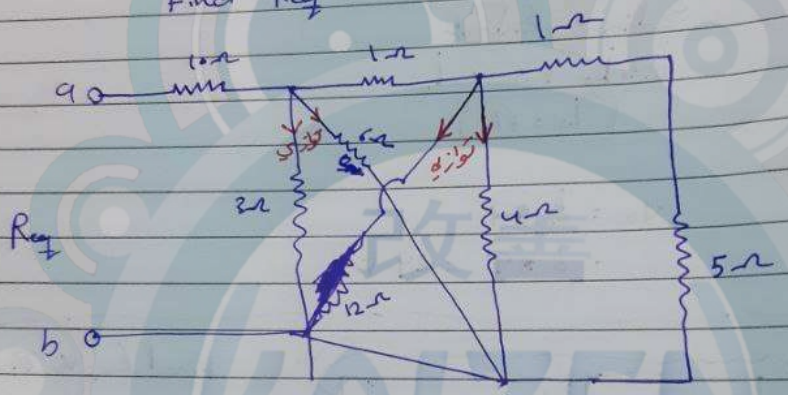
في حالة التوازي :

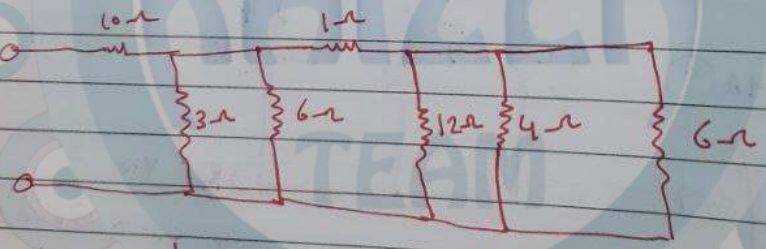
$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \dots$$

إذا كانت مقاومتين

$$R_{eq} = \frac{R_1 \times R_2}{R_1 + R_2}$$

Find R_{eq}



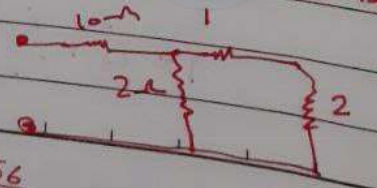


$\frac{3 \times 6}{9} = 2$

$$\frac{1}{R_{eq}} = \frac{1}{6} + \frac{1}{4} + \frac{1}{12}$$

$$= \frac{2}{12} + \frac{3}{12} + \frac{1}{12} = \frac{6}{12} = \frac{1}{2} \Rightarrow R_{eq} = 2$$

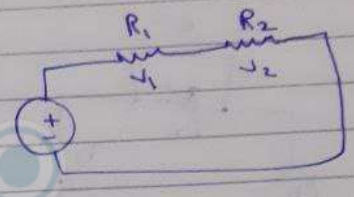
$$R = \frac{3 \times 2}{5} = \frac{6}{5}$$



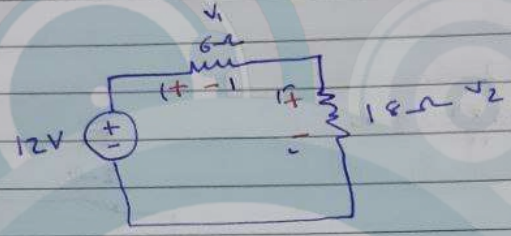
$$R_{eq} = \frac{6}{5} + \frac{50}{5} = \frac{56}{5}$$

Five Appl

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



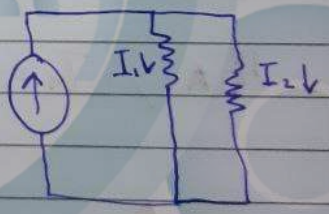
Ex:-



$$V_2 = \frac{18 * 12}{18 + 6} = 9 \text{ Volt}$$

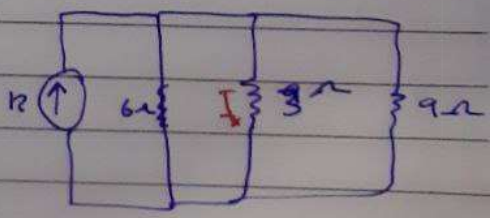
$$I_1 = \frac{I_T R_2}{R_1 + R_2}$$

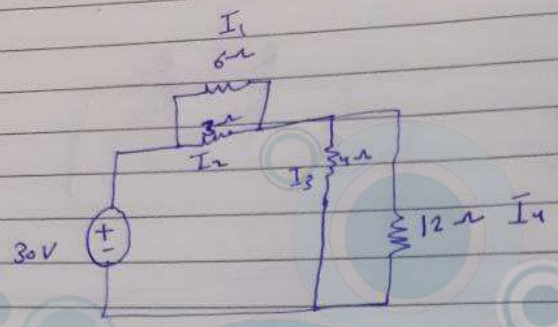
$$I_2 = \frac{I_T R_1}{R_1 + R_2}$$



Ex:- $6 // 9 \Rightarrow R = \frac{9 * 6}{15} = \frac{54}{15}$

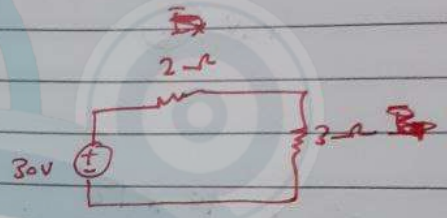
$$I_x = \frac{12 * 54/15}{\frac{54}{15} + 3} A$$





$6 // 3 = 2\,\Omega$

$12 // 4 = \frac{12*4}{16} = 3\,\Omega$

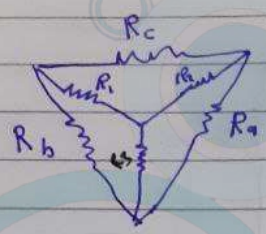


$V_{12} = \frac{30*2}{5} = 12$ Volt

$V_{34} = \frac{30*3}{5} = 18$ Volt

$I_1 = \frac{12}{6} = 2A$, $I_2 = \frac{12}{3} = 4A$

$I_3 = \frac{18}{4} A$, $I_4 = \frac{18}{12} A$



Δ to Y

$$R_1 = \frac{R_b R_c}{R_a + R_b + R_c}$$

$$R_2 = \frac{R_a R_c}{R_a + R_b + R_c}$$

$$R_3 = \frac{R_a R_b}{R_a + R_b + R_c}$$

$$R_a = R_b = R_c = R_\Delta$$

$$R_Y = \frac{R_\Delta}{3}$$

Y to Δ

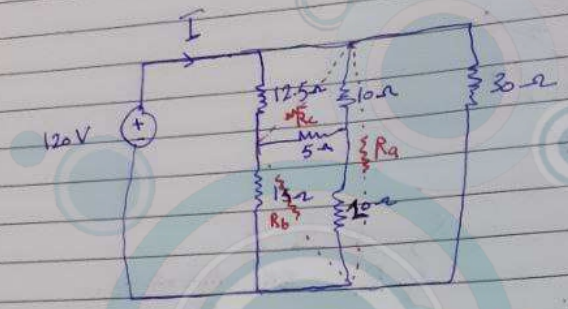
$$R_a = \frac{R_1R_2 + R_1R_3 + R_2R_3}{R_1}$$

$$R_b = \frac{R_1R_2 + R_1R_3 + R_2R_3}{R_2}$$

$$R_c = \frac{R_1R_2 + R_1R_3 + R_2R_3}{R_3}$$

$$R_1 = R_2 = R_3 = R_Y$$

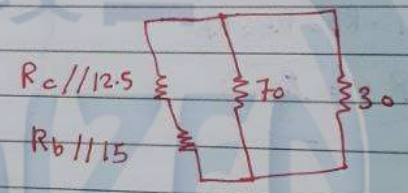
$$R_\Delta = 3R_Y$$



$$R_a = \frac{20\times10 + 10\times5 + 20\times5}{5} = \frac{350}{5} = 70\ \Omega$$

$$R_b = \frac{850}{10} = 35\ \Omega$$

$$R_c = \frac{350}{20} = 17.5\ \Omega$$



$$[R_c//12.5 + R_b//15]$$

$$= \frac{17.5\times12.5}{30} + \frac{35\times15}{50}$$

$$= 17.79\ \Omega$$

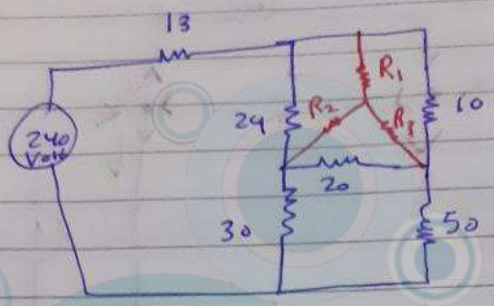
b

$$30 // 70 \Rightarrow \frac{30\times70}{100} = 21\ \Omega$$

$$21\ \Omega // 17.79\ \Omega \Rightarrow R_{eq} = \boxed{9.631\ \Omega}$$

$$I = \frac{120}{9.631}$$

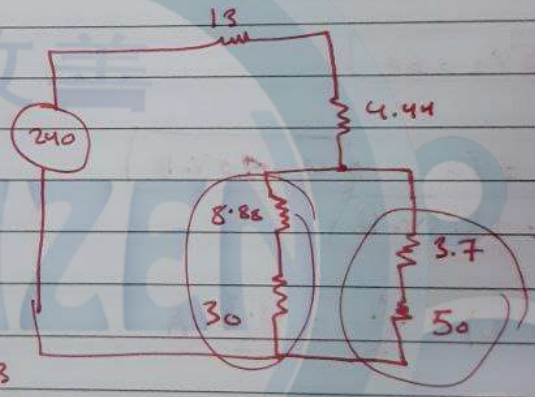
$$\boxed{I = 12.46A}$$



$$R_1 = \frac{10 * 24}{10 + 20 + 24} = \frac{240}{54} = 4.44\ \Omega$$

$$R_2 = \frac{20 * 24}{54} = 8.88\ \Omega$$

$$R_3 = \frac{10 * 20}{54} = 3.7\ \Omega$$



$3.7 \,//\, 38.88$

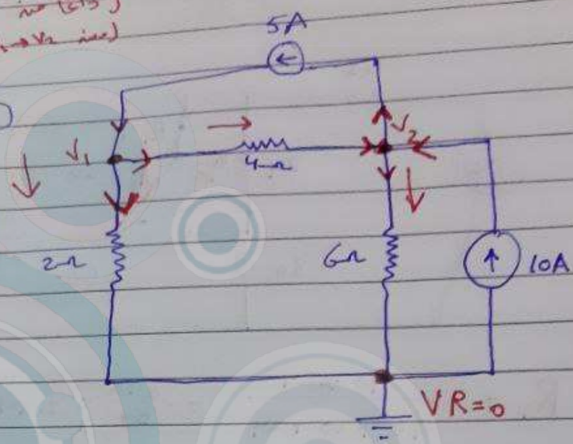
$\Rightarrow 22.552\ \Omega$

$$R_{eq} = 22.552\ \Omega + 4.44 + 13$$

$$\boxed{R_{eq} = 40\ \Omega}$$

$$I = \frac{240}{40} = \boxed{6A}$$

(Nodel) :-



$4\times\quad 5 = \frac{V_1 - V_2}{4} + \frac{V_1}{2} \rightarrow [1]$

$4\times\quad 10 + \frac{V_1 - V_2}{4} = 5 + \frac{V_2}{6}$

$20 = V_1 - V_2 + 2V_1$

$\boxed{3V_1 - V_2 = 20}$

$40 + V_1 - V_2 = 20 + \frac{2}{3}V_2$

$\boxed{V_1 - \frac{5}{3}V_2 = -20} \quad \times -3$

$\boxed{-3V_1 + 5V_2 = 60}$

$4V_2 = 80 \rightarrow \boxed{V_2 = 20 \text{ Volt}}$

$\boxed{V_1 = 13.3 \text{ Volt}}$

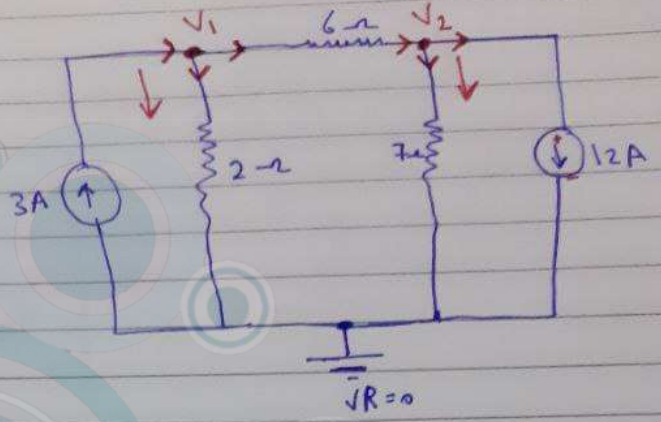
* $I(2\Omega) = \frac{V_1}{2} = \frac{13.3}{2}$ A

* $I(4\Omega) = \frac{V_1 - V_2}{4} = \frac{13.3 - 20}{4}$ A

* $V(10A) = V_2 = 20$ V

* $V(5A) = V_1 - V_2 = 13.3 - 20$

* $I(6\Omega) = \frac{V_2}{6} = \frac{20}{6}$ A



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

$$6* \ \frac{V_1 - V_2}{6} = 12 + \frac{V_2}{7}$$

$$V_1 - V_2 + 3V_1 = 18$$

$$V_1 - V_2 - \frac{6V_2}{7} = 72$$

$$4V_1 - V_2 = 18$$

$$V_1 - \frac{13}{7}V_2 = 72 \quad * -4$$

$$4V_1 - V_2 = 18$$

$$-4V_1 + \frac{52}{7}V_2 = -288$$

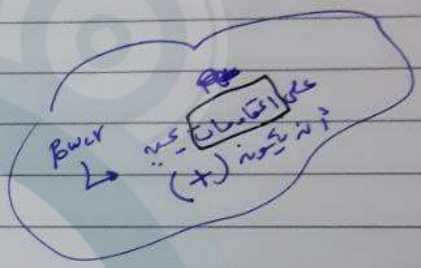
$$\frac{45}{7}V_2 = -270$$

$$\boxed{V_2 = -42 V}$$

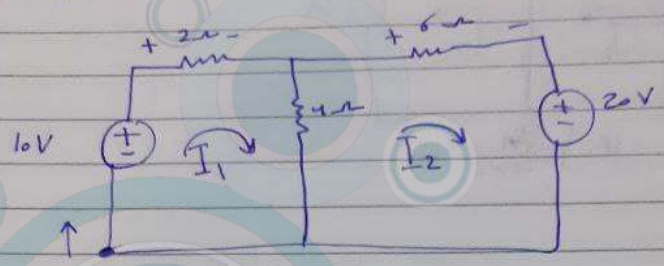
$$\boxed{V_1 = -6 \text{ Volt}}$$

$$P(12A) = V_2 * A$$

$$= -42 * 12 = \boxed{-504 \text{ watt}}$$



mesh analysis :-



[1] تحديد الـ polarity ← عن طريق I الداخل على المقاومة (+) والأخر سالب

$M_1 \rightarrow$ $-10 + 2I_1 + 4(I_1 - I_2) = 0$ (+ داخلة ذاهبة)

$2I_1 + 4I_1 - 4I_2 = 10$

$$\boxed{6I_1 - 4I_2 = 10}$$

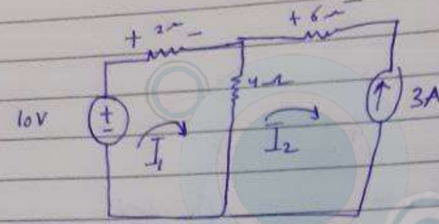
$M_2 \rightarrow$ $6I_2 + 20 + 4(I_2 - I_1) = 0$ (+ داخلة +)

$$\boxed{-4I_1 + 10I_2 = -20}$$

$I_1 = 0.45$, $I_2 = -1.8$

الأكبر - الأصغر

$V_{4\Omega} = (I_1 - I_2) \times 4 = 2.25 \times 4 = \boxed{9V}$



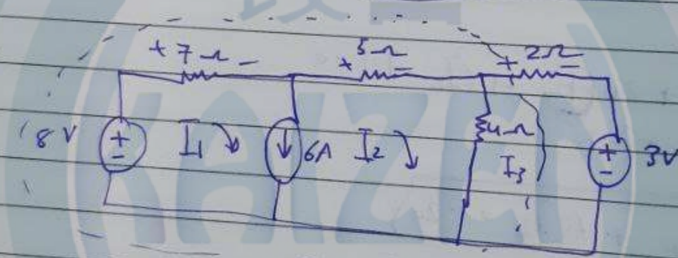
$\boxed{I_2 = -3A}$ → لانه عكس [illegible]

$M_1 = -10 + 2I_1 + 4(I_1 - I_2) = 0$

$6I_1 - 4I_2 = 10$

$I_2 = -3$ ↳ $6I_1 = -2 \rightarrow \boxed{I = -\frac{1}{3}A}$

EX:-



$M_3 \rightarrow 2I_3 + 3 + 4(I_3 - I_2) = 0$

لانه يوجد current بين I_1, I_2 ← Super mesh → $-8 + 7I_1 + 5I_2 + 4(I_2 - I_3) = 0$

$\rightarrow \boxed{I_1 - I_2 = 6}$

المصدر [illegible] في نفس اتجاه الفرض
$I_1 - I_2$ بالتالي