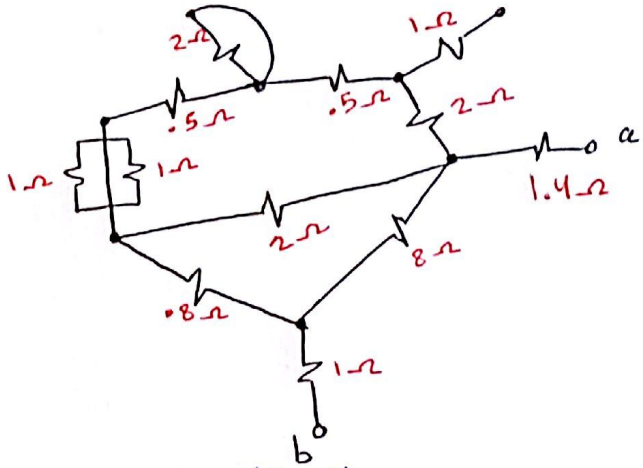
Power unit

Circuits 1
Pastpapper
first exam

summer semester
2014-2015
Dr. ghazi alsukkar

Q1 (25 marks): for the network shown in Fig. 1, find the equivalent resistance between terminal a and b (R_{ab}).



(Fig.1)

Q2 (25 marks): The network shown in Fig.2 is the visible part of a circuit, given that the power delivered by the 6V source is 12 watt, and $V_{bc} = 26V$, find i_1, i_2, i_3 and V_{ab}

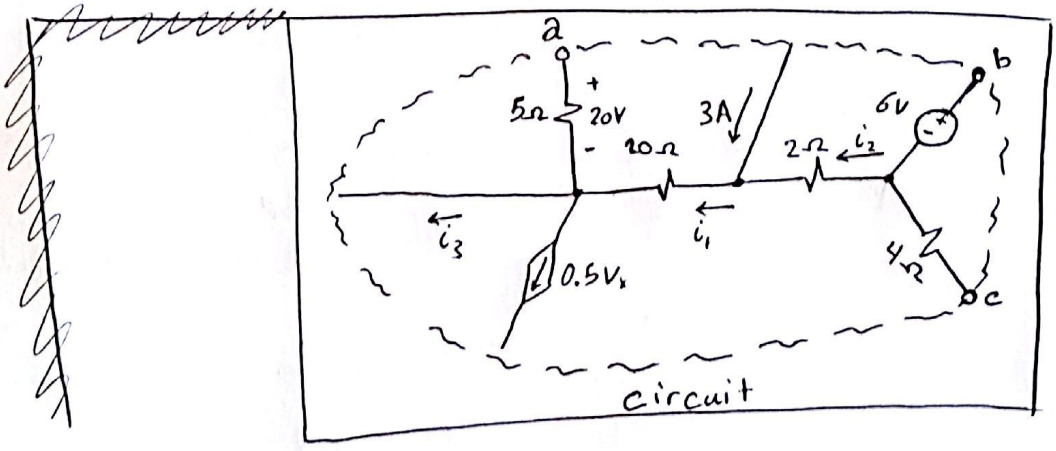


Fig. 2

Q3 (25marks): For the circuit shown in Fig.3, use Nodal analysis to formulate the required equations with V_1, V_2, V_3 and V_4 as the only unknowns (Do not Solve the equations). (note: other methods will worth 0marks).

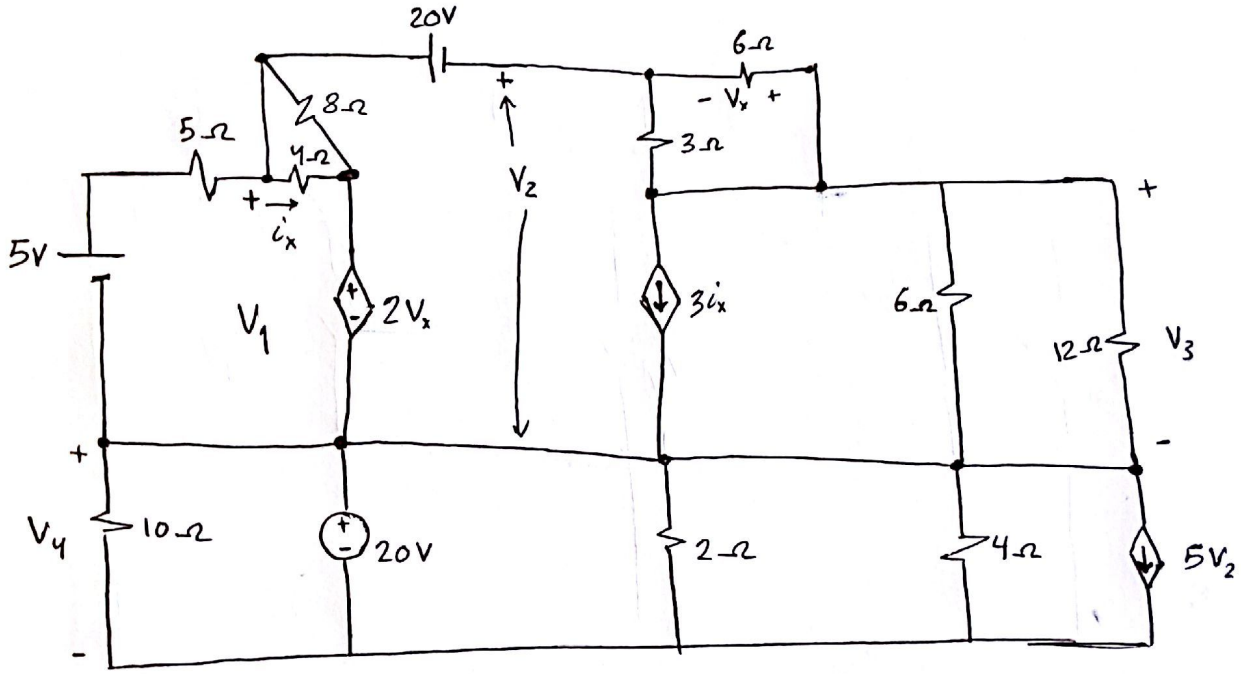


Fig.3

Q4 (25marks): For the circuit in Fig.4, use mesh analysis to find i_1 and V_1. (note: other methods will worth 0marks).

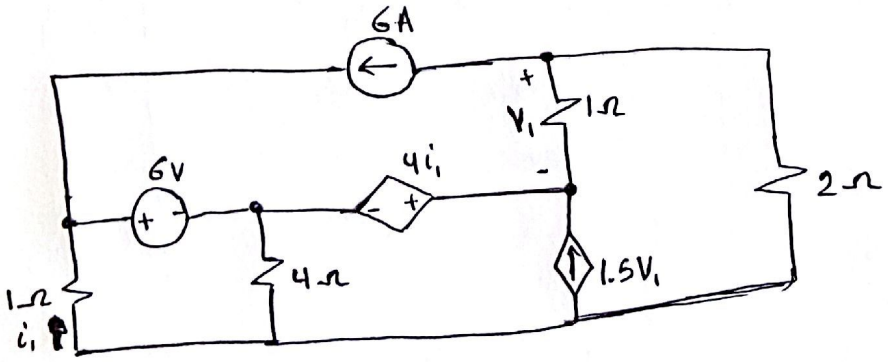


Fig.4

Circuits 1
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Dr. Ghazi Al sukkar
Summer semmester
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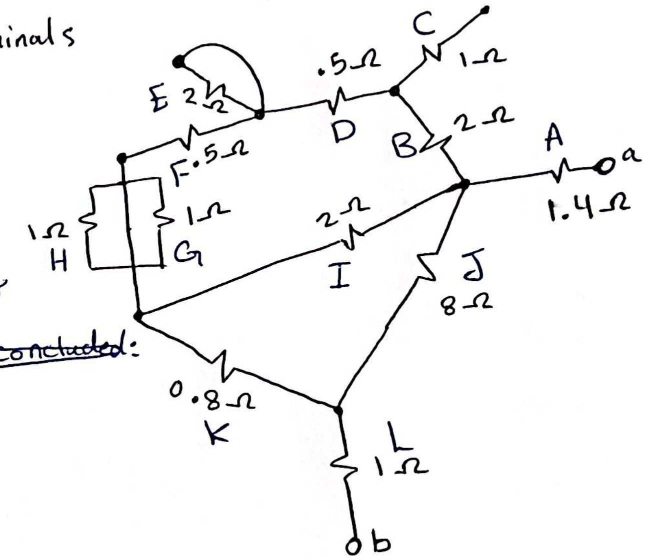
Power unit

* كل سؤال كان من 25 علامة
* ٤ أسئلة

Q1 Find equivalent resistance in the Figure between the two terminals a and b (Rab)



لتسهيل عملية شرح السؤال سوف أسمي كل Resistance بحرف .

~~by looking at the circle i concluded: A and L are parallel with the rest of the circle~~

By looking at the circuit i concluded:

* Resistances A and L are in series with the rest of the circuit

* C, E, H, G are not included in the calculations why?

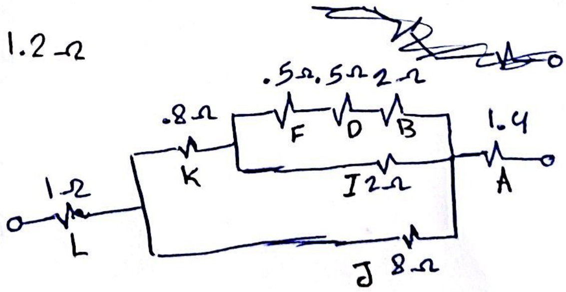
- C because it has a dead end
- E because it's neither in parallel nor in series with the rest of the CKT.
- H & G because of the wire between them ⇒ short CKT

التيار يختار الطريق الأقل المقاومة

اذا شكل ال CKT أصبح:

- B & D & F in series ⇒ $2+.5+.5=3\Omega$

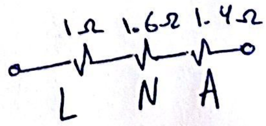
- I & (B,D,F) in parallel ⇒ $\left(\frac{1}{2}+\frac{1}{3}\right)^{-1}=\frac{6}{5}=1.2\Omega$ (التسمية: Z)



- Z & K in series ⇒ $1.2+.8=2\Omega$

- J & (Z,K) in parallel ⇒ $\left(\frac{1}{8}+\frac{1}{2}\right)^{-1}=1.6\Omega$ (N)

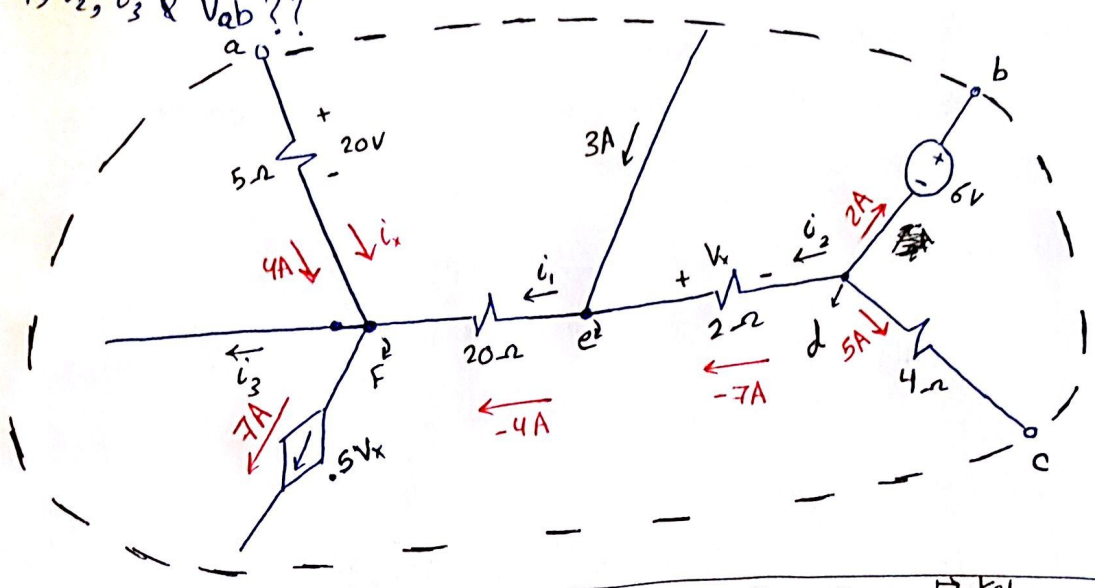
- $\boxed{Rab = L+N+A = 1.4+1.6+1 = 4\Omega}$



Q2

* Power delivered by the 6V source is 12 watt
* $V_{bc} = 26$ Volt
* find i_1, i_2, i_3 & V_{ab} ??

power unit



step1: * اضرب بالخطايا

* $P = IV$

$P_{6V} = IV$

$12 = 6I_{6V}$

$I_{6V} = 2A$

$V_{bc} = 26V$

$V = IR$

$V_{bc} = 6 + 4I_{4\Omega}$

$26 = 6 + 4I_{4\Omega}$

~~5A = 7~~

$20 = 4I_{4\Omega}$

$5A = I_{4\Omega}$

step2 use themethods → KCL, KVL to find the ~~unknowns~~ unknowns.

KCL at node d :

$I_{out} = I_{in}$

$2 + 5 + i_2 = 0$

$i_2 = -7A$

KCL at node e :

$I_{out} = I_{in}$

$i_1 = 3 + -7$

$i_1 = -4A$

$V_x = IR$

$= 7 \times 2$

$V_x = 14V$

$i_x = \frac{V}{R}$

$= \frac{20}{5}$

$i_x = 4A$

⇒ خدول اتعلموا عشان نطلع i_3

KCL at node F

$I_{in} = I_{out}$

$-4 + 4 = i_3 + 7$

$i_3 = -7A$

Vab

~~From a to f~~

$a \to f = 20V$

$f \to e = 4 \times 20 = 80V$ (Ohm's law)

$e \to d = V_x = 14V$

$d \to b = -6V$

$V_{ab} = 20 + 80 + 14 - 6$

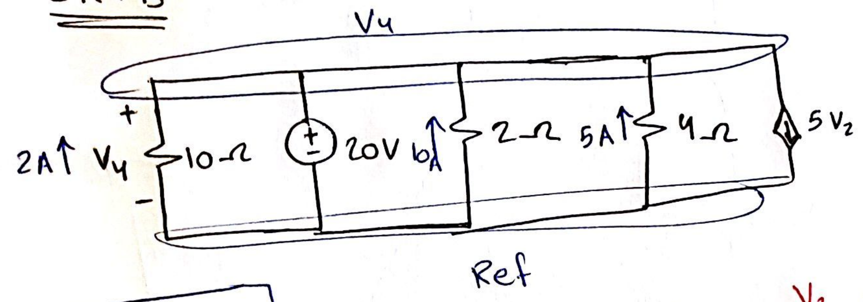
$V_{ab} = 108$ Volt

Q_3: ~~find V_1 & V_2 & V_3 & V_4~~

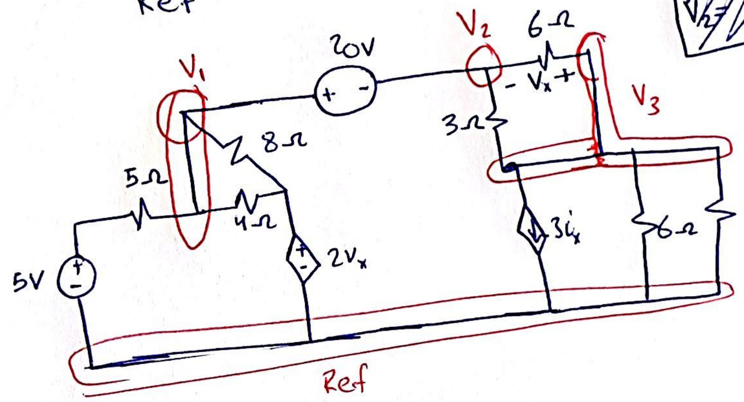
find V_1, V_2, V_3 & V_4 by Nodal Analysis:

فكرة هاد السؤال كالتالي افصل الدارة لدارتين وحلها ب Nodal

CKTB



$V_4 = 20V$



CKTA

at super node (1-2):

$$\frac{V_1 - 2V_x}{8} + \frac{V_1 - 2V_x}{4} + \frac{V_1 - 5}{5} + \frac{V_2 - V_3}{3} + \frac{V_2 - V_3}{6} = 0$$

$V_1 - V_2 = 20$

$V_x = V_3 - V_2$

at node 3

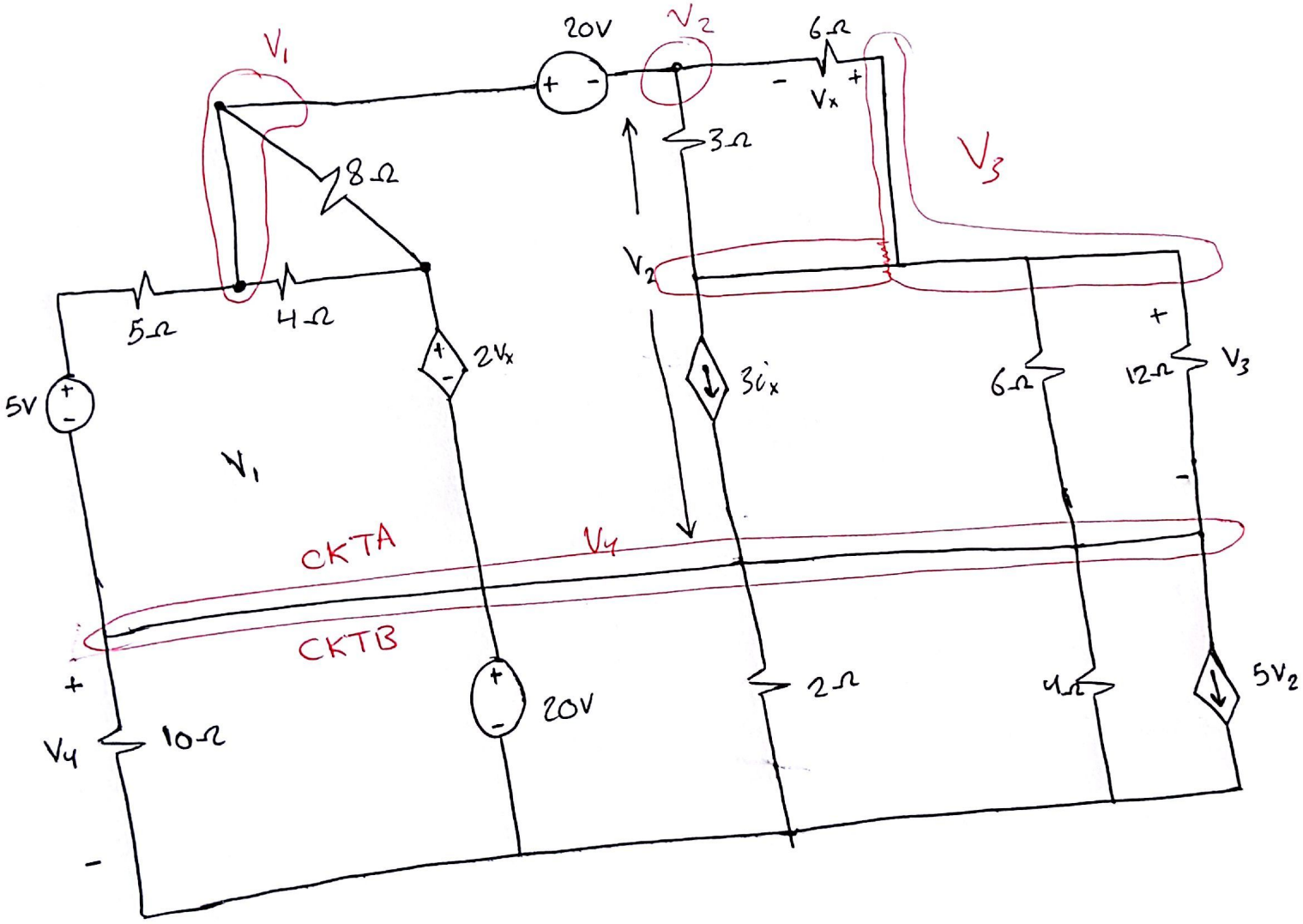
$$\frac{V_3 - V_2}{6} + \frac{V_3}{12} + \frac{V_3}{6} = 0$$

① $\frac{V_1 - 2V_3 + 2V_2}{8} + \frac{V_1 - 2V_3 + 2V_2}{4} + \frac{V_1 - 5}{5} + \frac{V_2 - V_3}{3} + \frac{V_2 - V_3}{6} = 0$

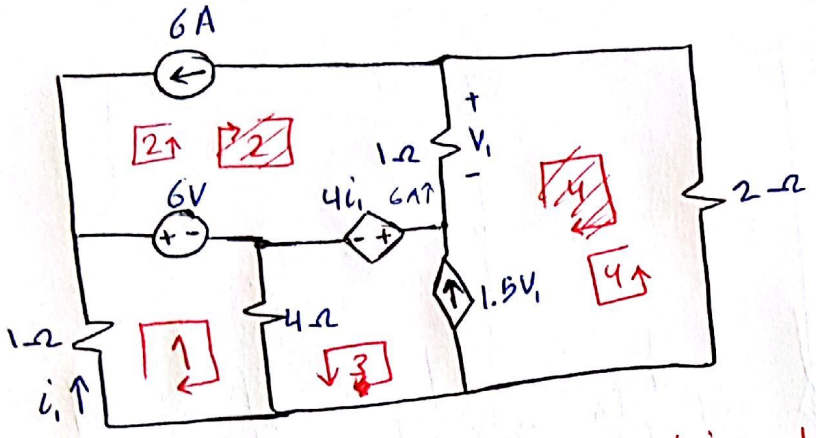
② $V_1 - V_2 = 20$

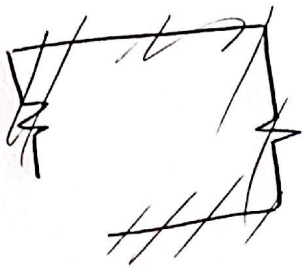
④ $V_4 = 20V$

③ $\frac{V_3 - V_2}{6} + \frac{V_3}{12} + \frac{V_3}{6} = 0$



Q4 : Use mesh analysis to find i_1 & V_1.





i have concluded that $i_2 = 6A$ so that i wouldn't need another mesh(equation).

@ Mesh 1

$i_1 + 6 + 4i_1 - 4i_3 = 0$

$5i_1 + 4i_3 = -6$ — (1)

@ Super mesh (3-4)

$i_4 + 2i_4 - 6 + 4i_1 + 4i_3 + 4i_1 = 0$

$3i_4 + 4i_1 + 4i_3 = 6$ — (2)

$i_3 - i_4 = 1.5V_1$ — (3)

$= \frac{3}{2}i_4 - 9$

$i_3 - \frac{5}{2}i_4 = -9$ — (3)

$V_1 = i_4 - 6$

(1) $5i_1 + 4i_3 = -6$

(2) $4i_1 + 4i_3 + 3i_4 = 6$

(3) $i_3 - \frac{5}{2}i_4 = -9$

→ $i_1 = -1.2A$, $i_3 = 0A$, $i_4 = 3.6A$

$V_1 = i_4 - 6$

$V_1 = -2.4V$