ch:1

" Introduction "

Units. A , V , Ω

Ω law:

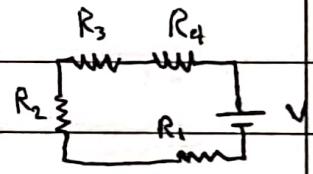
Schematic bbs

المصادر / مصدر فولتيه = فولتيه ثابته وتيار يعتمد على الحمل.
مصدر تيار = تيار ثابت وفولتيه تعتمد على الحمل.

+ Resistors
- Source

$P_{dis} = VI$

* القدرة المستهلكة أو المجددة : تكون موجبة للمقاومات وسالبه للمصدر

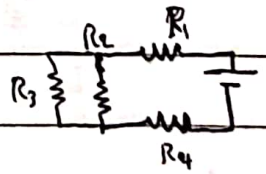


سلسلة Series : $Req = R_1 + R_2 + R_3 + R_4$

موازي Paraller: $\frac{1}{Req} = \frac{1}{R_1} + \frac{1}{R_2}$

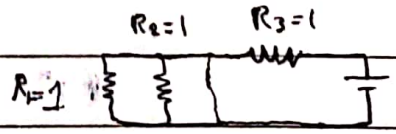
$$Req = \frac{R_1 R_2}{R_1 + R_2}$$

R_3 , R_2 توازي



مختلط Mixed:

Ex: find the current ?

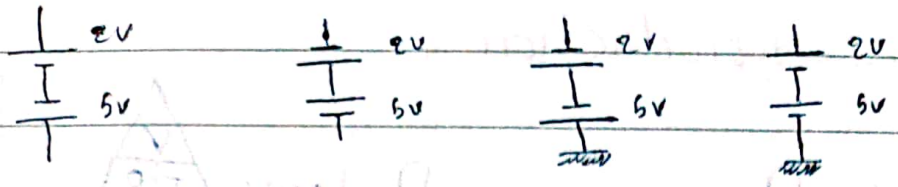


$Req = R_3 = 1\,\Omega$

$$I = \frac{5}{1} = 5\,A$$

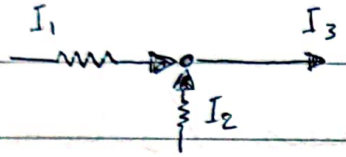
∴ السبب وجود shortcircuit

كيف نحسب المصادر



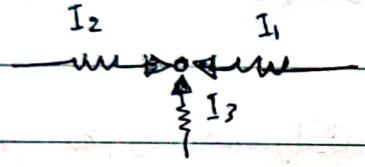
-3 3 -7 7

نحن طريق الاتجاه



$I_3 = I_1 + I_2$ 6 $I_1 + I_2 - I_3 = 0$

* كلما زادت الفولتية زاد التيار والعكس صحيح .

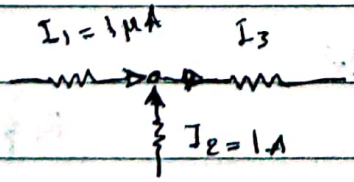


حسب الاتجاه $I_2 + I_3 + I_1 = 0$

Ex:

$I = \frac{V}{R} = \frac{5}{0} = \infty$

* السبب Open Circuit



$I_3 = I_2 = 1A$

تقريب لتسهيل الحل

Engineering cct Analysis 8th Edition

ch:2

Units :

MA
kA

A . V . Ω . m . S"

mA
μA
nA
pA

. Independent .

8V

-P

-P

2A

-P

. Power .

P = IV

I + V R −

a)

3A + 2V −

b)

2V −3

c)

5A + 4V −

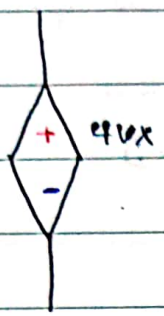
$P = IV$

$= (2)(3) = 6W$ a_2

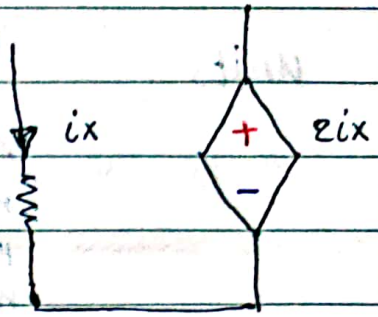
$= (-2)(-3) = 6W$ b_4

$= (-5)(4) = -20W$ c_4

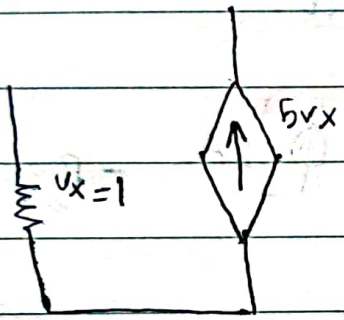
• dependent •

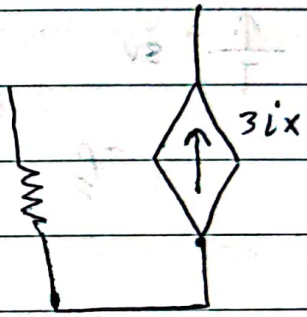


مصدر فولتية يعتمد على التيار



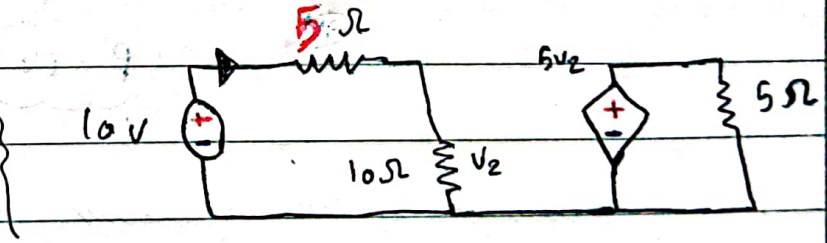
مصدر تيار يعتمد على الفولتية





مصدر تيار يعتمد على التيار

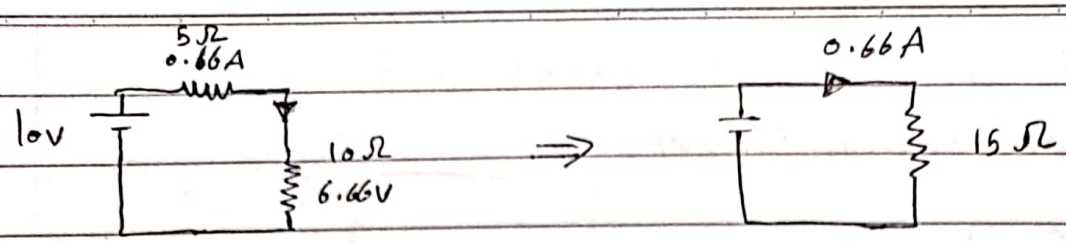
@/ find the Power of each element in fig. Below.



$$v_2 = \frac{10 \times 10}{10+5} = 6.66\ v$$

قانون تقسيم الفولتيات = الفولتية × المقاومة المطلوبة / مجموع المقاومات

Dependent v.s = 5 * 6.66 = 33,3 volt



$P_{5\Omega} = \frac{V^2}{R} = I^2R = IV$

$= \frac{(3.33)^2}{5} = 2.2\ W$

$P_{10\Omega} = \frac{(6.66)^2}{10} = 4.4\ W$

$P_{5\Omega} = \frac{(33.3)^2}{5} = 221.7\ W$

$P_{dependent} = (33.3) * (6.66)$

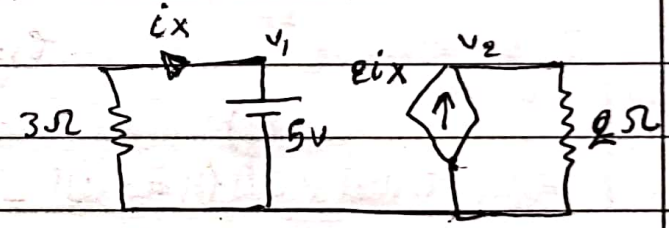
$= 221.7\ W$

ملاحظة مهمة:
أن المجموع الجبري للقدرة في الدائرة يساوي صفر.

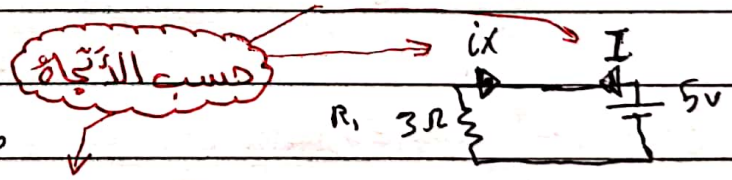
$P_{10V} = 10 * 0.66 = 6.6\ W$

@ 1 of 3

find the dependent Source Current ?



Sol



$I = \frac{5}{3} = 1.66\ Amp$

$ix = -I \Rightarrow ix = -1.66\ A$

$= +2ix \Rightarrow = +2 * -1.66 = -3.3\ A$

@ 2 of 3

find the Power

Sol

$P_{R_1} = \frac{V^2}{R} = \frac{25}{3} = 8.3\ W$

$P_{R_2} = I^2R = (-3.3)^2 * 2 = 21\ W$

الموضوع: التاريخ: / / ٢٠١

Q/ 3 of 3

Find the Power Supply

$$P_{6V} = VI = 5 * (-1.66) = -8\ W$$

$$P_{2ix} = VI = (3.33 * 2) * (-3.33) = -22.1\ W$$

ملاحظات :-

م/ هناك فرق بين Power supply و بين Power أو Power dissipated

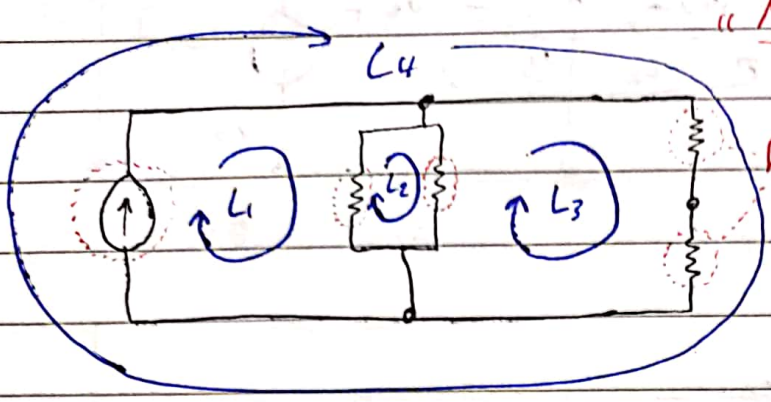
م/ القدرة المجهزة = القدرة المبددة

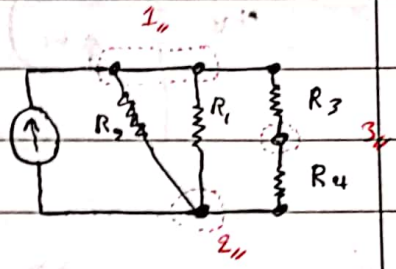
م/ قانون تقسيم الفولتيات = الفولتية الكلية × المقاومة المعنية / مجموع المقاومات

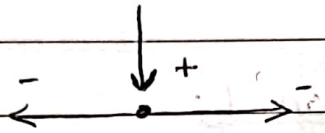
قانون تقسيم التيارات = التيار الكلي × المقاومة البعيدة (غير المعنية) / مجموع المقاومات

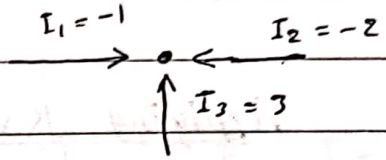
Node Path Loops Branches :

« K.C.L »





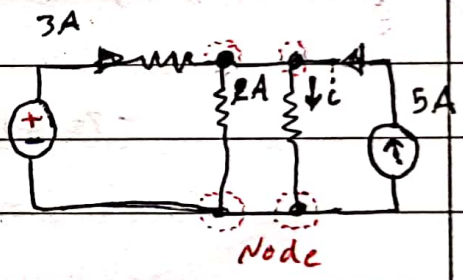




لازم يساوي صفر

* التيارات الداخلة تساوي التيارات الخارجة

@/ find the current I ?



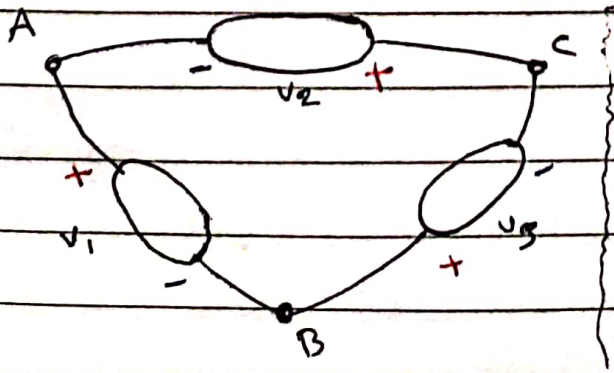
Sol/

$$(3) + (-2) + (-i) + 5 = 0$$

$$i = 6 \text{ Amp.}$$

« K.V.L »

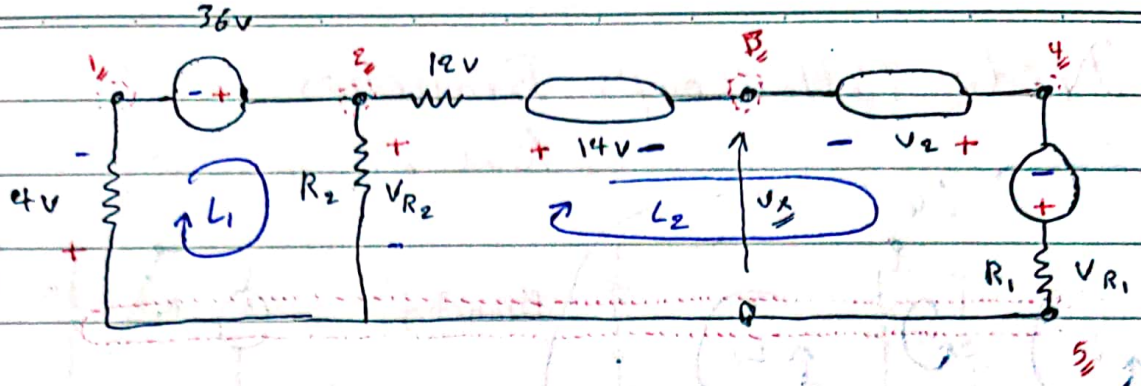
المجموع الجبري للفولتيات في أي لوب يساوي صفر



$$V_1 + V_3 + V_2 = 0$$

$$-V_1 - V_2 - V_3 = 0 \quad (*-1)$$

$$V_1 + V_2 + V_3 = 0$$



Q/

find V_{R_2} and find V_x

Sol

Applying KVL on L_1

$$4 - 36 + V_{R_2} = 0 \qquad V_{R_2} = 32 \text{ volt}$$

Sol

Applying KVL on L_2

$$-32 + 12 + 14 + V_x = 0 \qquad V_x = 6 \text{ volt}$$

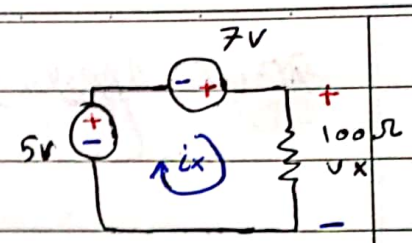
* إذا حسبناها بالعكس أيضاً تعمل اى نفس الناتج

* kcl يطبق على النقاط فقط أي على node

* kvl يطبق على اللوبات فقط أي على loop

Q1

Find the current ix



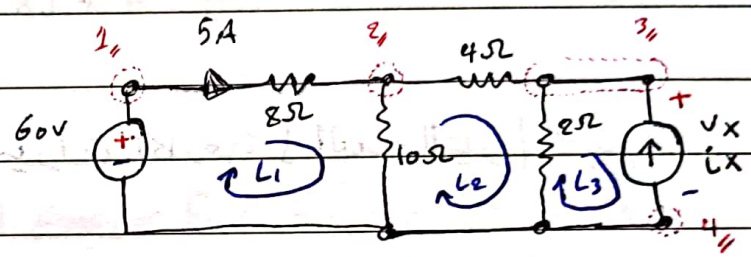
Sol

$-5 - 7 + V_x = 0 \quad \therefore V_x = 12$

$i_x = \frac{V_x}{R} = \frac{12}{100} = 0.12\,A$

Q2

find Vx and ix



Sol

Applying K.V.L on L_1

First Find V_{R8} / $V_{R8} = 5 \times 8 = 40\,V$

Now Applying K.V.L on L_1

$-60 + 40 + V_{R10} = 0 \quad \{V_{R10} = 20\ volt\}$

Find I_{R10}

$I_{R10} = \frac{20}{10} = 2\,A$

Now Applying KCL at n2 $\quad 5 - 2 - I_{R4} = 0$

$I_{R4} = 3\,A$

Find V_{R4}

$V_{R4} = IR = 3 \times 4 = 12\ volt$

Now Applying K.V.L on L_2

$$-20 + 12 + V_{R_2} = 0$$

$$V_{R_2} = 8V = V_x$$

Find $I_{R_2} = \frac{V_{R_2}}{R_2} = \frac{8}{2}$ $\quad I_{R_2} = 4 \cdot A$

Now Applying K.C.L at n3

$$3 - 4 + i_x = 0 \Rightarrow i_x = 1\,A$$

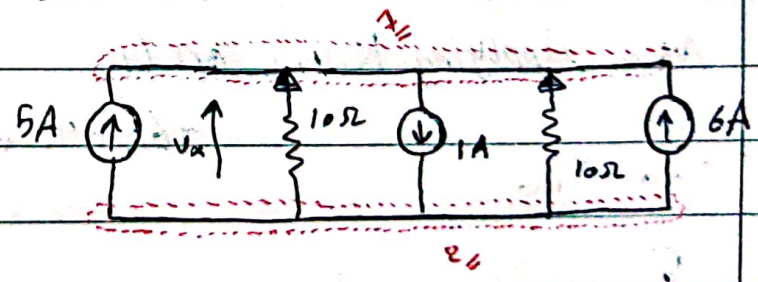
* التأكد من الحل نحسب التيارات الخارجة [بالنسبة للتيار] يجب أن تساوي صفر

والفولتية كذلك نطبقها حلقة الدائرة كاملة أيضاً يجب أن تساوي صفر

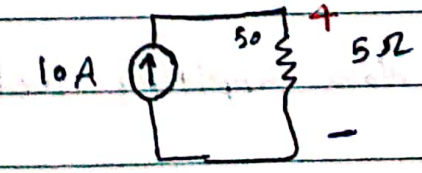
Applying KCL at n4 $\quad -5 + 2 + 4 - 1 = 0$

Applying KVL out $\quad -60 + 40 + 12 + 8 = 0$

Q/ find V_x



Sol



with Best wishes.

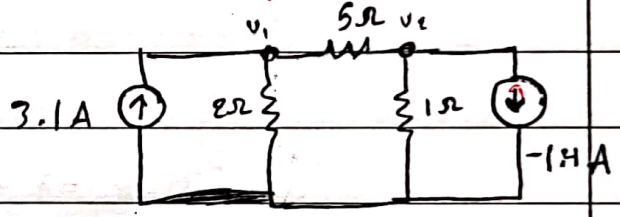
Kirchhoff's Voltage Law.

Kirchhoff's Current Law.

Nodal Analysis

1- Determin the nodes. — 1- تحدد العقد
2- Choose 1 node as Reference. — 2- اختر أحد العقد كمرجع
3- Apply KCL at each node. — 3- تطبق KCL كل كل عقدة.
4- Solve the equations — 4- حل المعادلات

Q/ find the dissipated power for the circuit below



Sol/

Applying KCL at V_1

$$3.1 - \frac{V_1}{2} - \left(\frac{V_1 - V_2}{5}\right) = 0 \quad \cdots\cdots (1)$$

Applying KCL V_2

$$\frac{V_1 - V_2}{5} - \frac{V_2}{1} - (-1.4) = 0 \quad \cdots\cdots (2)$$

Now multiply (1) *10

$$31 - 5V_1 - 2V_1 + 2V_2 = 0$$

$$31 - 7V_1 + 2V_2 = 0 \quad \cdots\cdots (3)$$

Now multiply (2) *5

$$V_1 - V_2 - 5V_2 + 7 = 0$$

$$V_1 - 6V_2 + 7 = 0 \quad \cdots\cdots (4)$$

Now ③ × 3 + ④

$$93 - 21V_1 + 6V_2 = 0$$

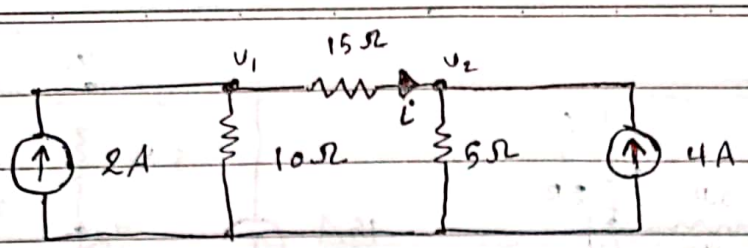
$$V_1 - 6V_2 + 7 = 0$$

$$-20V_1 + 100 = 0 \Rightarrow \boxed{V_1 = 5}$$

نعوض في ④

$$5 - 6V_2 + 7 = 0 \quad \boxed{V_2 = 2}$$

Q/



Find i

Sol

Applying KCL at V_1

$$2 - \frac{V_1}{10} - \left(\frac{V_1 - V_2}{15}\right) = 0 \quad \text{---(1)}$$

Applying KCL at V_2

$$\frac{V_1 - V_2}{15} - \frac{V_2}{5} + 4 = 0 \quad \text{---(2)}$$

Multiply (1) * 30

$$60 - 3V_1 - 2V_1 + 2V_2 = 0$$

$$60 - 5V_1 + 2V_2 = 0 \quad \text{---(3)}$$

Multiply (2) * 15

$$V_1 - V_2 - 3V_2 + 60 = 0$$

$$V_1 - 4V_2 + 60 = 0 \quad \text{---(4)}$$

Multiply (3) * 2

and plus with (4)

$$120 - 10V_1 + 4V_2 = 0$$

$$60 + V_1 - 4V_2 = 0$$

$$180 - 9V_1 = 0 \Longrightarrow \boxed{V_1 = 20}$$

نعوض في (4)

$$20 - 4V_2 + 60 = 0 \qquad \boxed{V_2 = 20\ V}$$

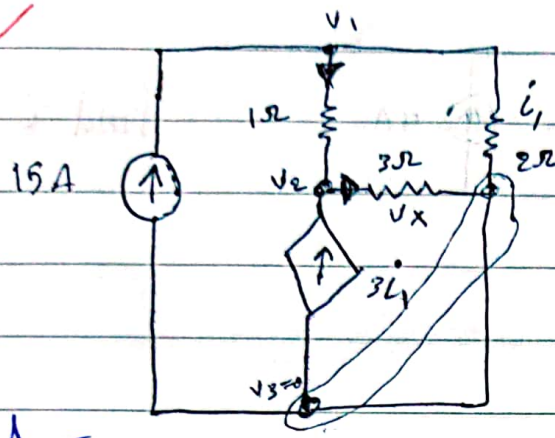
$$i = \frac{20 - 20}{15} = 0$$

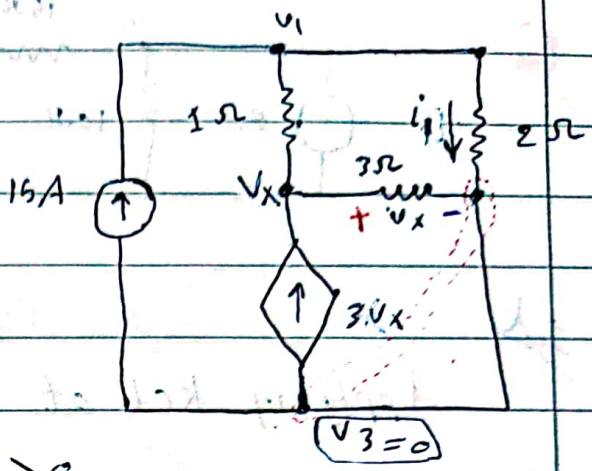
find the diss Power of $R_{3\Omega}$

الموضوع:

التاريخ: ٢٠١ / / :

Q/





Sol

$\therefore V_1 > V_2 \quad V_1 > 0 \quad V_2 > 0$

$$15 - \left(\frac{V_1 - V_2}{1}\right) - \frac{V_1}{2} = 0 \quad \cdots (1)$$

at $V_2 \quad \therefore V_2 > 0$

$$-\left(\frac{V_2 - V_1}{1}\right) - \frac{V_2}{3} + 3i_1 = 0 \quad \cdots (2)$$

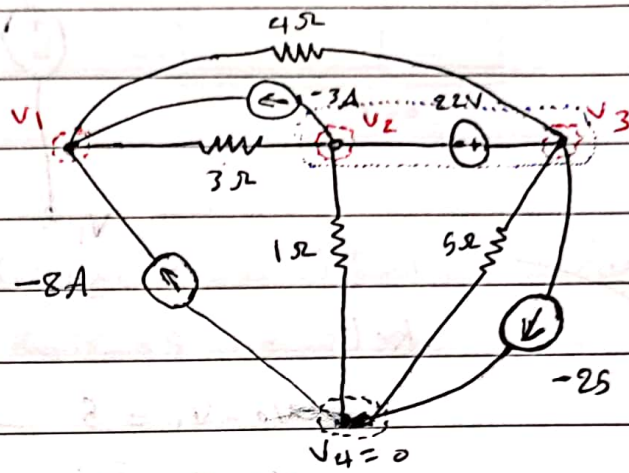
$$i_1 = \frac{V_1}{2} \quad \cdots (3) \quad \text{نعوض في (2)}$$

$$-\left(\frac{V_2 - V_1}{1}\right) - \frac{V_2}{3} + \frac{3V_1}{2} = 0$$

* تطبيق KCL at node 1 شرط أن كل التيارات خارجه

* All current is out of the Node.

Ex: What is the current throw the voltage supply.



Sol

KCL V_1

$$-8-3-\frac{(V_1-V_2)}{3}-\frac{(V_1-V_3)}{4}=0 \quad \text{---(1)}$$

KCL V_2

$$-\frac{(V_2-V_1)}{3}+3-\frac{V_2}{1}-99$$

* لا يمكن حساب اكثر من نود كل معادلة جهد.

* أي نودين أو أكثر مرتبطين بمصدر فولتية يعتبرون نود واحد ويسمى Supper node

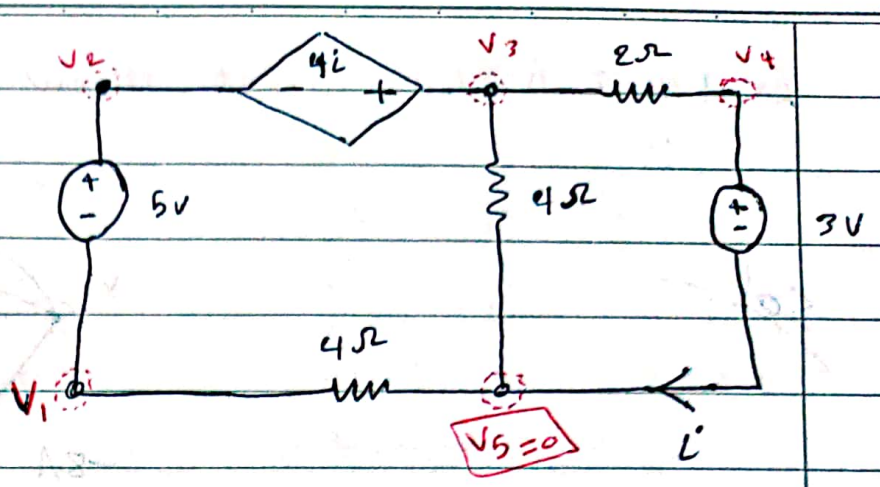
KCL at Supper Node. (V_2, V_3) Super Node

$$-(-3)-\frac{(V_2-V_1)}{3}-\frac{V_2}{1}-\frac{V_3}{5}-(-25)-\frac{(V_3-V_1)}{4}=0 \quad \text{---(2)}$$

$$V_3-V_2=22V \quad \text{---(3)}$$

To find the current I نستغل V_2

Find the current i



Sol

KCL

$$v_2 - v_1 = 5 \quad \text{---} \quad (1)$$

$$v_3 - v_2 = 4i \quad \text{---} \quad (2)$$

$$v_4 = 3 \quad \text{---} \quad (3)$$

Applying KCL at v_2, v_3, v_1 Super node

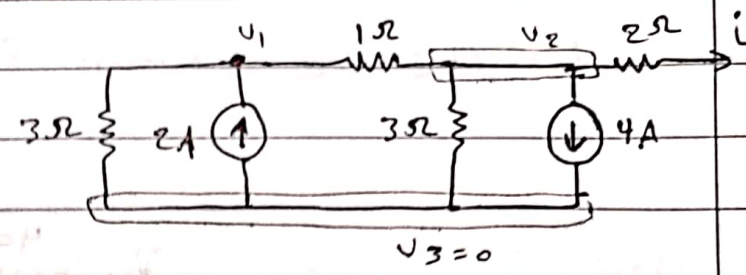
$$-\frac{(v_3 - v_4)}{2} - \frac{v_3}{4} - \frac{v_1}{4} = 0 \quad \text{---} \quad (4)$$

$$i = \frac{v_3 - v_4}{2} \quad \text{---} \quad (5)$$

الموضوع:

التاريخ: / / ٢٠١

Q/ quiz A



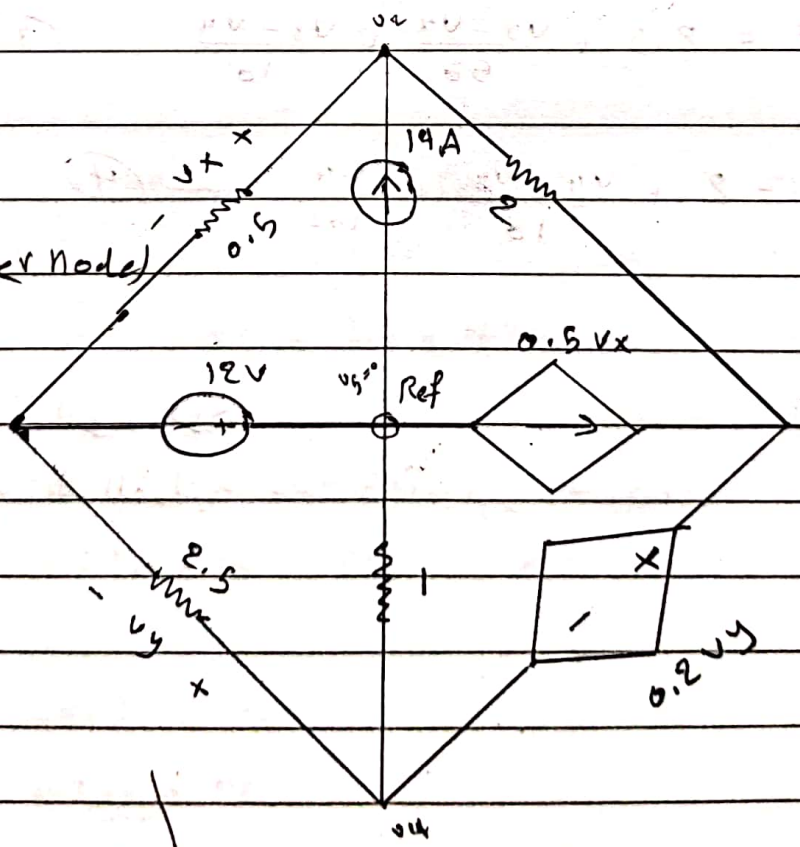
Sol

* طبعاً هو السؤال كان مقاومتين 6Ω على التوازي ولكن جمعتهم وصارو مقاومة وحدي 3Ω

$$\frac{-V_1}{3} + 2 - \frac{(V_1 - V_2)}{1} = 0 \quad \text{---} (1)$$

$$-\frac{(V_2 - V_1)}{1} - \frac{V_2}{3} - 4 = 0 \quad \text{---} (2)$$

Q/ quiz B



$V_1 = -12$ (Supernode)

$V_2 - V_4 = 0.2 V_y$

$V_y = V_4 - V_1$

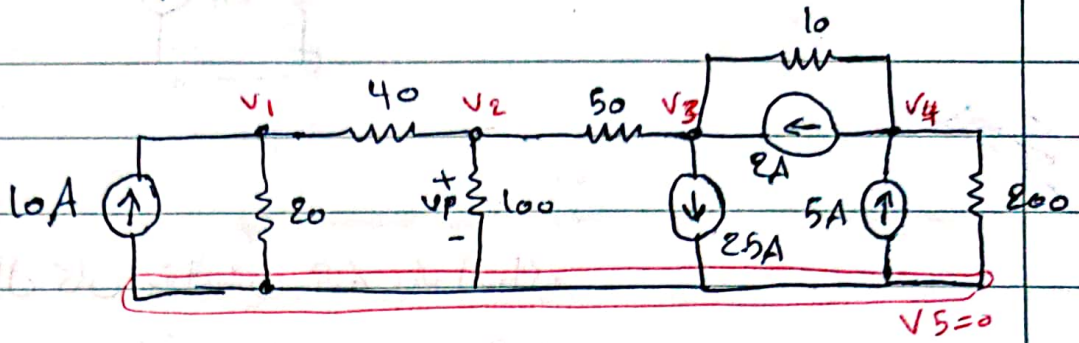
$V_x = V_2 - V_1$

KCL at V_2

$$\frac{V_2 - V_1}{0.5} + \frac{V_2 - V_3}{2} = 19$$

$0.5 V_x - 2 - 1 - 2.5 V_y$ V3 Supernode

Q/ for the circuit shown find v_p



Sol

① تحديد النودات

v_1 kcl ②

$$10 = \frac{v_1 - v_2}{40} + \frac{v_1}{20} \quad \text{---} \quad ①$$

v_2 kcl

$$0 = -\frac{(v_2 - v_3)}{50} - \frac{v_2}{100} - \frac{v_2 - v_1}{40} \quad \text{---} \quad ②$$

v_3 kcl

$$2 = 2.5 + \frac{v_3 - v_2}{50} + \frac{v_3 - v_4}{10} \quad \text{---} \quad ③$$

v_4 kcl

$$5 = 2 + \frac{v_4 - v_3}{10} + \frac{v_4}{100} \quad \text{---} \quad ④$$

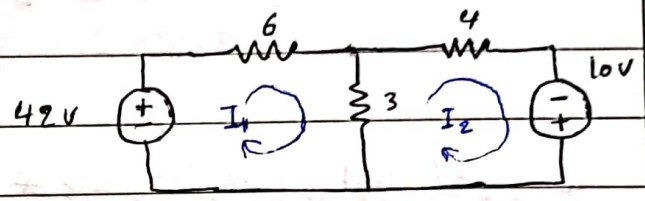
* التيار لا يجوز سوبر نود.

* Super node فقط للفولتيه معتمد أو غير معتمد.

MESH Analysis

Mesh : هو لوب واحد دون تداخل أي الرسم يكون مسطح دون تقاطع الخطوط .

Ex:



1- Simplify
2- Mesh تحدد
3- I
4- Applying KVL at Mesh.

Sol

Mesh 1/ $-42 + 6I_1 + 3(I_1 - I_2) = 0$ — ①

Mesh2/ $-10 + 3(I_2 - I_1) + 4I_2 = 0$ — ②

$9I_1 - 3I_2 = 42$ — ③ .....

$-3I_1 + 7I_2 = 10$ — ④ $*3$

$-9I_1 + 21I_2 = 30$

$+ \quad 9I_1 - 3I_2 = 42$

$0 + 18I_2 = 72 \Rightarrow \boxed{I_2 = 4}$

$9I_1 - 3(4) = 42 \Rightarrow 9I_1 = 42 + 12 = 54$

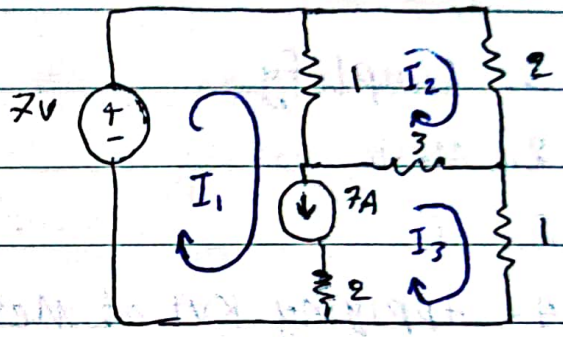
$\boxed{I_1 = 6}$

Super node

في المثال السابق إذا تعتبر تطبق KCL فأن مثالك Note $
للمصدرين وبالتالي الستبق نقطة واحدة لكل السؤال.

Exs find the Power Supply by 7v

* مصدر التيار لا يمكن ايجاد الفولتية له



Sol

1- mesh 2//

$$-2I_2 + 3(I_2 - I_3) + 1(I_2 - I_1) = 0 \quad \text{---} ①$$

2- mesh 1,3 { Super Mash }

$$-7 + 1(I_1 - I_2) + 3(I_3 - I_2) + 1 \times I_3 = 0 \quad \text{---} ②$$

$$I_1 - I_3 = 7 \quad \text{---} ③$$

$$2I_2 + 3I_2 - 3I_3 + I_2 - I_1 = 0$$

$$-I_1 + 6I_2 - 3I_3 = 0 \quad \text{---} ④$$

$$-7 + I_1 - I_2 + 3I_3 - 3I_2 + I_3 = 0$$

$$I_1 - 4I_2 + 4I_3 = 7 \quad \text{—— (5)}$$

$$I - I_3 = 7 \quad \text{—— (6)}$$

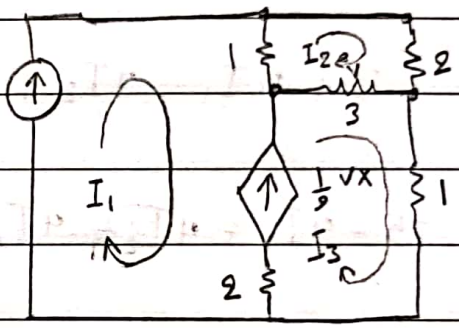
$$-I_1 + 6I_2 - 3I_3 = 0 \quad \text{—— (4)}$$

Ex: find the current of all mesh

1- simplify

2- Mesh حدد

3- Super mesh



Kvl at I_2

$$2I_2 + 3(I_2 - I_3) - 1(I_2 - I_1) = 0 \quad \text{—— (1)}$$

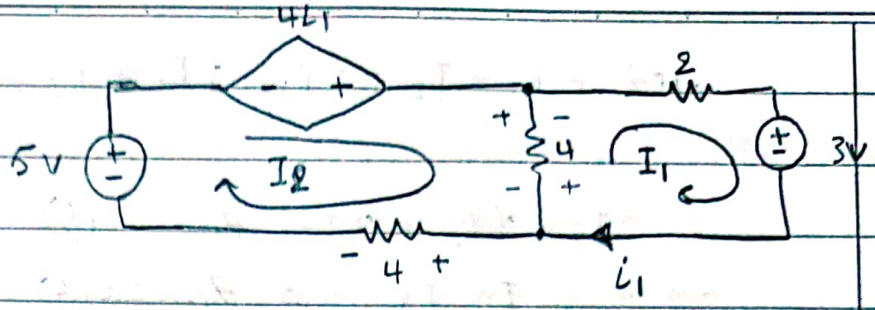
$$I_1 = 15 \quad \text{—— (2)}$$

$$I_3 - I_1 = \frac{1}{9}vx \quad \text{—— (3)}$$

$$V = (I_3 - I_2)3 \quad \text{—— (4)}$$

* لا يجوز حل I_3, I_1 بـ Super Mesh

Ex: Find I_1, I_2



KVL at I_1

$$3 + 4(I_1 - I_2) + 2I_1 = 0 \quad \text{— ①}$$

KVL at I_2

$$-5 - 4I_1 + 4(I_2 - I_1) + 4I_2 = 0 \quad \text{— ②}$$

$$3 + 4I_1 - 4I_2 + 2I_1 = 0 \Rightarrow 6I_1 + 3 - 4I_2 = 0 \quad \text{— ③} \quad (\times 2)$$

$$-5 - 4I_1 + 4I_2 - 4I_1 + 4I_2 = 0 \Rightarrow -8I_1 + 8I_2 - 5 = 0 \quad \text{— ④}$$

$$12I_1 + 6 - 8I_2 = 0$$

$$-8I_1 + 8I_2 - 5 = 0$$

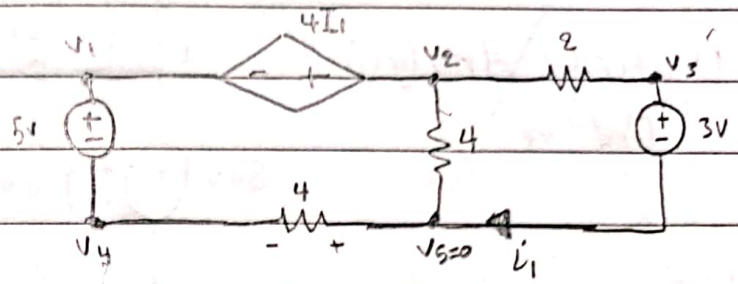
$$4I_1 + 1 = 0 \Rightarrow I_1 = \frac{-1}{4} = -250\,mA$$

$$I_2 = 375\,mA$$

Ex: find I_1 by using Nodal Analysis

1- Simplify

2- Node نقطة



V_1, V_3, V_4 {Supuer Node}

Applying Kcl at V_2

$$\frac{-V_4}{4} - \frac{V_2}{4} - \frac{V_2 - V_3}{2} = 0 \quad \text{---} (1)$$

$$V_1 - V_4 = 5i \quad \text{---} (2)$$

$$V_2 - V_1 = 4i \quad \text{---} (3)$$

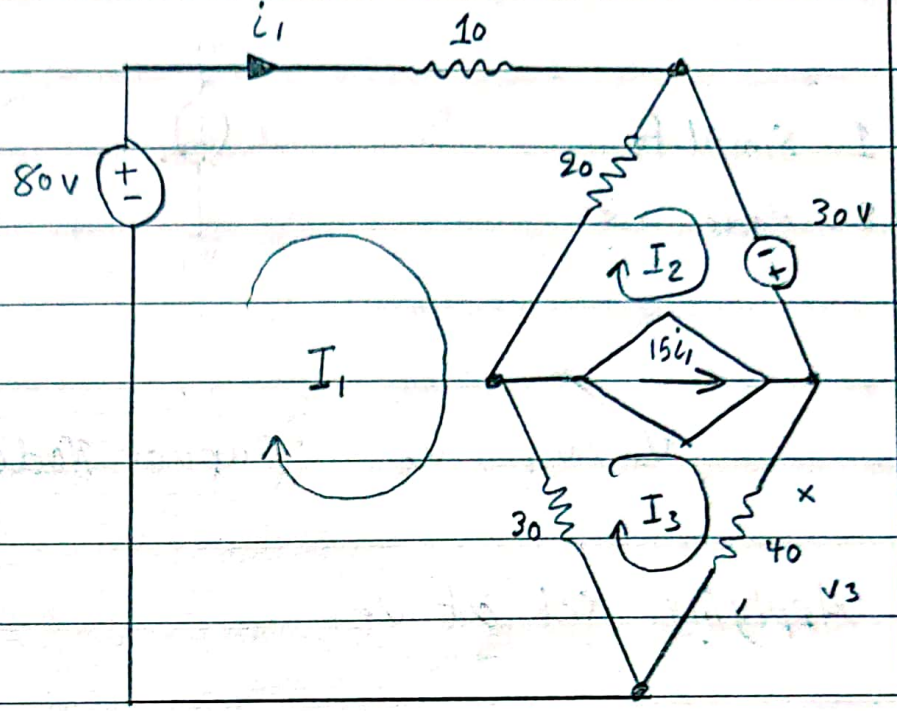
$$V_3 = 3 \quad \text{---} (4)$$

$$i = \frac{(V_2 - V_3)}{2} \quad \text{---} (5)$$

Ex: find i_1 using 1) Mesh Analysis 2) Nodal Analysis

1) Mesh Analysis

Find v_3



KVL at I_1

$$-80 + 10I_1 + 20(I_1 - I_2) + 30(I_1 - I_3) = 0 \quad \text{---} ①$$

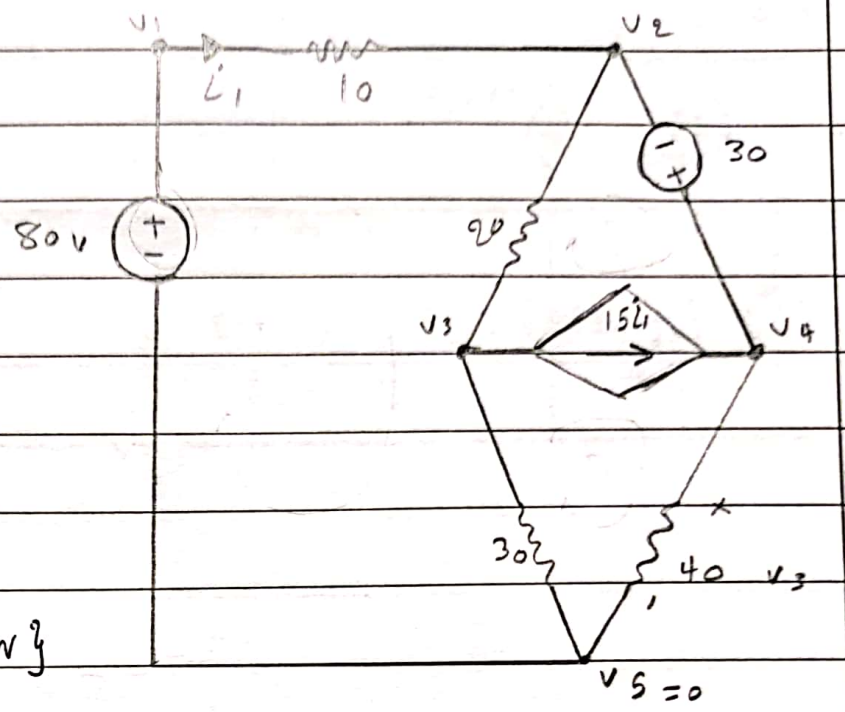
KVL at I_2, I_3 {Super Mesh}

$$-30 + 40I_3 + 30(I_3 - I_1) + 20(I_2 - I_1) = 0 \quad \text{---} ②$$

$$I_3 - I_2 = 15I_1$$

Ex: find V_3 in using Nodal Analysis

Sol



$V_1 = 80$ —①

$V_4 - V_2 = 30$ —②

KCL at V_2, V_4 {S.N}

$$-\frac{(V_2 - V_1)}{10} - \frac{(V_2 - V_3)}{20} + 15i_1 - \frac{V_4}{40} = 0 \quad —③$$

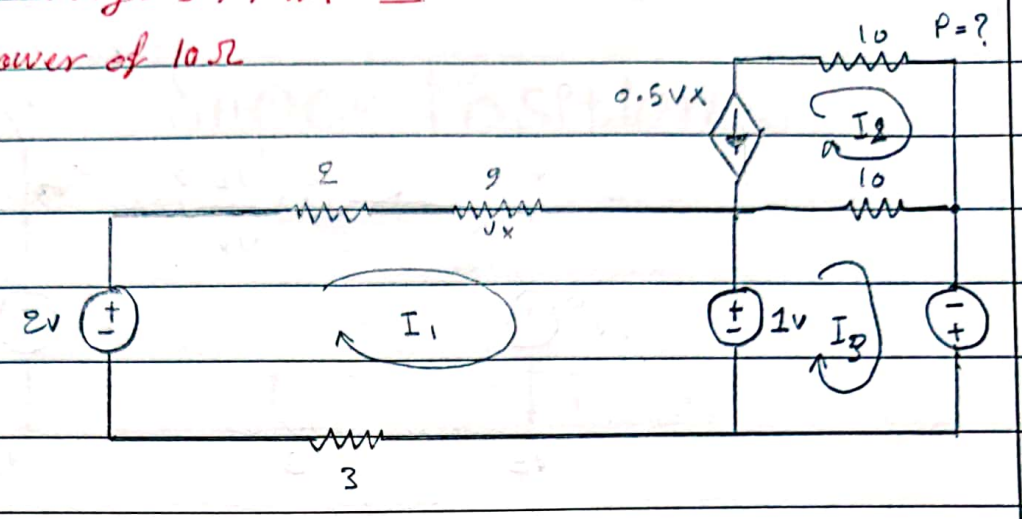
KCL at V_3

$$-15i_1 - \frac{(V_3 - V_2)}{20} - \frac{V_3}{30} = 0 \quad —④$$

$$i = \frac{V_1 - V_2}{10} \quad —⑤$$

using Mesh Analysis, find v_x 4,65 بشكل

or: find the power of 10Ω



Sol 1- ✓

2- Determine Mesh

$$I_2 = -0.5v_x \quad \text{—— ①}$$

kvl at I_1

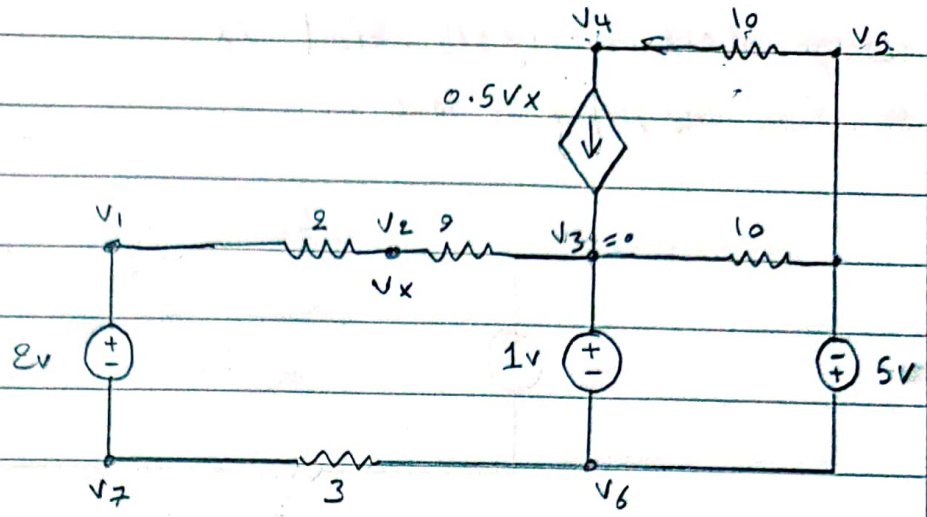
$$-2 + 2I_1 + 9I_1 + 1 + 3I_1 = 0 \quad \text{—— ②}$$

kvl at I_3

$$-1 + (I_3 + I_2)10 - 5 = 0 \quad \text{—— ③}$$

$$V_x = I_1 * 9 \quad \text{—— ④}$$

* Re sole using Nodal Analysis



Sol

$V_1 - V_7 = 8$ —— ①

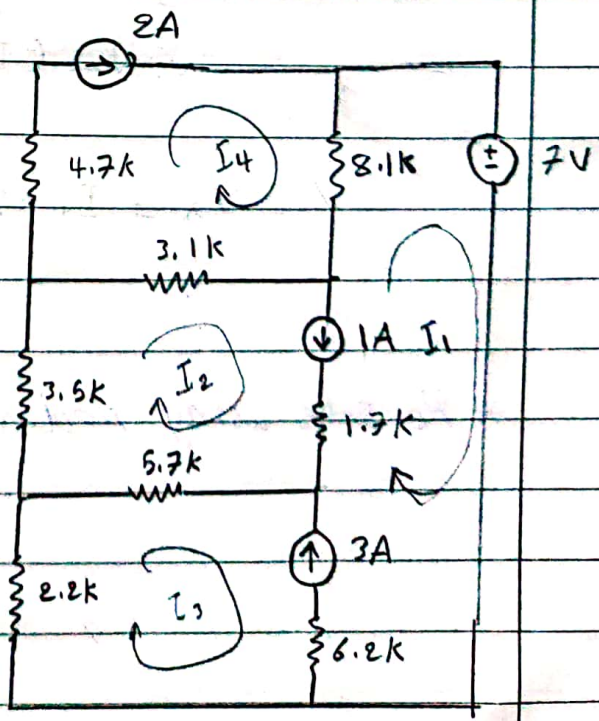
$V_6 = -1$ —— ②

$V_6 - V_5 = 5$ —— ③

$V_x = V_2$ —— ④

$$0.5V_x = \frac{V_5 - V_4}{10}$$

Calculate there mesh current labled in cct below



I1
I2
I3
I4

super mash I_2, I_1 } I_3, I_1

$I_4 = 2$ — ①

Kvl at I_1, I_2 → — ②

$+7 + 2.2I_3 + 3.5I_2 + 3.1(I_2 - I_4) + (I_1 - I_4)8.1 = 0$

$I_2 - I_1 = 1$ — ③

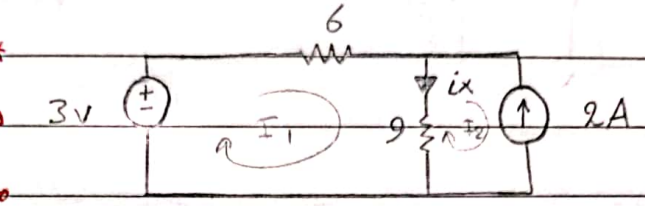
$I_1 - I_3 = 3$ — ④

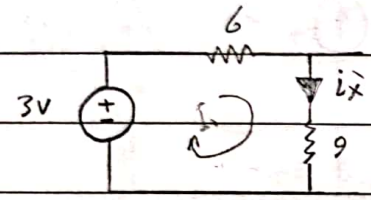
CH:5

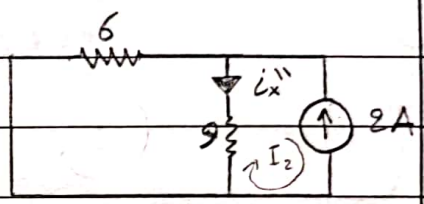
التأثير الكلي للمصادر = تأثير كل مصدر على حده

« Super Position »

*إذا أردنا الغاء مصدر الفولتية نعمله شورت Short وإذا أردنا الغاء مصدر التيار نعمل Open Circuit







$$ix = ix' + ix''$$

حل السؤال بطريقة Super mesh

$$I_2 = -2 \quad \text{---} ①$$

$$I_1 \Rightarrow \quad -3 + 6I_1 + 9(I_1 - I_2) = 0$$

$$-3 + 6I_1 + 9I_1 + 18 = 0 \Rightarrow 15 + 15I_1 = 0$$

$$\boxed{I_1 = -1 \text{ Amp}}$$

$$ix = I_1 - I_2 = -1 + 2 \Rightarrow \boxed{ix = 1 \text{ Amp}}$$

حل السؤال بطريقة Super position

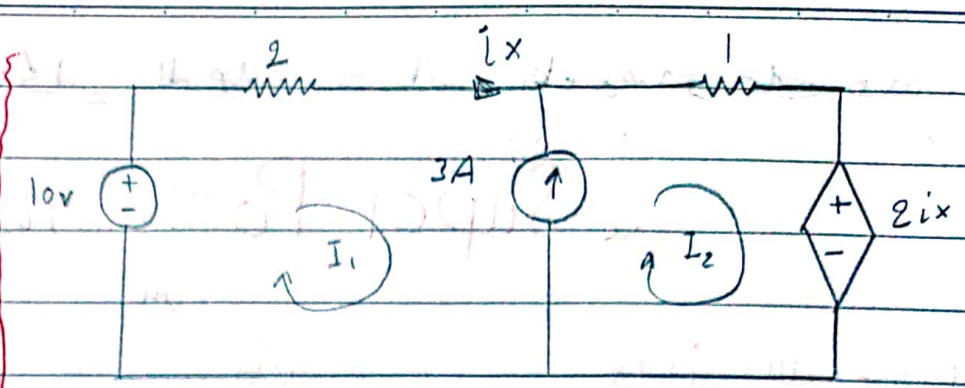
$$ix' = \frac{3}{15} = 0.2 \text{ A}$$

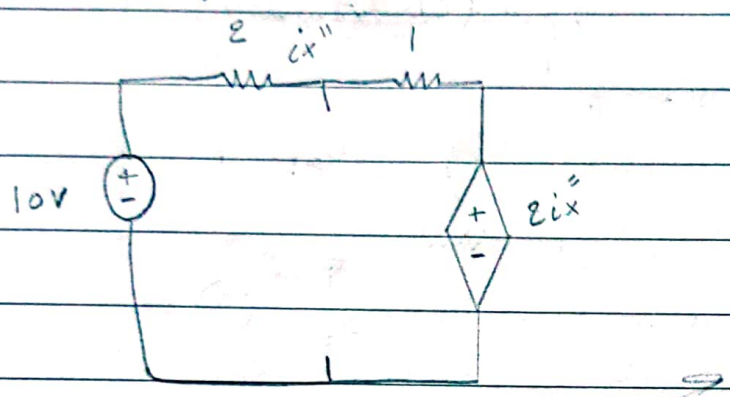
$$ix'' = \frac{\text{التيار الكلي} \times \text{المقاومة البعيدة}}{\text{مجموع المقاومتين}}$$

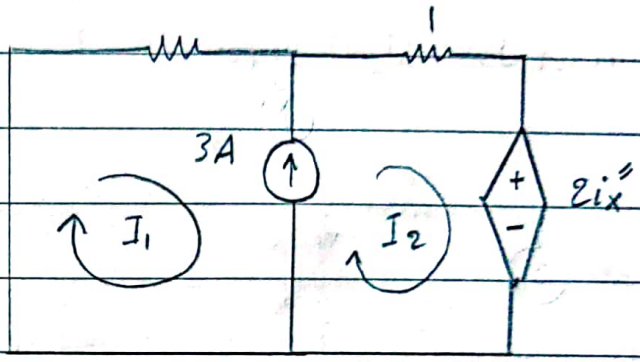
$$ix'' = \frac{2 \times 6}{9+6} = 0.8$$

$$ix = 0.2 + 0.8 = 1 \text{ Amp}$$

You Can't Ignore * Depended Source.







Sol KVL I_1

$$2ix + I_2 + 2ix = 0 \quad \text{---} ①$$

$$I_2 - ix = 3 \quad \text{---} ②$$

$$ix = -0.6A$$

$$-10 + 2ix'' + ix'' + 2ix'' = 0$$

$$ix'' = 2$$

$$= -0.6 + 2 = 1.4$$

KVL I_1, I_2 الحل بإستخدام Super Mesh

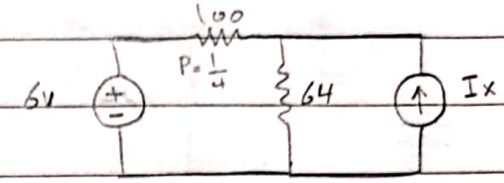
$$I_2 - I_1 = 3$$

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

$$I_1 = 1.4 \qquad I_1 = ix$$

Ex: Determine the Maximum Positive Current i_x Before any resistor exceeds it's power rating.

or: Calculated I_x such that $P_{100} = \frac{1}{4}$ W



* في التيار بكل مقاومه قبل ما تطلع i_x

بعدين نفرض I_1 مرة وبتطلع منو i_x

وبعدين نفرض I_2 مرة أخرى وبتطلع منو i_x

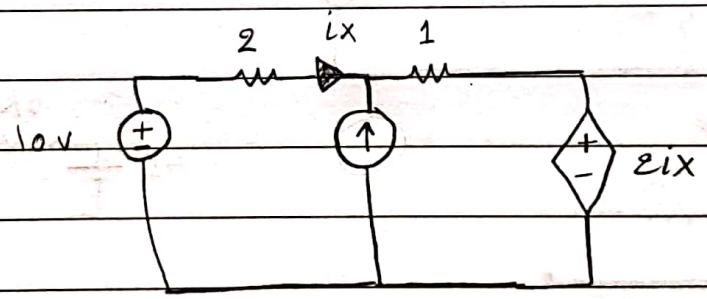
Sol

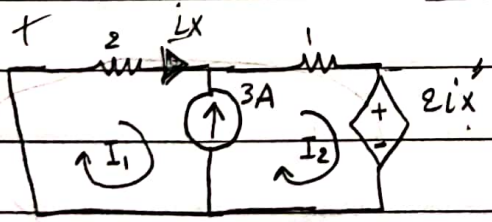
$P = I^2 R$

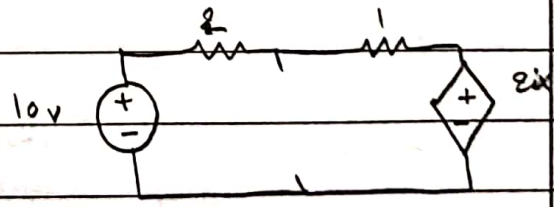
$\frac{1}{4} = I_1^2 * 100$ $\quad I_1 = 50\,mA$

$P_{64} = I_2^2\, 64$ $\quad I_2 = 62.5\,mA$

إعادة شرح المثال في الصفحة السابقة:







$I_2 - I_1 = 3$ ——— ①

KVL Super Mash I_1, I_2

$-10 + 2ix' + ix' + 2ix' = 0$

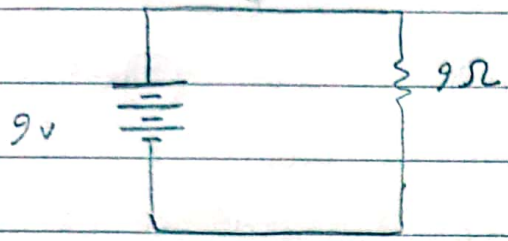
$ix' = 2$

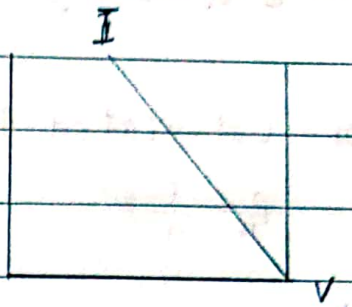
$2Ix'' + I_2 + 2Ix'' = 0$

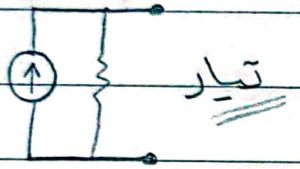
$ix'' = -1$

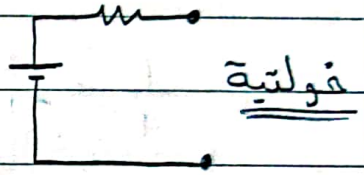
$ix = 2 + (-1) = 1\,Amp$

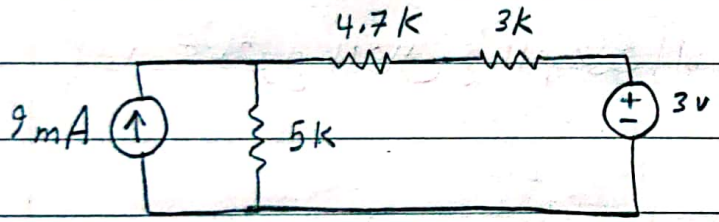
<< Source Transformation >>

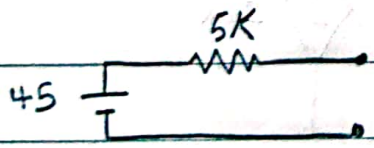


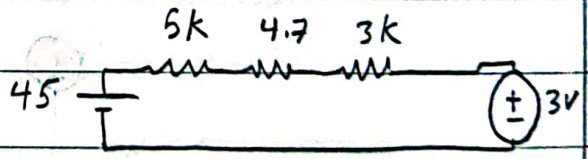


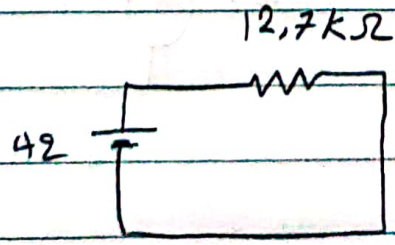






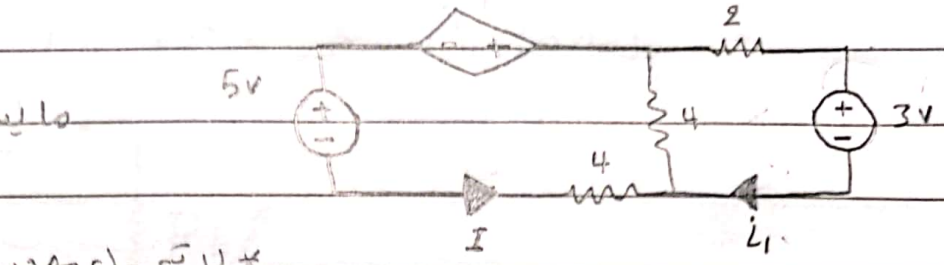


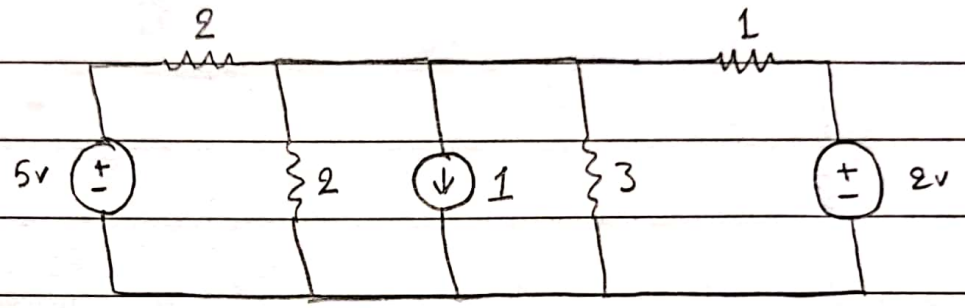


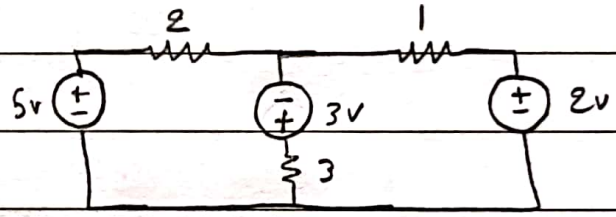


$$I = \frac{42}{12,7} = 3,2\,mA$$

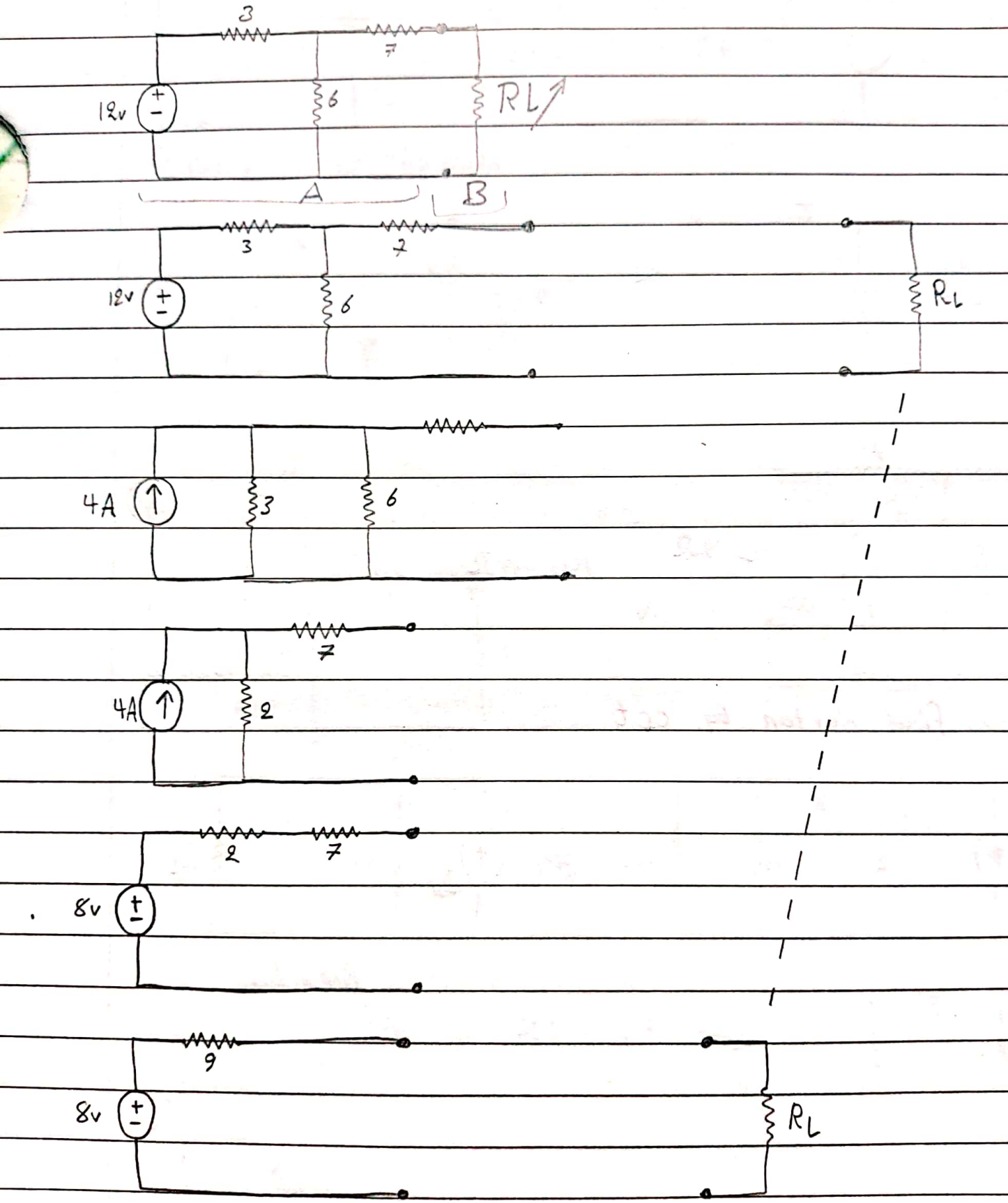
Source ماينفع بال
Transformation
* لا تحول مصدر غاز تحتاجو بعدين





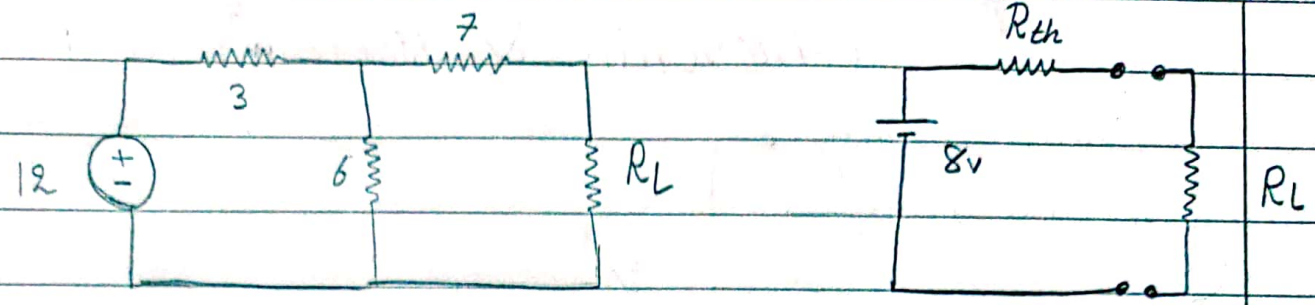


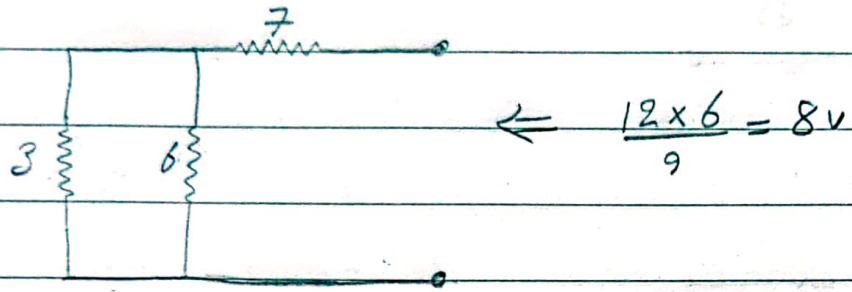
{Thévenin & Norton}



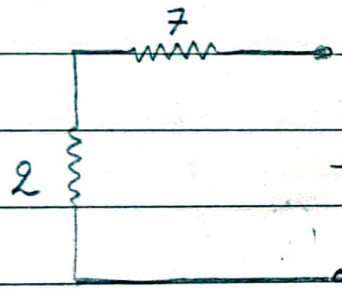
إذا R_L معلومة نطبق نظلع التيار

Ex 3



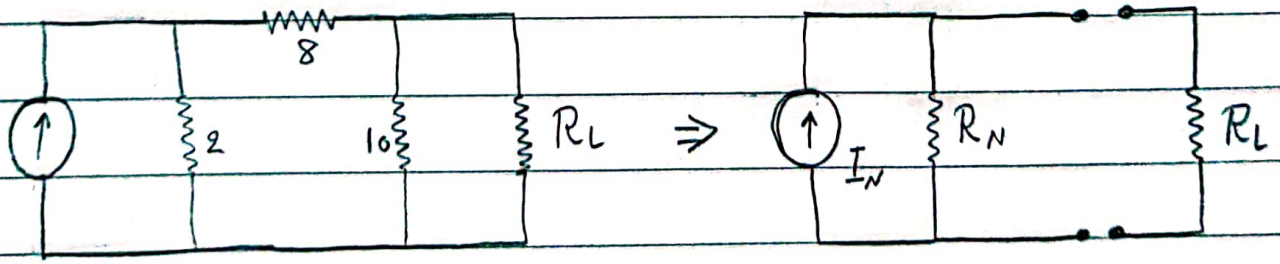


$\Leftarrow \frac{12 \times 6}{9} = 8v$

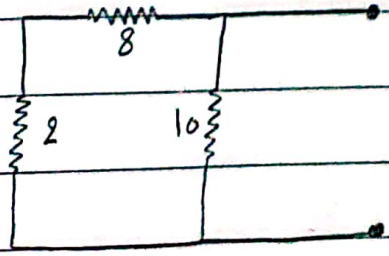


$\Rightarrow 9\Omega$ $\quad R_{th} = 9\Omega$

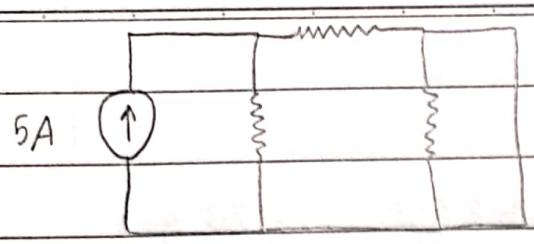
Ex: find Norton Eq. cct

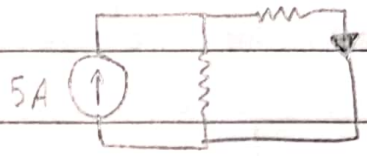


$R_N = R_{th}$



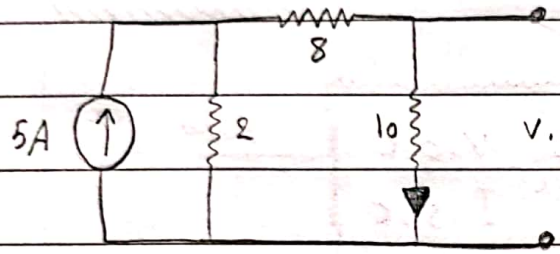
$\Leftarrow R_N = 5\Omega$





$\frac{5 \times 2}{10} = 1$ Amp

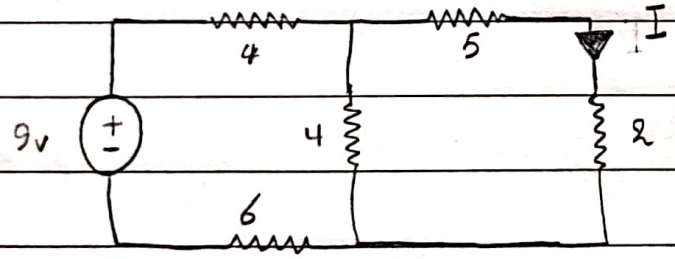
Resolve using Thévinin

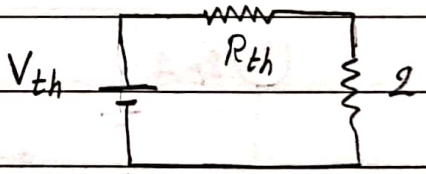


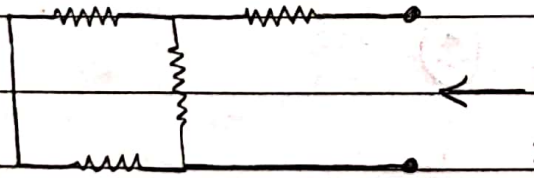
$I = \frac{5 \times 2}{20} = 0.5$

$V_{o.c} = 0.5 \times 10 = 5V$

Find the current through the 2Ω resistor using Thévenin



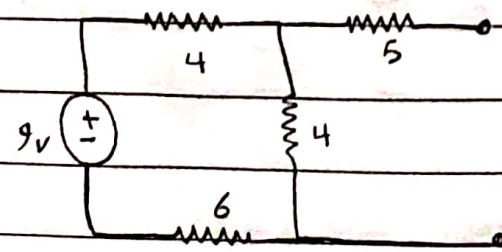




$2.8 + 5 = 7.8\Omega$

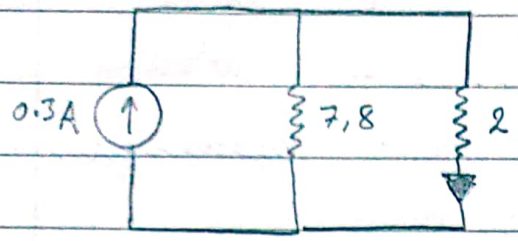
7.8Ω

$V_{th} = V_{o.c}$



$\frac{9 \times 4}{14} = 2.5V$

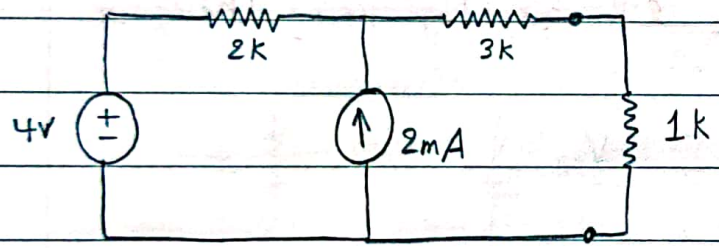
Find Norton Eq.

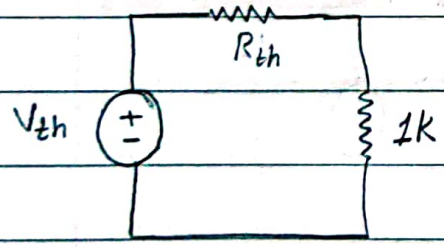


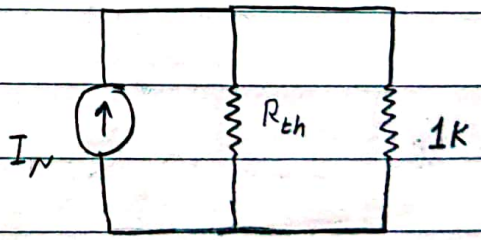
$$I = \frac{0.3 \times 7,8}{9,8} = 0,23\ A$$

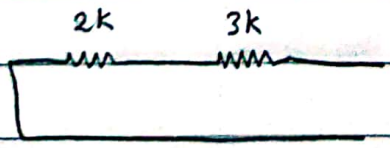
$$R_{th} = \frac{V_{th}}{I_{th}} \quad , \quad \boxed{R_{th} = \frac{V_{o.c}}{I_{s.c}}} \quad \text{two}$$

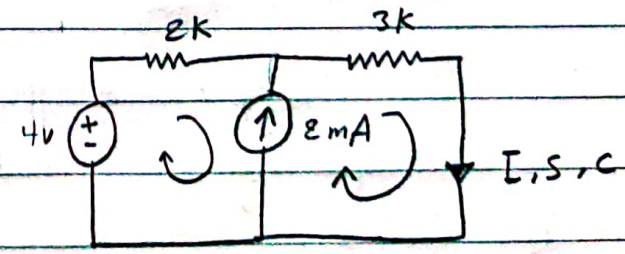
Ex find Norton Eq at 1KΩ











$$-V_{o.s} + 4 + 4 = 0$$

$$V_{o.c} = 8$$

$$I_{s.c} = 1,6mA$$

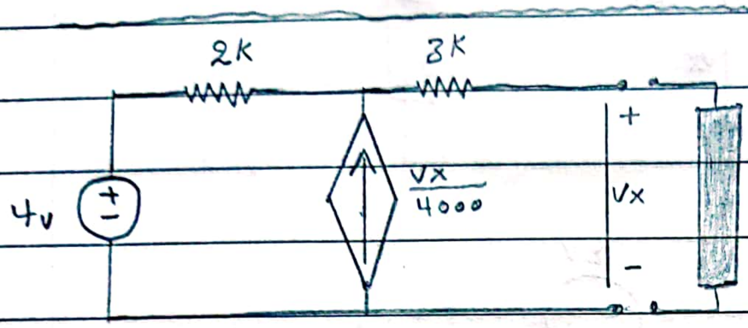
مراجعة: $R_{th} = R_N$

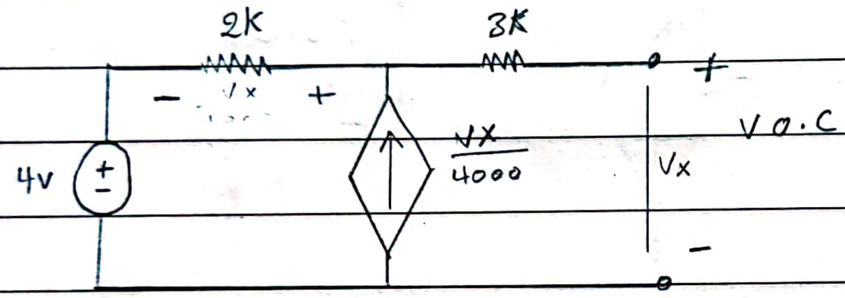
$V_{th} = I_n \cdot R_N$

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

* من كدنا مصدر معتمد، لازم نطلع I.s.c و V o.s

Find Thévinin in circuit

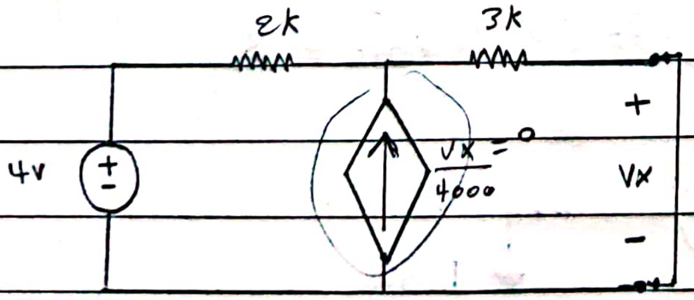




$$KVL = -V_x + 0 + \frac{2\times10^{3} V_x}{4000} + 4 = 0$$

$V_x = V_{o.c}$

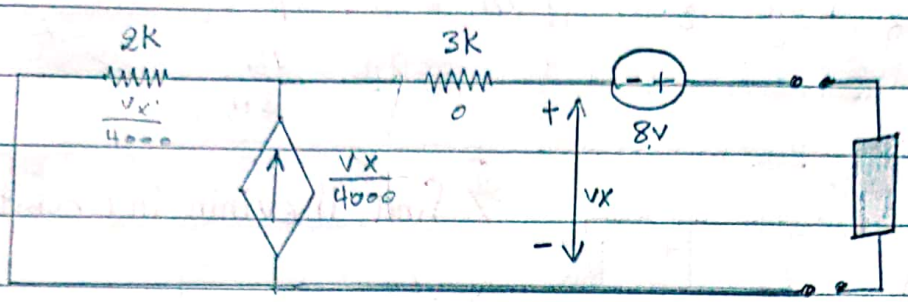
$V_{oc} = 8V$

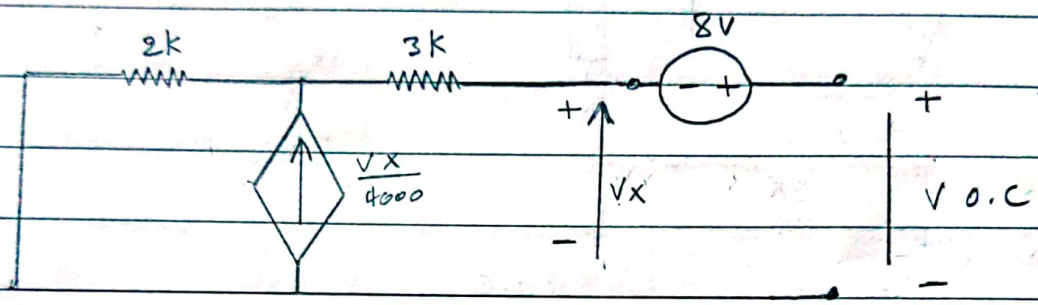


$$I_{s.c} = \frac{4}{(2+3)k} = \frac{4}{5} = 0.8\ mA$$

$$R_{th} = \frac{8}{0.8} = 10\ k\Omega$$

Find thévinin Eq. circuit for the circuit below

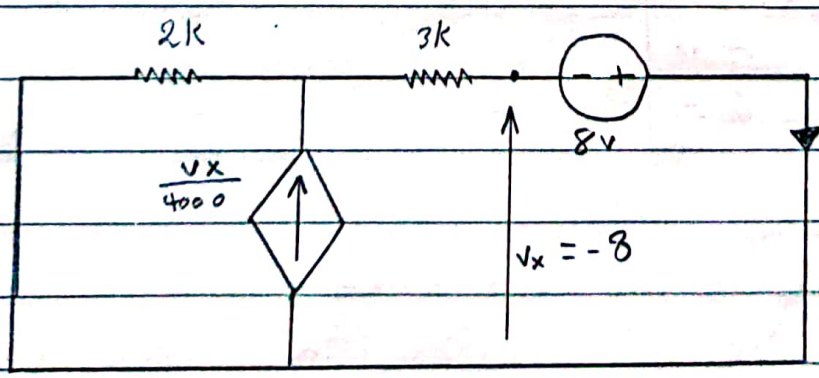




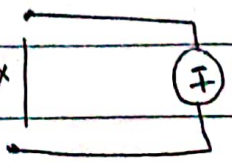
$$-V_{o.c} + 8 + 0 + \frac{2\times10^{3} V_x}{4000} = 0 \quad \text{—— ①}$$

$$-V_{o.c} + 8 + V_x = 0 \quad \text{—— ②}$$

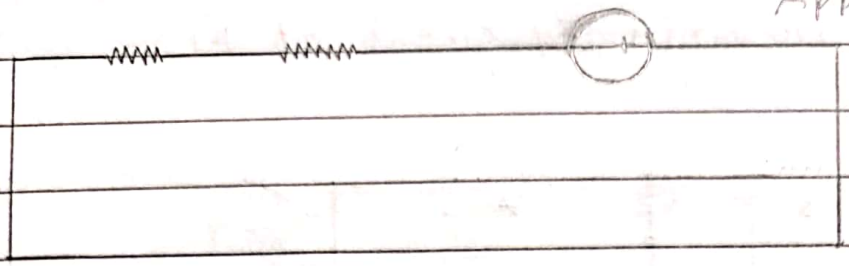
$$V_{o.c} = 8 + V_x \qquad \therefore V_{o.c} = 8$$



$$V_x = -8$$

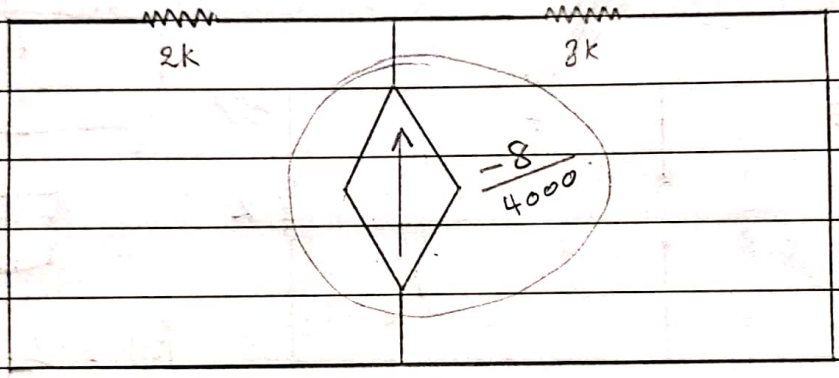


Apply Super Position



$\bar{I}_{sc}$

$$I_{s.c} = \frac{8}{5} = 1.6\,mA$$



$\bar{\bar{I}}_{sc}$

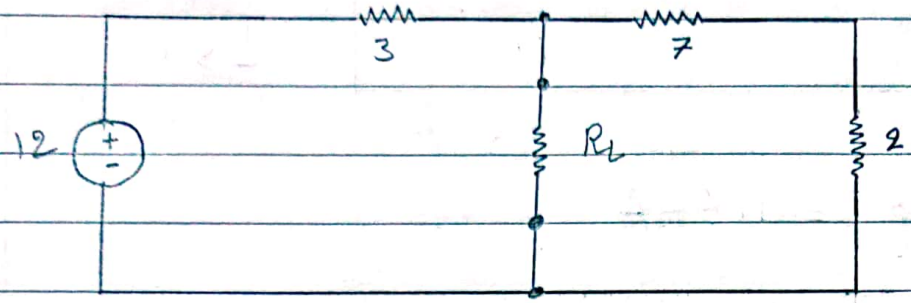
$$\frac{-8}{4000} * \frac{2k}{5k} = -0.8\,mA$$

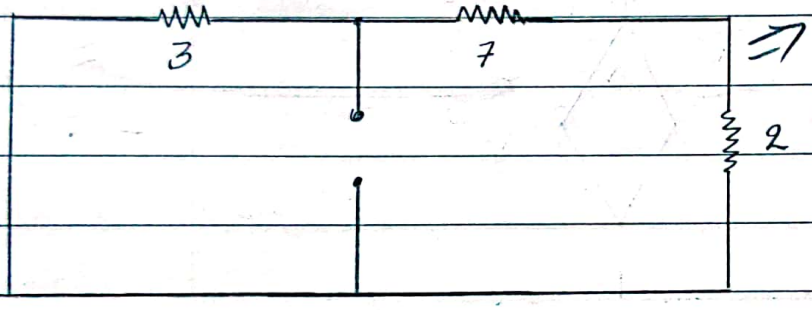
$$I_{s.c} = 1.6 - 0.8 = 0.8\,mA$$

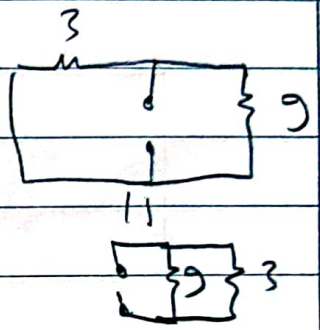
$$\bar{I_{sc}} + \bar{\bar{I_{sc}}}$$

$$R_{th} = \frac{V_{o.c}}{I_{s.c}} \Rightarrow \frac{8}{0.8} = 10k$$

Find the Thévinin Eq circuit at R_L

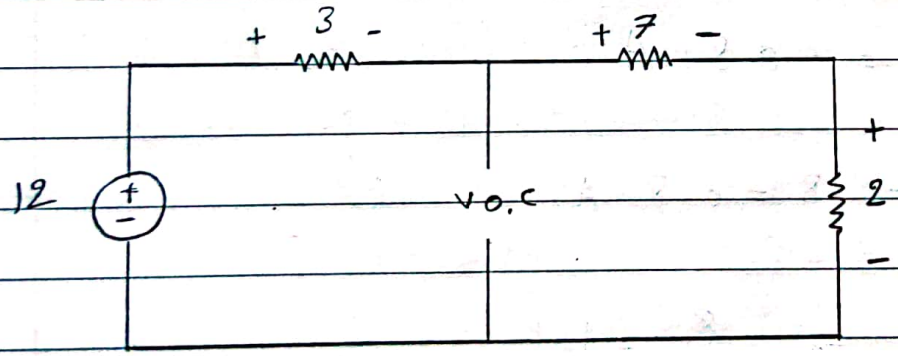






$\frac{3 \times 9}{12} = 2.25$

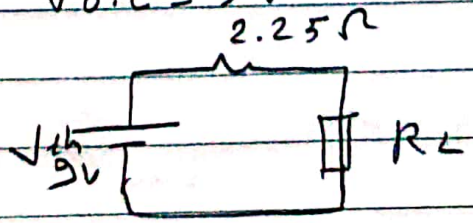
$R_{th} = 2.25\Omega$



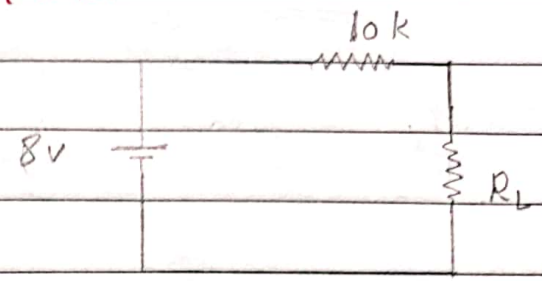
$V_{o.c} = \frac{12 \times 9}{12} = 9V$

$I = \frac{12}{3+7+2} = 1\,mA$

$V_{o.c} = 9\,V$



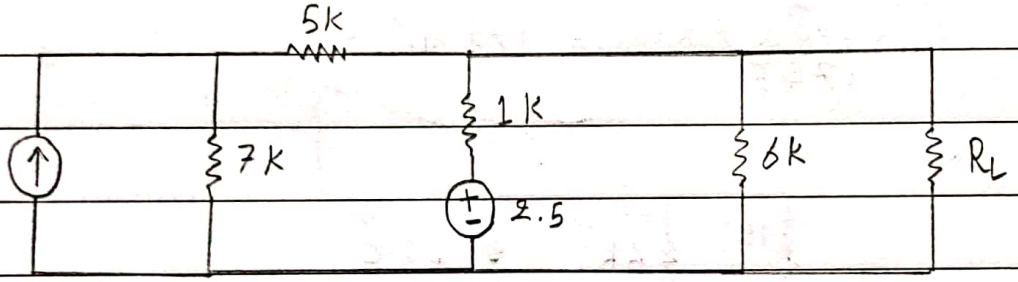
Find the power diss by $R_{th} = 1K$



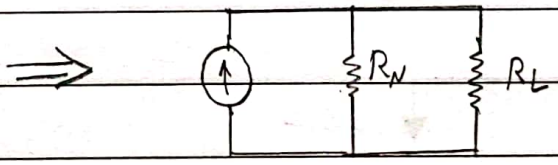
$P = I^2 R$

$I = \frac{8}{11} = 0.72$

Use Norton theory to reduce the following circuit



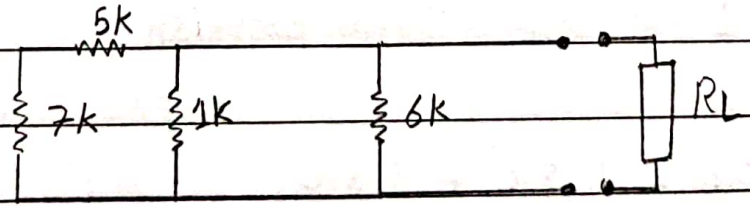
المطلوب

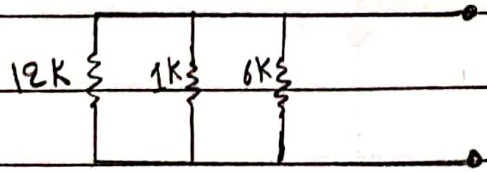


Sol

$R_{th} = R_N$, $I_N = I_{S.C}$

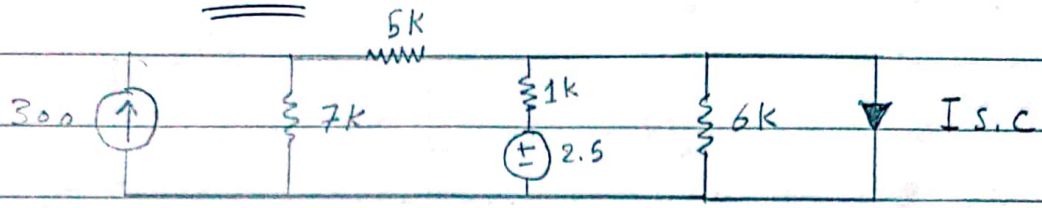
1- R_N

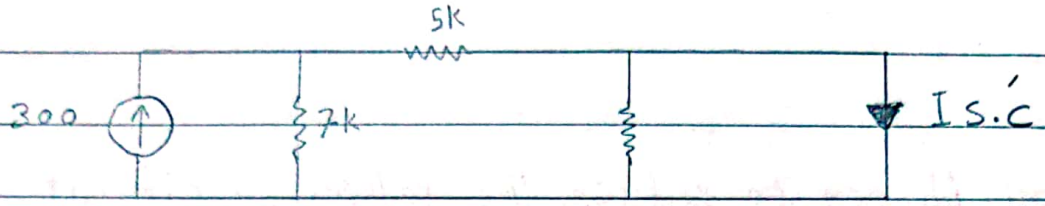




$R_{th} = 0.8\ K\Omega$

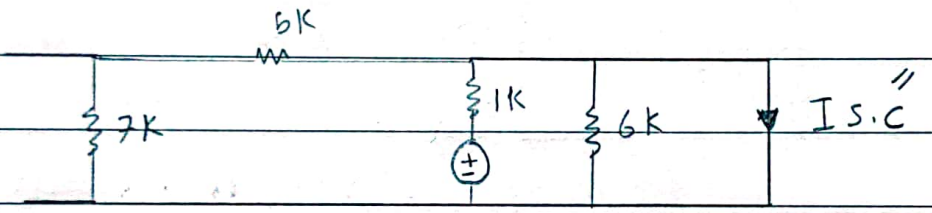
$I_N = I_{s.c}$

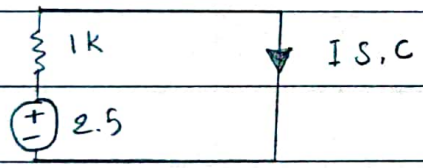




البعدة

$$I_{s.c}' = \frac{10^{-3} \times 300 \times 7 \times 10^{3}}{7+5} = 175\ mA$$

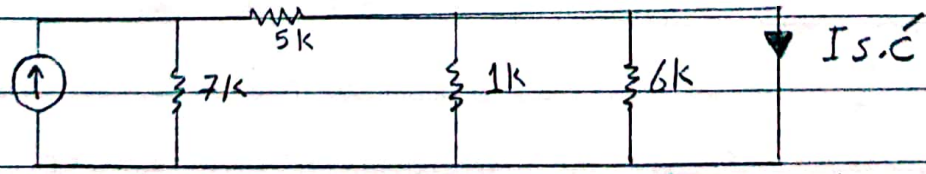


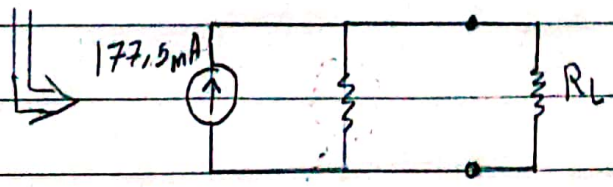


$\frac{2.5}{10^3} = 2.5\ mA$

To find $I_{s.c}$ use . Super position

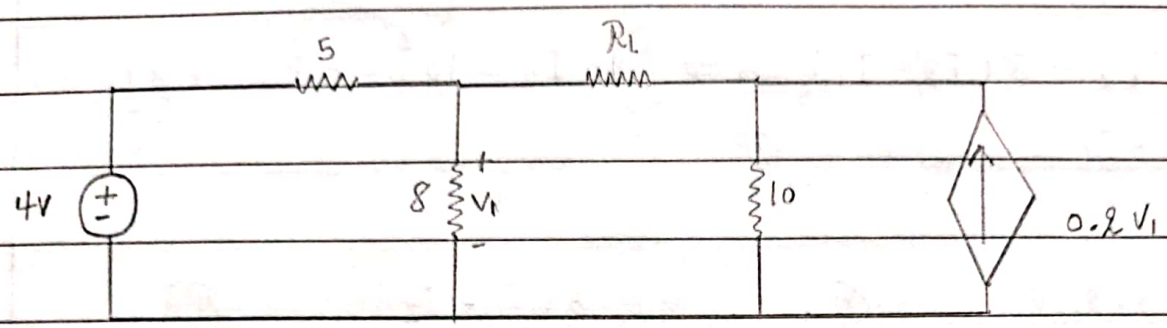
$$I_{s.c} = I_{s.c}' + I_{s.c}''$$

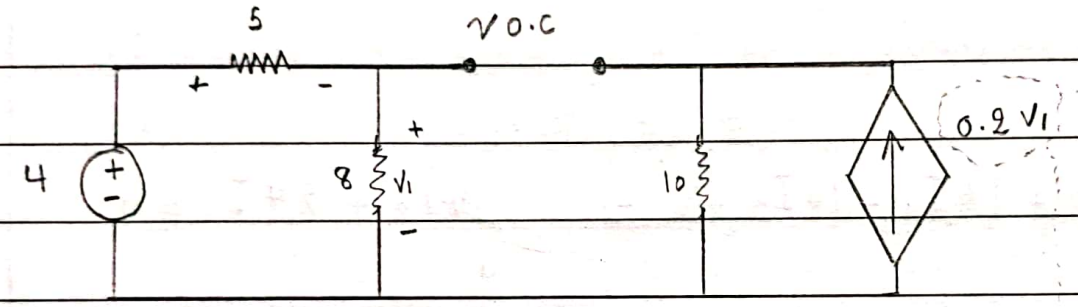




$R_L = 0.8\ k\Omega$

Find the value of the R_L in sure maximum absorbed Power R_L أوجد أكبر نقل للقدرة لـ R_L





$$V_1 = \frac{4 \times 8}{13} = 2.46\ V$$

$$0.2 \times (2.46) = 0.49\ A$$

$$V_{10} = 10 \times 0.49 = 4.9\ V$$

KVL $V_{o.c}$

$$-2.46 + V_{o.c} + 4.9 = 0$$

$$V_{o.c} = -2.44$$

$-4 + 5I_1 + 8(I_1 - I_2) = 0 \Rightarrow 4 + 5I_1 + 8I_1 - 8I_2 = 0$

$\Rightarrow \boxed{-4 + 13I_1 - 8I_2 = 0}$ ---- ① *4

$10(I_2 - I_3) - 8(I_2 - I_1) = 0 \Rightarrow 10I_2 - 10I_3 - 8I_2 + 8I_1 = 0$

$\Rightarrow \boxed{2I_2 + 8I_1 - 10I_3}$ ---- ②

$I_3 = -0.2V_1$ ---- ③ $\quad V = 8(I_1 - I_2)$ ---- ④

$I_3 = -1.6I_1 + 1.6I_2$

$2I_2 + 8I_1 + 16I_1 - 16I_2 = 0 \Rightarrow -14I_2 + 24I_1 = 0$ ---- ② *2

$-56I_2 + 96I_1 = 0$

$-28 + 91I_1 - 56I_2 = 0$ *-1

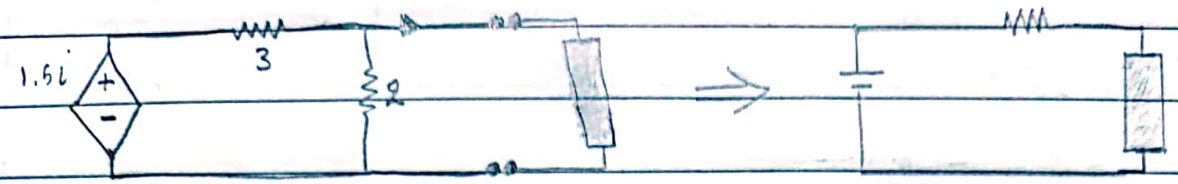
$28 + 5I_1 = 0 \quad I_1 = \frac{28}{5} = -5.6$

$-14I_2 - 134.4 = 0 \quad I_2 = -9.6$

$R_{th} = \frac{-2.44}{-9.6} = 0.25\,\Omega$

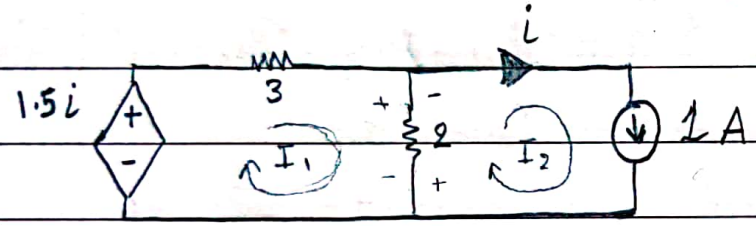
أوجد مكافئ ثفنن للدائرة أدناه

find the Thévinin eq circuit below



$$R_{th} = \frac{V_{o.c}}{I_{s.c}} = V_{o.c} = o$$

* نلاحظ أن الدائرة تحتوي على مصدر معتمد فقط فـ نضع أنضيف مصدر تيار أو مصدر فولتية بقيمة افتراضية 1 مثلاً ويكون الموقع مكان الـ R_L.



$$R_{th} = \frac{V}{I} \quad , I_2 = 1$$

KVL at I_1

$$-1.5i + 3I_1 + 2(I_1 - I_2) = o$$

$$-1.5i + 3I_1 + 2I_1 - 2I_2 = o$$

$$-1.5i + 5I_1 - 2I_2 = o \quad \text{---} ①$$

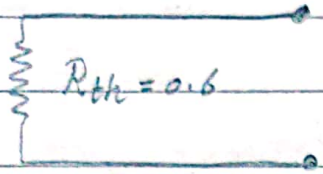
$I_2 = -1 = i$

$$-1.5 + 5I_1 - 2 = o$$

$V = 2(0.3)$ $\qquad 5I_1 = 3.5 \qquad I_1 = 0.7$

$V_2 = 0.6$ volt

$$R_{th} = \frac{V_{test}}{I_{test}} = \frac{0.6}{1} = 0.6\ \Omega$$



عدم وجود مصدر مستقل

وجود مصدر مستقل

Thévenin

$R_{th} = Req$

$V_{th} = V_{o.c}$

$R_{th} = \frac{V_{.OC}}{I_{.SC}}$

Norton

$R_N = Req = R_{th}$

$I_N = I_{s.c}$

~~or~~

نضيف V_T أو I_T