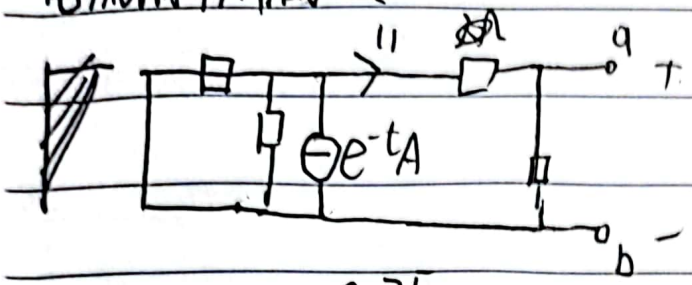
4-1.

电流源作用时

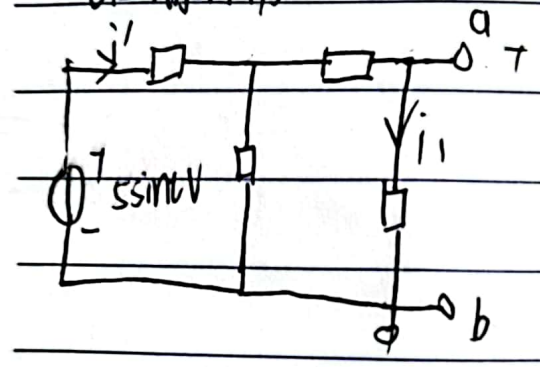


$i_1 = e^{-t} \cdot \frac{0.75}{0.75+3}$

$= 0.2e^{-t}$

$U_{ab}' = 0.2e^{-t} \cdot 1\Omega = 0.2e^{-t}$

电压源作用时



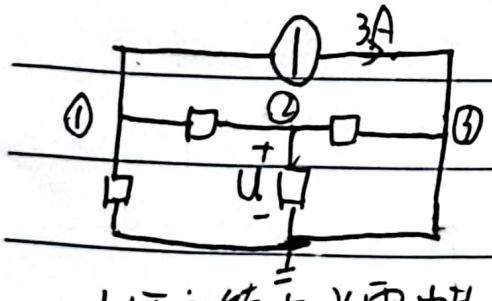
$i' = 5\sin t / 5 = 2\sin t$

$i_1' = \frac{i'}{2} = \sin t$

$\therefore U_{ab}'' = i_1' \cdot 1\Omega = \sin t$

$\therefore U_{ab} = U_{ab}' + U_{ab}'' = 0.2e^{-t} + \sin t$.

4-2. 3A电流源作用时



以下方结点为零电势

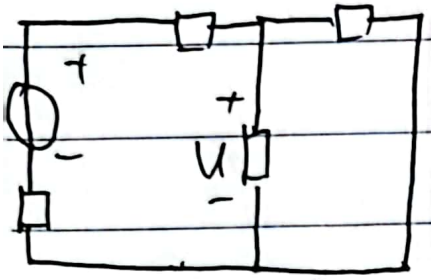
$U_{n1}(\frac{1}{2}+\frac{1}{8}) - U_{n2} \cdot \frac{1}{8} = -3$

$-\frac{1}{8}U_{n1} + (U_{n2}(\frac{1}{8}+\frac{1}{10}+\frac{1}{10}) - \frac{1}{10}U_{n3} = 0$

$U_{n3} = 0$ ~~$-\frac{1}{10}U_{n2} + \frac{1}{10}U_{n3} = 0$~~

$U_{n2} = -\frac{8}{3}V$. $U_1 = -\frac{8}{3}V$

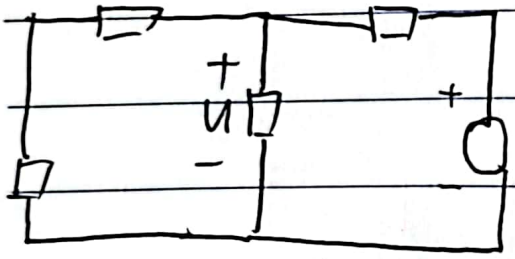
136V电压源作用图



$R' = \frac{10\times40}{10+40} = 8\Omega$

$U_2' = \frac{8}{8+8+2}\times136 = \frac{544}{9}V$

50V电压源作用图



$R'' = \frac{(2+8)\times40}{40+2+8} = 8\Omega$

$U_3 = \frac{8}{10+8}\times50$

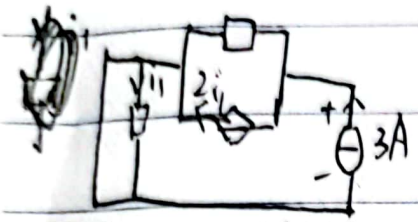
$= \frac{200}{9}V$

$U = U_1 + U_2 + U_3 = 80V$

4-4.

(1).

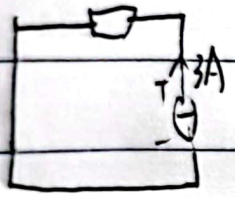
3A电流源作用时:



由图如左侧电阻短路

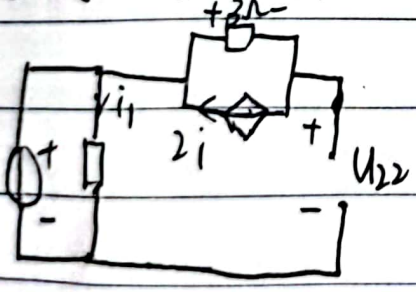
∴ $i_1 = 0$

∴ 电路等效为



∴ $U_{21} = 3A \cdot 3\Omega = 9V$.

左侧2V电压源作用时



∴ $i_1 = \frac{2}{4} = 0.5A$

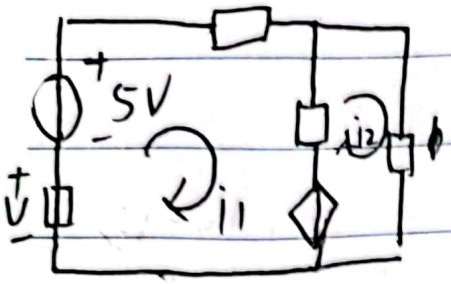
易知两回路相互之间无电流流过

$U_1 = 2i_1 \cdot 3 = 3V$

∴ $U_{22} - 2V + 3V = 0$

$U_{22} = -1V$ ∴ $U_2 = U_{21} + U_{22} = 8V$

(2). 左侧5V电压源作用时



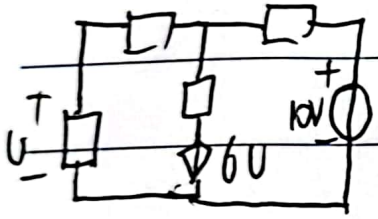
$-5+6U+5i_1-2i_2=0$

$3i_2-6U-2i_1=0$

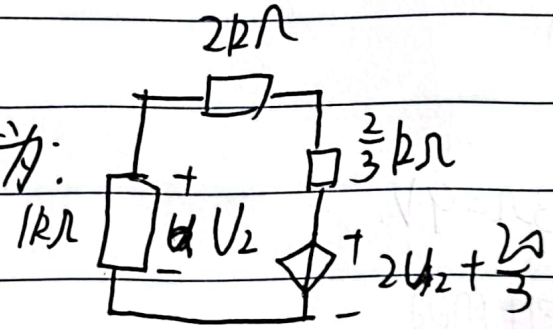
$U=-i_1$

解得: $i_1=3A$, $U=-3V$.

右侧10V电压作用时



等效为:



等效为

$(2U_2+\frac{2}{3})\cdot\frac{1}{1+2+\frac{2}{3}}=U_2$

解得 $U_2=4V$

$U=U_1+U_2=1V$

4-7、设原电路中, i_s 在ab产生电压为 U_1, U_{s1} 产生为b, 和 U_{s2} 产生为c

$$\begin{cases} a+b+c=1 \\ -a-b+c=0.5 \\ -a+b-c=0.3 \end{cases}$$ 联立解得 $$\begin{cases} a=-0.1 \\ b=0.6 \\ c=0.4 \end{cases}$$

∴反 i_s 反向, $U_{ab}'=(-a+b+c)U_{ab}=1.1$

∴应为原来的1.1倍

4-8 电压源 U_{S1} 在毫安表处产生电流

$I_{US1}=I''-I'=-100\,mA$

以上电压源 U_{S1} 在毫安表处产生电流

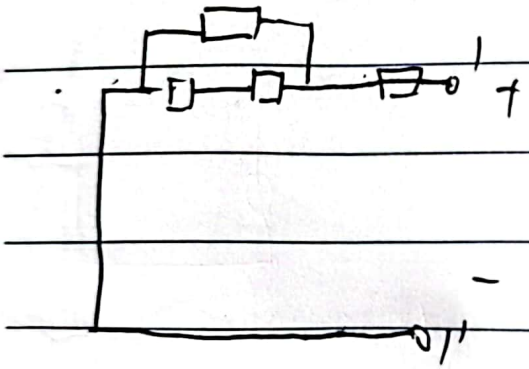
$I_{US2}=-\frac{U_{S2}}{U_{S1}}\cdot I_{US1}=150\,mA$ （~~非关联参考取~~（正负极方向相反，故产生电流方向相反）

故 $I''=I'+I_{US1}=190\,mA$

4-12.

(1).

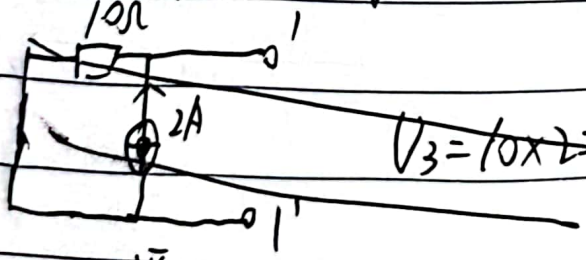
将图中电流源、电压源置零：



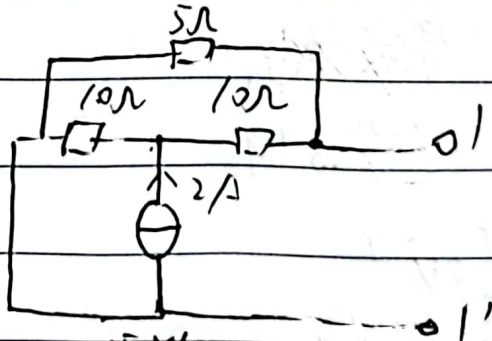
$\therefore R_{eq}=14\Omega$

易知，6V，5V电压源分别在1'处产生电压为6V，5V $U_1=6V$，$U_2=5V$

2A电流源作用时，等效为

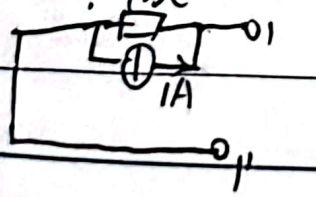


$U_3=10\times 2=20V$



$U_3=(20\times\frac{5\times10}{5+10}+1\times\frac{5}{15}=4V$

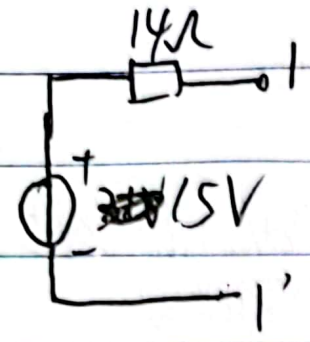
1A电流源作用时，等效为



$U_4=10V$

$\therefore U_{OC}=U_1+U_2+U_3+U_4=15V$

∴等效为



(b). 把电流源电压源归零

$R_{eq}=16\Omega$

9V电压源独立电压.

$U_1=-9V$.

2A电流源独立

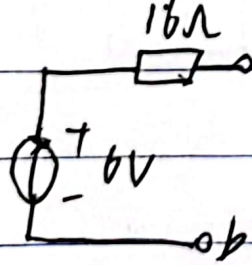
$U_2=6\times2=12V$

3V电压源.

$U_3=\frac{3}{10+6}\times10=3V$

$U_{oc}=6V$

∴等效为



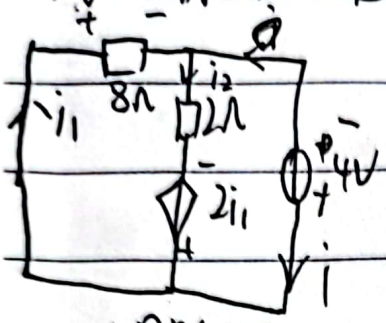
(c). 在回路列KVL方程得

$-4+10i_1-2i=0$

$i=0.5A$

$U = 2i_1 - 2i_1 = 0$.

外加电源 4V 如图所示，把电压源电流源归零



大回路 KVL

$8i_1 - 4 = 0$

$i_1 = 0.5A$

左侧回路 KVL

$8i_1 + 2i_2 - 2i_1 = 0$

$i_1 = -1.5A$

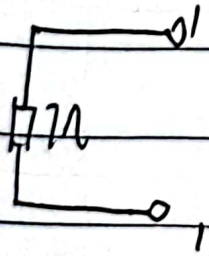
~~$i = i_2 - i_1 = 1A$~~

$i = i_1 - i_2 = 2A$

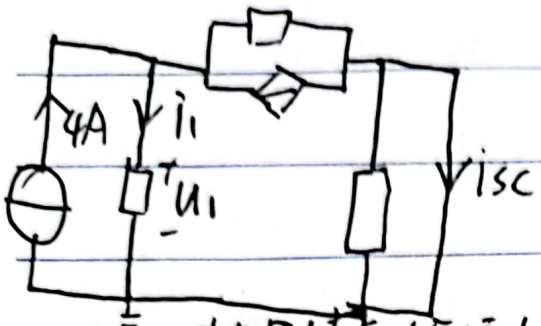
$\therefore R = \frac{4}{2} = 2\Omega$

$R_{eq} = 2 + 5 = 7\Omega$

∴ 等效



(d). 先短路，得



用结点电压法如图所示

则 $U_1(\frac{1}{8}+\frac{1}{2})=4+2U_1$

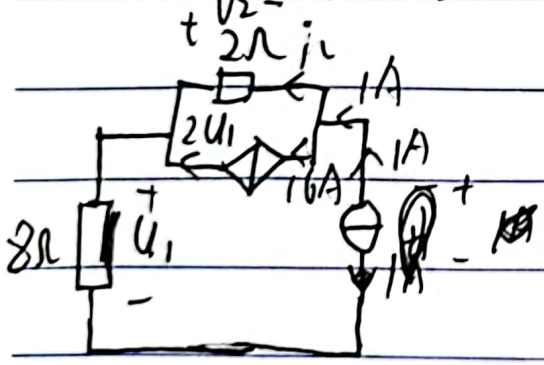
解得 $U_1=-6.4V$

$i_1=\frac{U_1}{8}$

$\therefore i_{sc}=4A-i_1=4.364A$.

将内部独立电流源电压源归零

外加一个1A的电流源



$U_1=8V$

$i_2=1-16=-15A$, $U_2=30V$

$\therefore U=-30+8=-22\Omega V$

$R=\frac{U}{I}=-22\Omega$

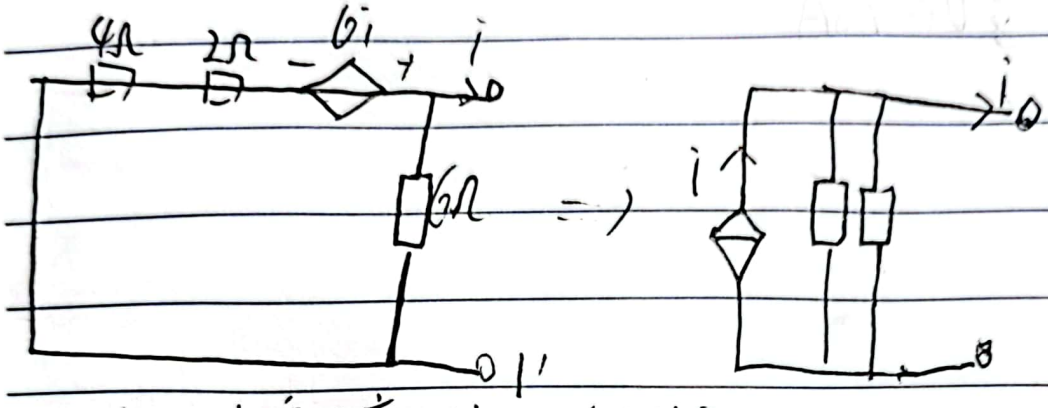
$R=\frac{-22\times5}{-22+5}=6.471\Omega$

4-13.(a)

断开时，$i=0$

$U_{OC}=10\times\frac{6}{6+2+4}=5V$

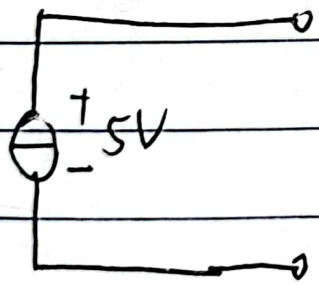
电路作变化得



端口电流任意，端口电压为零

∴短路

∴$R_{eq}=0$



(b).运用结点电压法求U_{OC}

$$U_2\left(\frac{1}{6}+\frac{1}{12}+\frac{1}{12}\right)=\frac{15}{6}+\frac{4U_2}{12}$$

$$\frac{U_2-U_1}{3}=\frac{5}{2}$$

$\therefore U_{OC}\to\infty$

$U_{OC}=U_2$，且$U_{OC}\to\infty$

短路电路

~~$i_{sc} = i_1 + i_2$~~

$U_2 = \frac{15}{6 + \frac{12\times8}{12+8}} \cdot \frac{12\times8}{12+8} = \frac{20}{3}V$

$i_{sc} = i_1 + i_2$

$= \frac{U_2}{8} + \frac{4U_1}{4} = \frac{1}{8}U_1 = 7.5A$

$Req = \frac{Voc}{Isc}$

$Voc \to \infty$

$i_{sc} = 7.5$

$\therefore Req \to \infty$

$\therefore$ 等效为