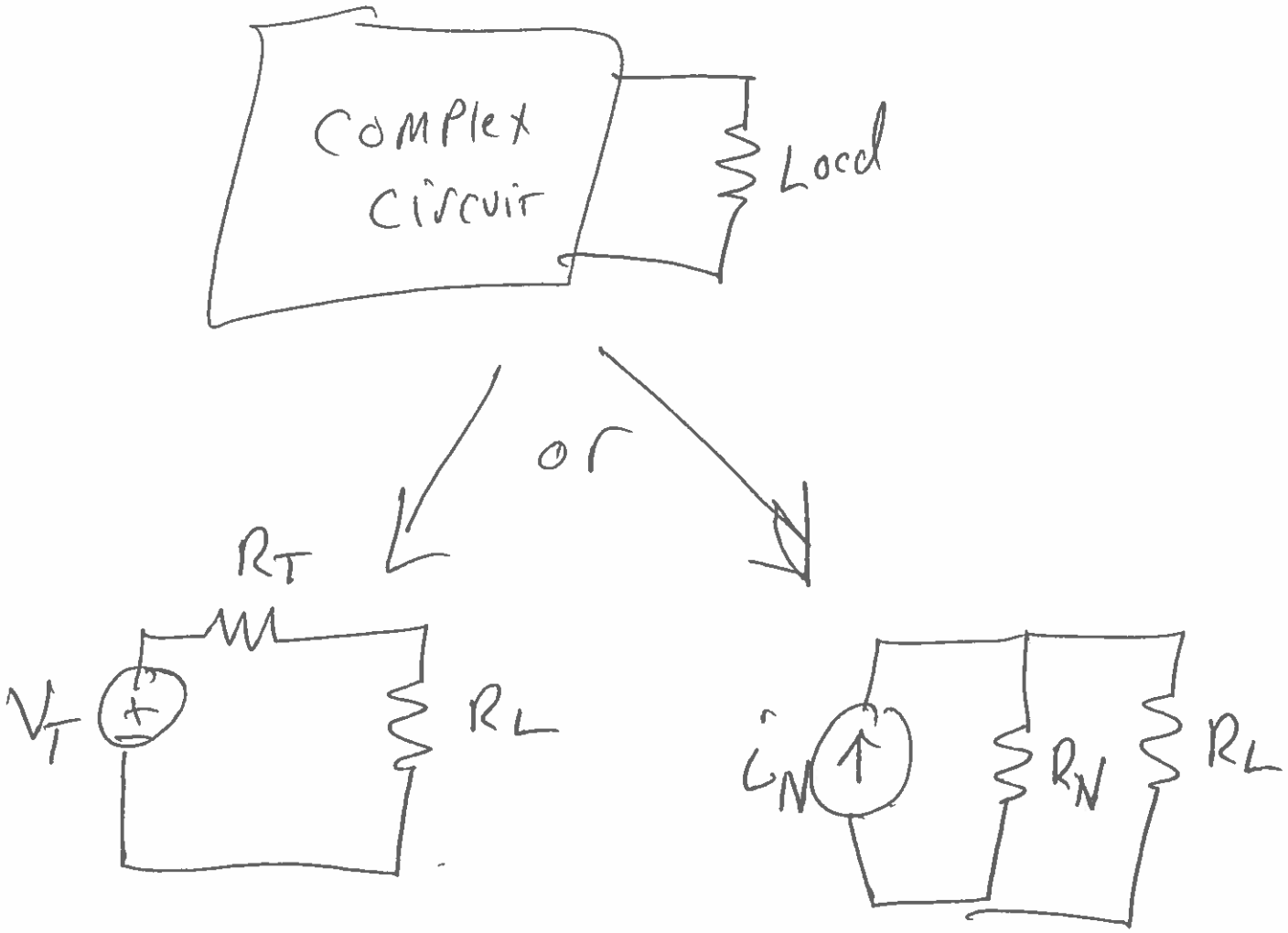
BASIC Idea of chapter 5

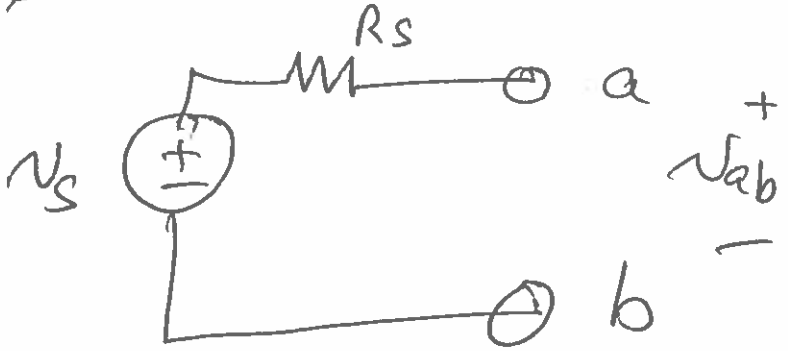
All circuits can be reduced to 1 of 2 types

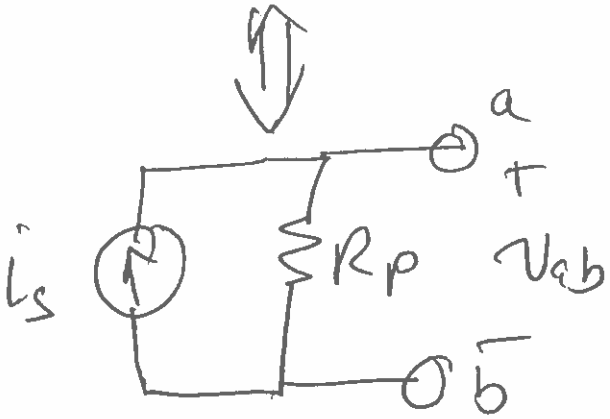


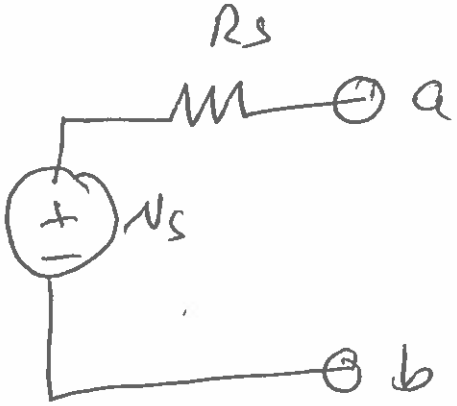
Thevenin Equivalent circuit

Norton Equivalent circuit

Source Transformation



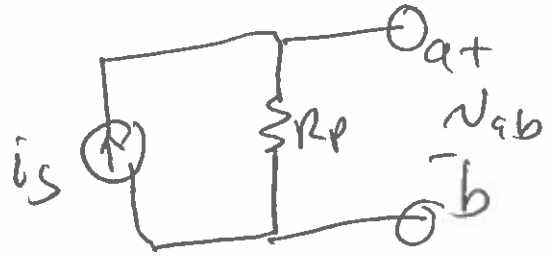




$V_{ab} = V_s$

b open circuit no voltage dropped across Rs

$V_{ab} = V_s$



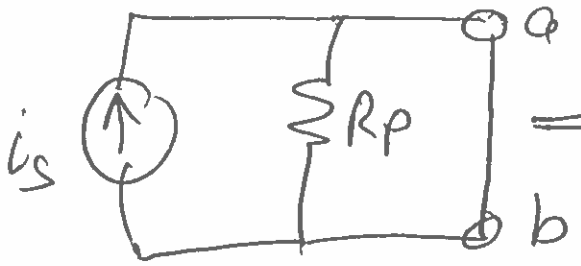
$V_{ab} = i_s R_p$

To be equivalent circuits

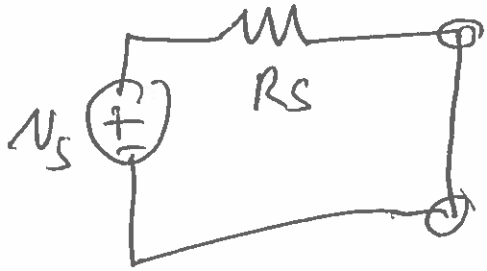
$$v_{ab} = v_{ab}$$

$$v_s = i_s R_p$$

$$\boxed{i_s = \frac{v_s}{R_p}}$$



$$\Rightarrow i_{ab} = i_s$$



$$i_{ab} = i_{ab}$$

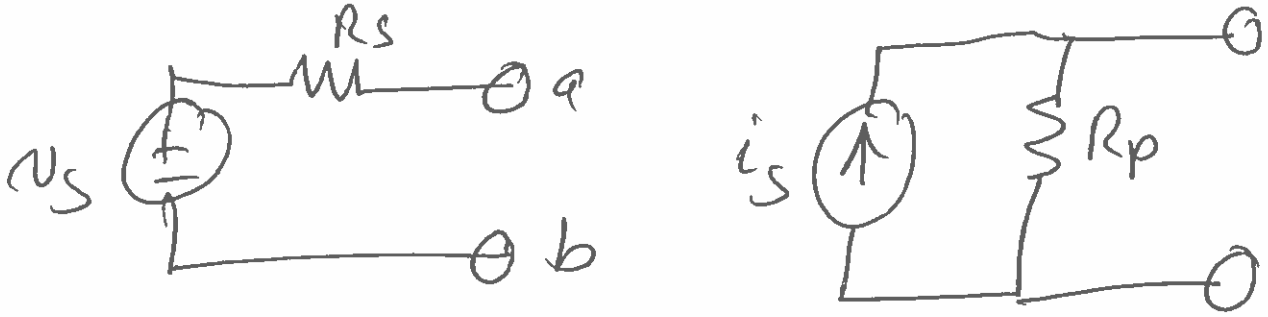
$$i_s = \frac{v_s}{R_s}$$

$$v_s = i_s R_p$$

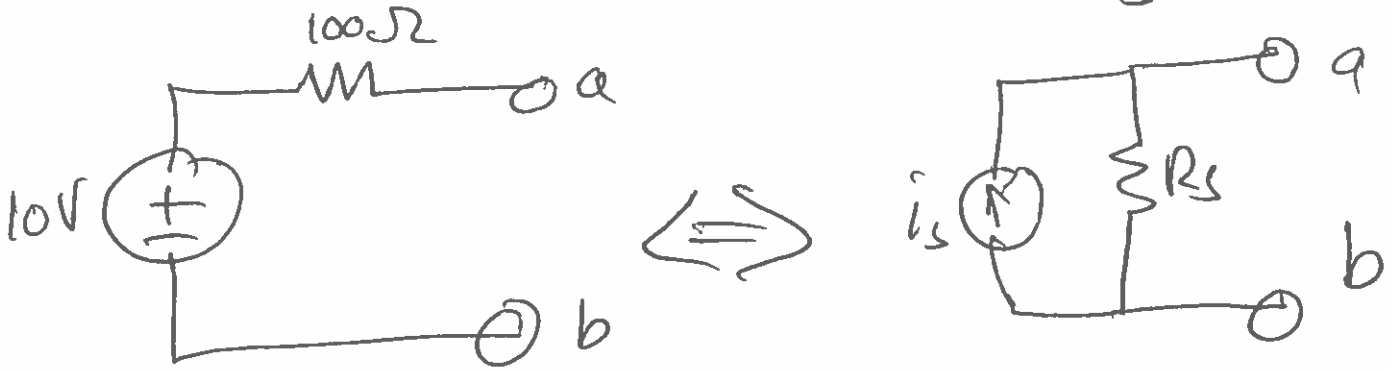
$$i_s = \frac{v_s}{R_s}$$

$$\Rightarrow R_p = R_s$$

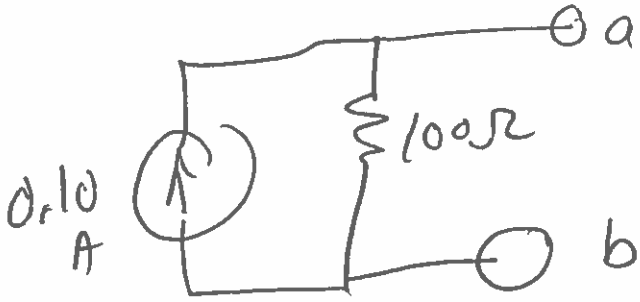
Two Sources are equivalent



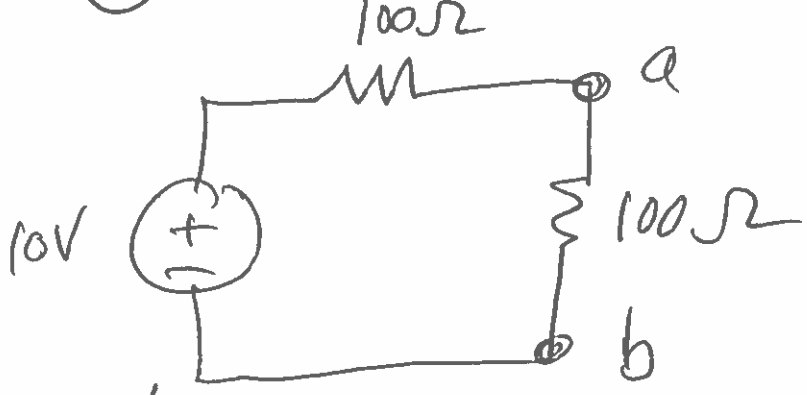
if $R_p = R_s$ and $i_s = \frac{V_s}{R_s}$ or $V_s = i_s R_s$



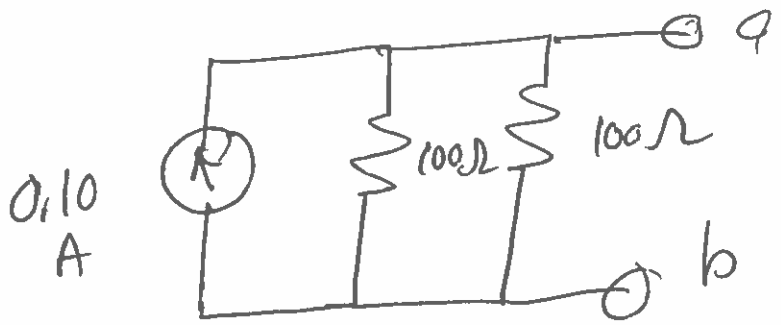
$$i_s = \frac{10V}{100\Omega} = 0.10\,A$$



Let's Test



$V_{ab} = 5V$



$$v_{ab} = i_{ab}(100\Omega)$$

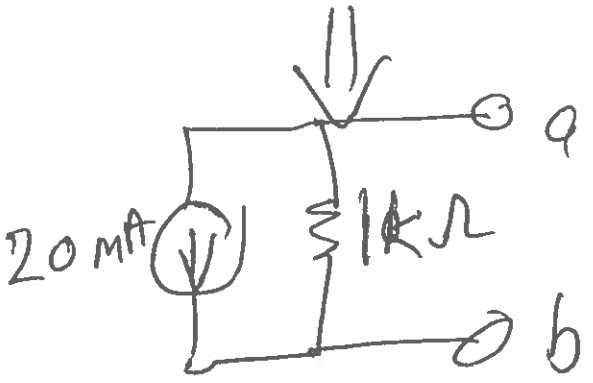
$$i_{ab} = 0.05\,A$$

$$v_{ab} = (0.05A)(100\Omega)$$

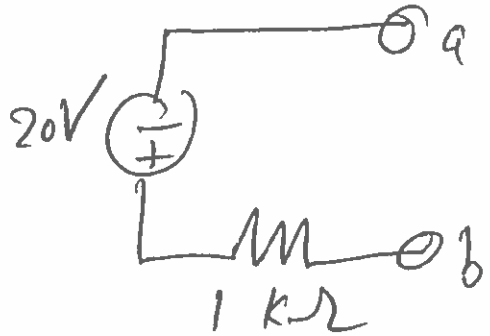
$$= 5V \quad \checkmark$$

Dual circuits

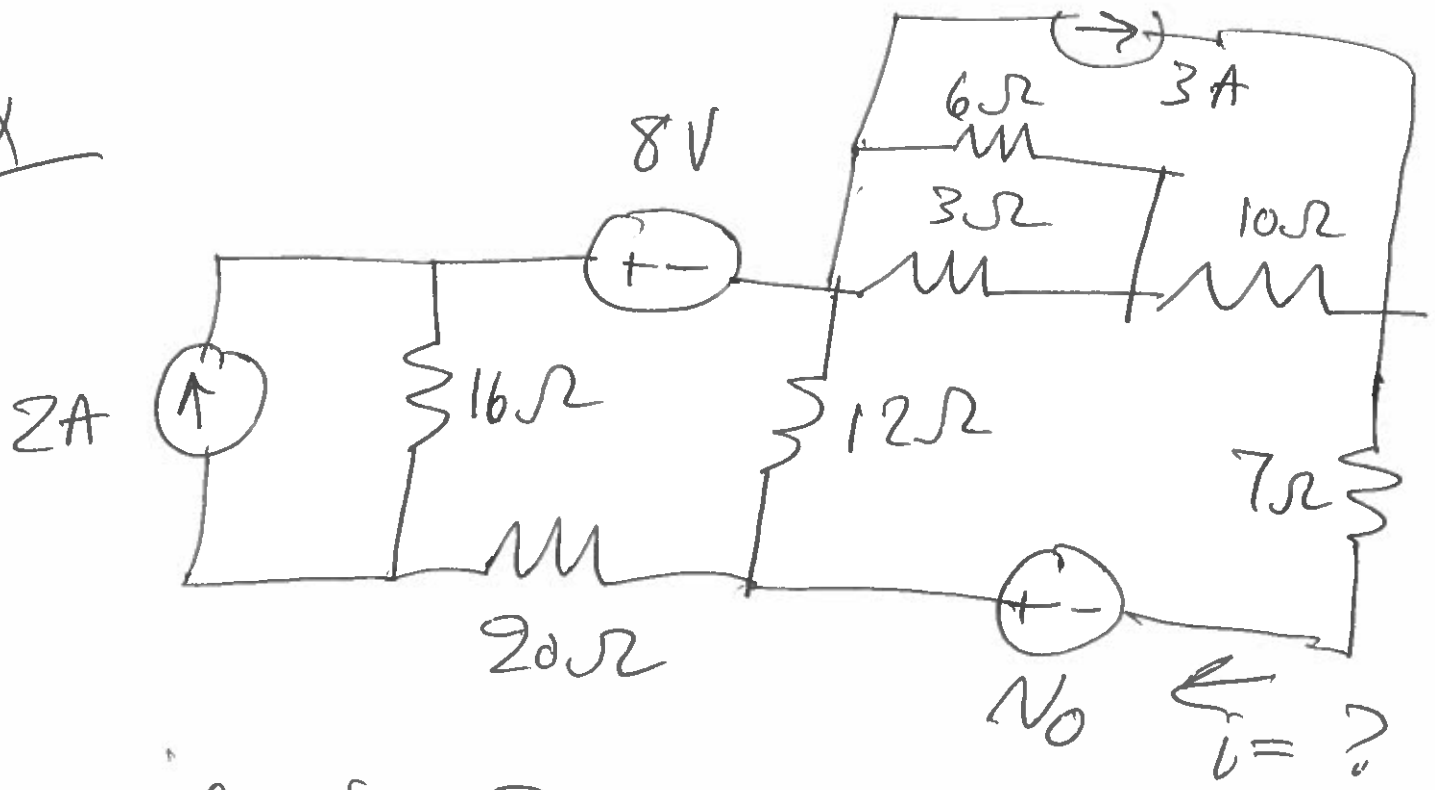
Dual circuits are circuits where an equivalent circuit is obtained by replacing V sources with i-sources and R by $G\left(\frac{1}{R}\right)$



$\Leftrightarrow$



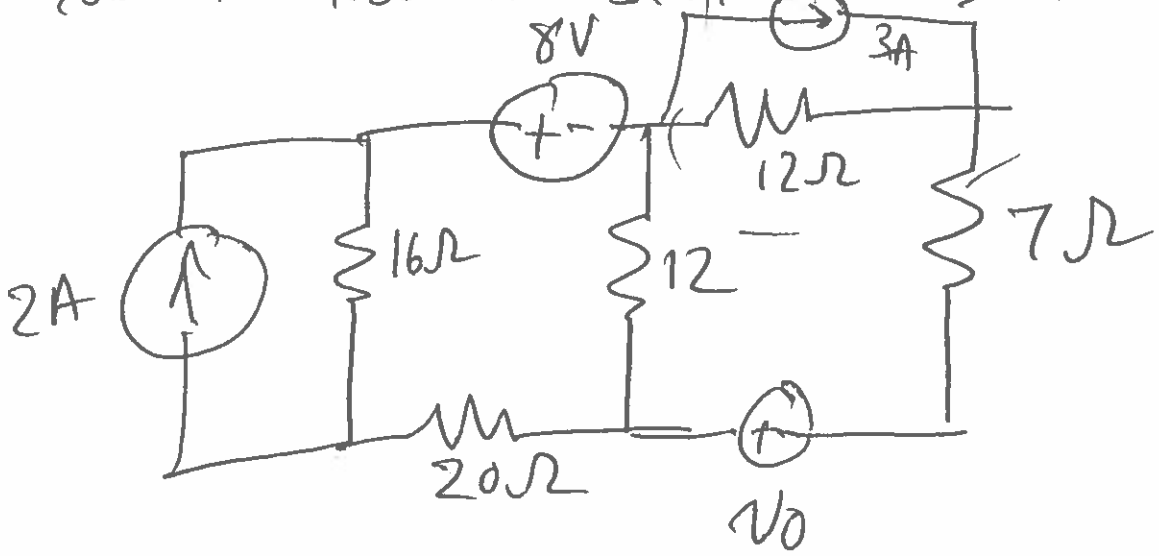
ex

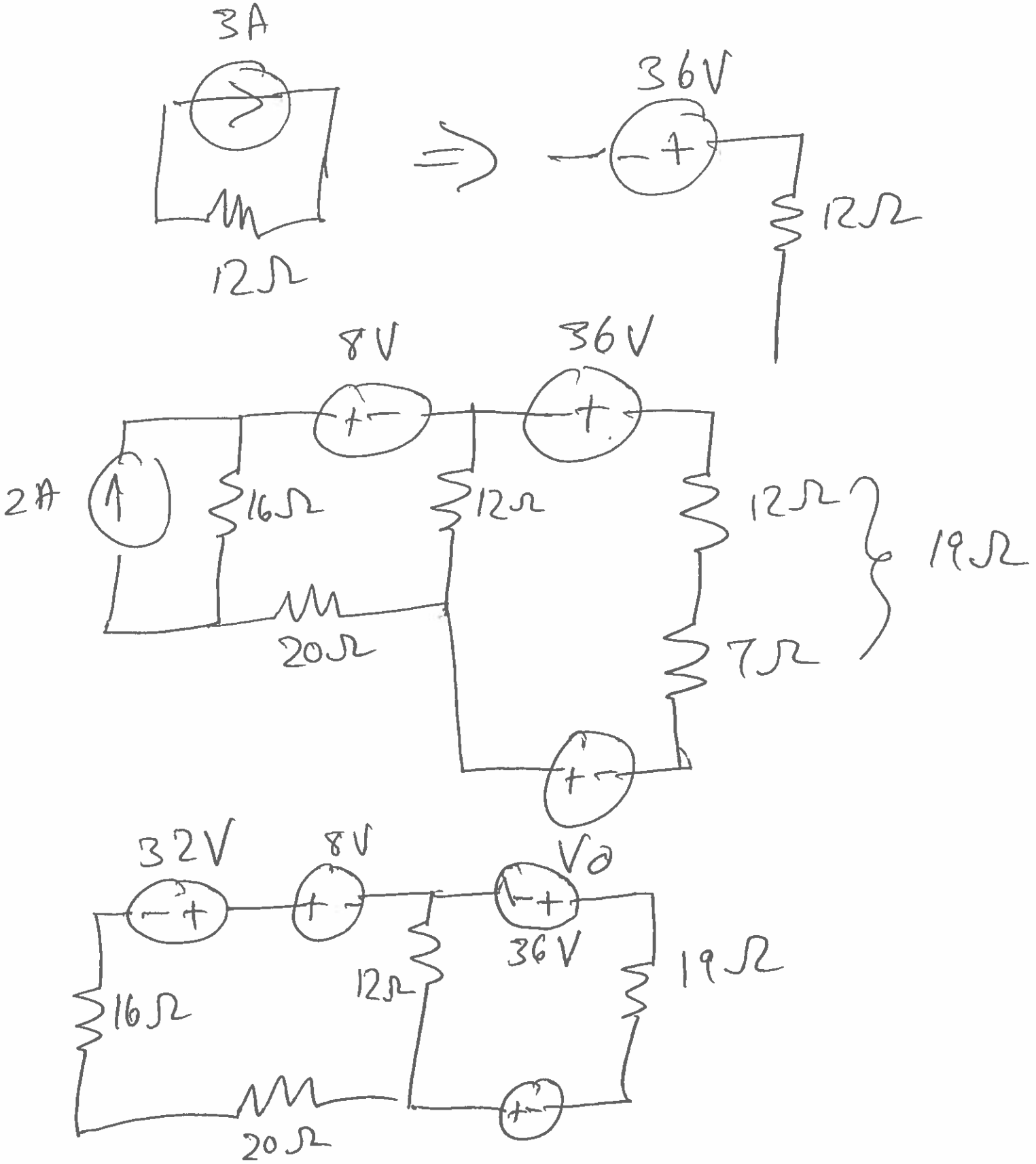


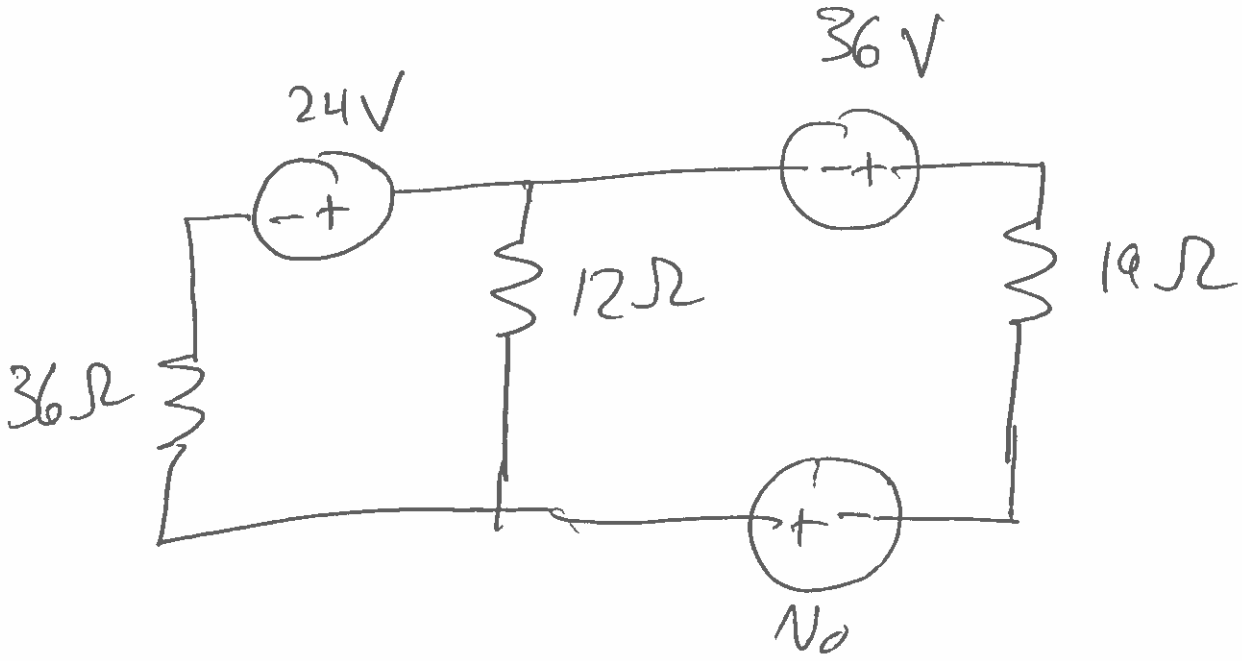
If $i = \frac{5}{2}$ A $\quad V_o = ?$

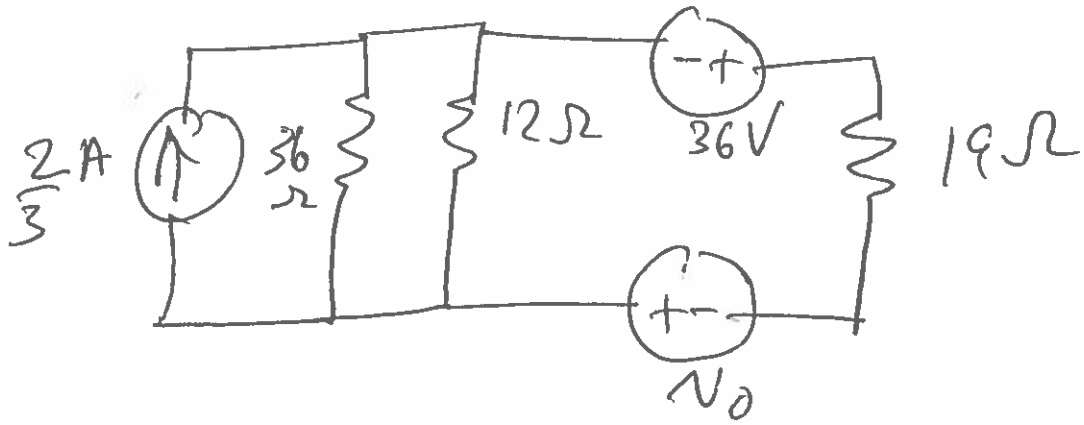
$$\frac{1}{6\Omega} + \frac{1}{3\Omega} = \frac{1+2}{6\Omega} = \frac{3}{6\Omega} = \frac{1}{R} \Rightarrow 2\Omega$$

add to 10Ω in Series $\Rightarrow$ 12Ω



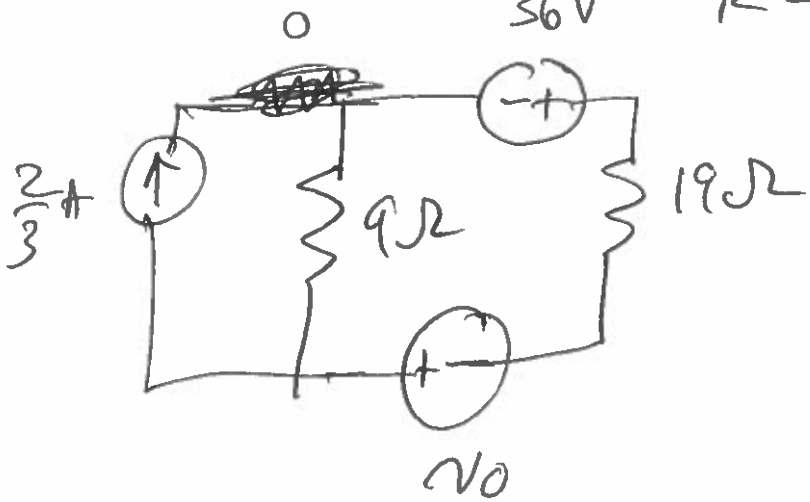

3A
12Ω
36V
12Ω
8V
36V
2A
16Ω
12Ω
12Ω
19Ω
20Ω
7Ω
32V
8V
Vo
36V
16Ω
12Ω
19Ω
20Ω

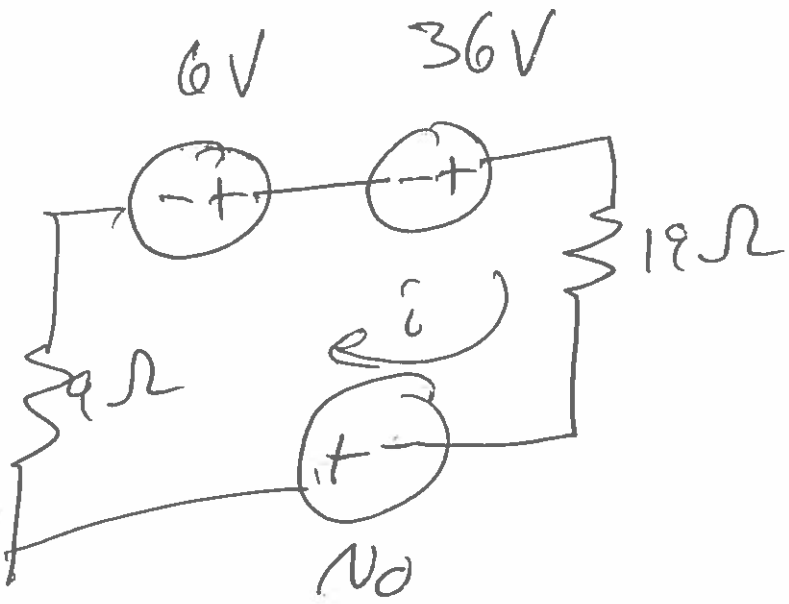




$$\frac{1}{36\Omega} + \frac{1}{12\Omega} = \frac{1+3}{36\Omega} = \frac{4}{36\Omega} = \frac{1}{9\Omega}$$

$R \Rightarrow 9\Omega$



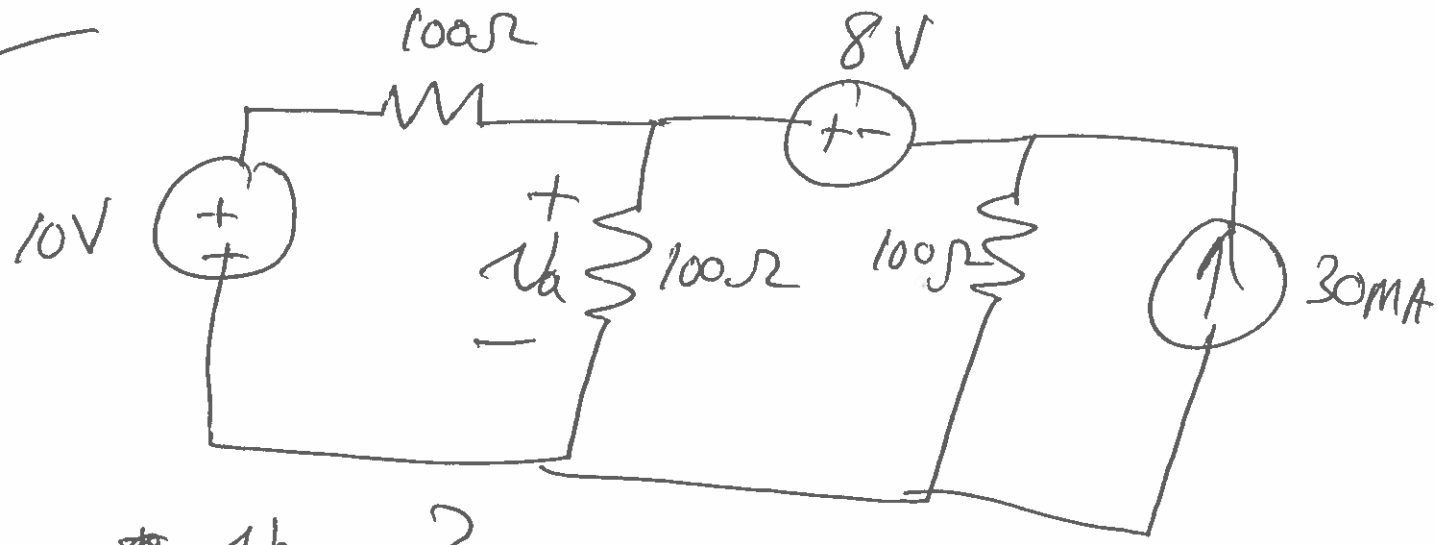


$$i = \frac{V_o + 42V}{28\Omega} = \frac{5}{2}A$$

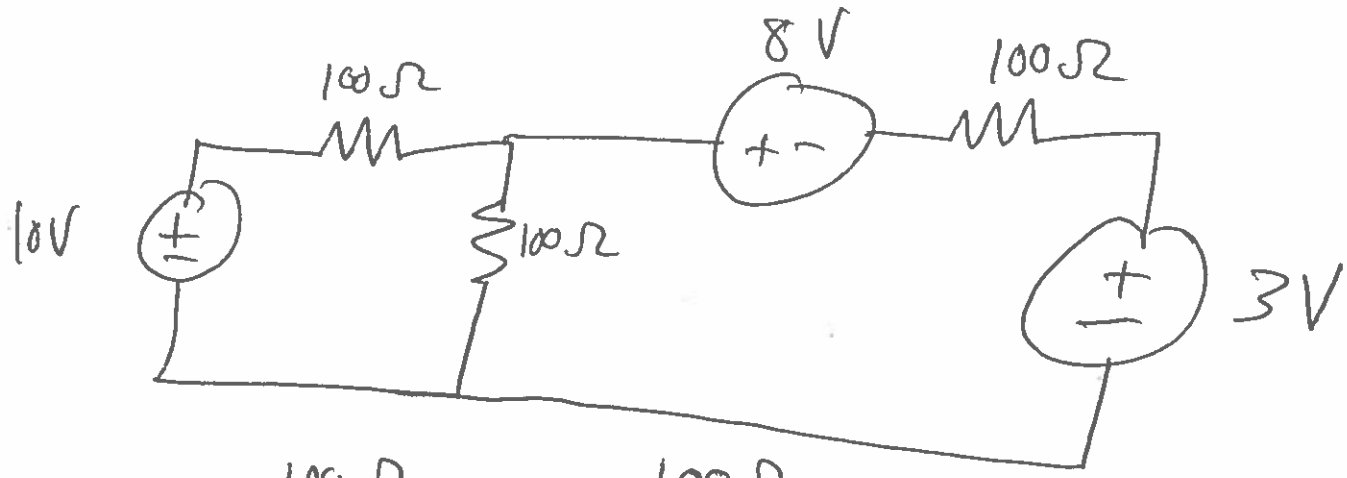
$$V_o = -42V + 28\Omega\left(\frac{5}{2}A\right)$$

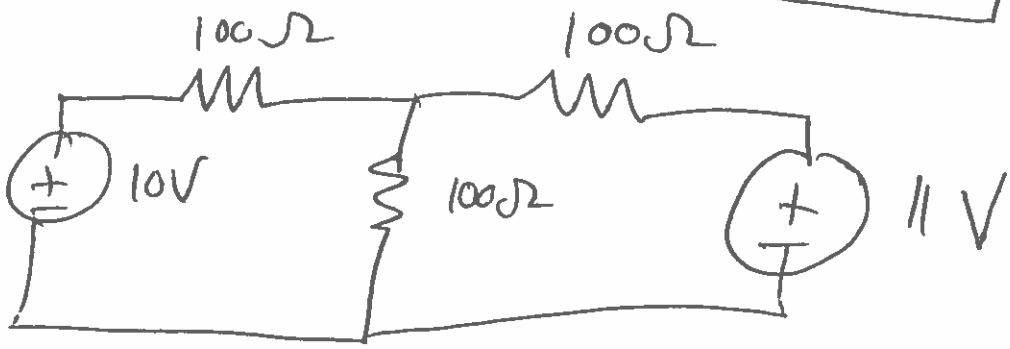
$$V_o = 70V - 42V = \boxed{+28V}$$

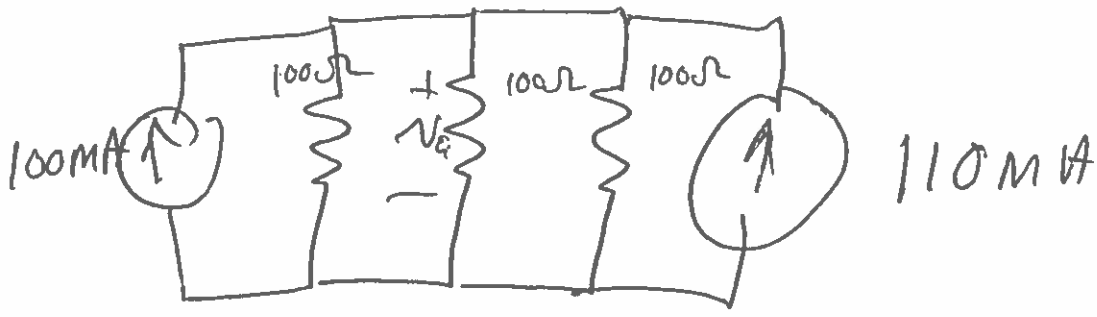
ex


100Ω
8V
10V
+
V_a
−
100Ω
100Ω
30mA

* $V_a = ?$


100Ω
8V
100Ω
10V
100Ω
3V


100Ω
100Ω
10V
100Ω
11V


100Ω
+
100Ω
100Ω
100mA
V_a
−
110mA

$$i_{100\Omega} = \frac{1}{3}(210\text{mA}) = 70\text{mA}$$

$$v_o = (70\text{mA})(100\Omega) = \boxed{7\text{V}}$$