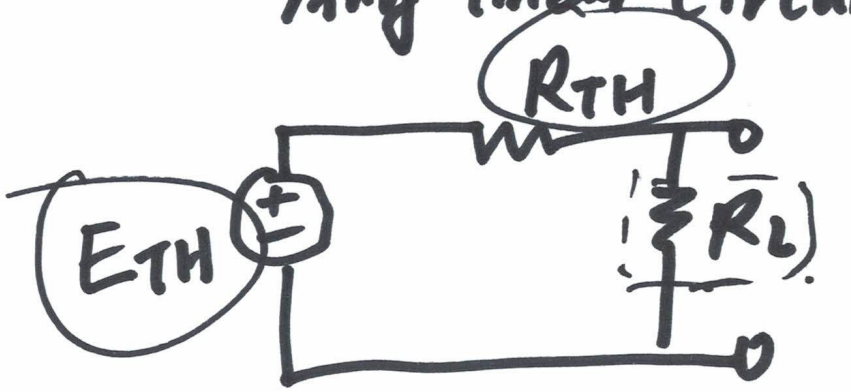
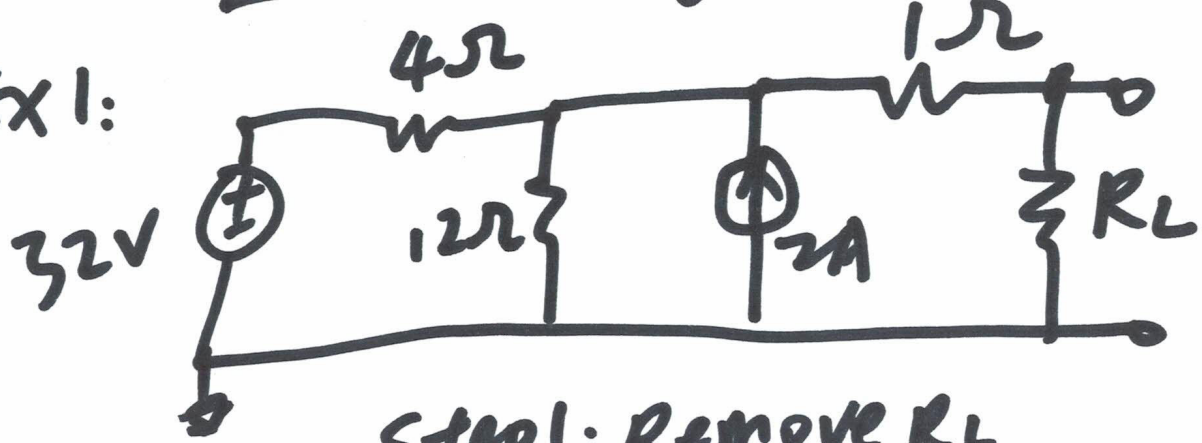
Equivalent Circuit Theorems - Part I

① Thevenin's Theorem

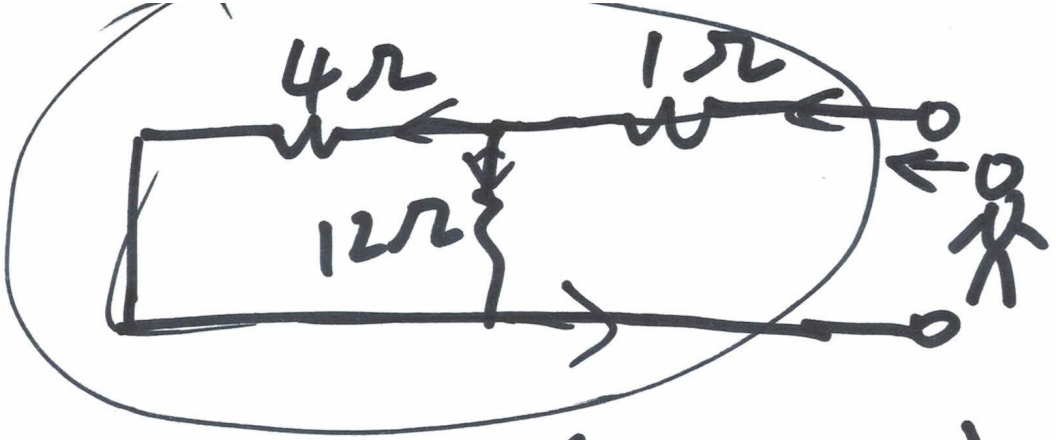
Any linear circuit can be simplified to:



Ex 1:



For R_{TH}:
- Step 1: Remove R_L
- Step 2: Short voltage source / disconnect the current source
- Step 3: Get R_{TH}

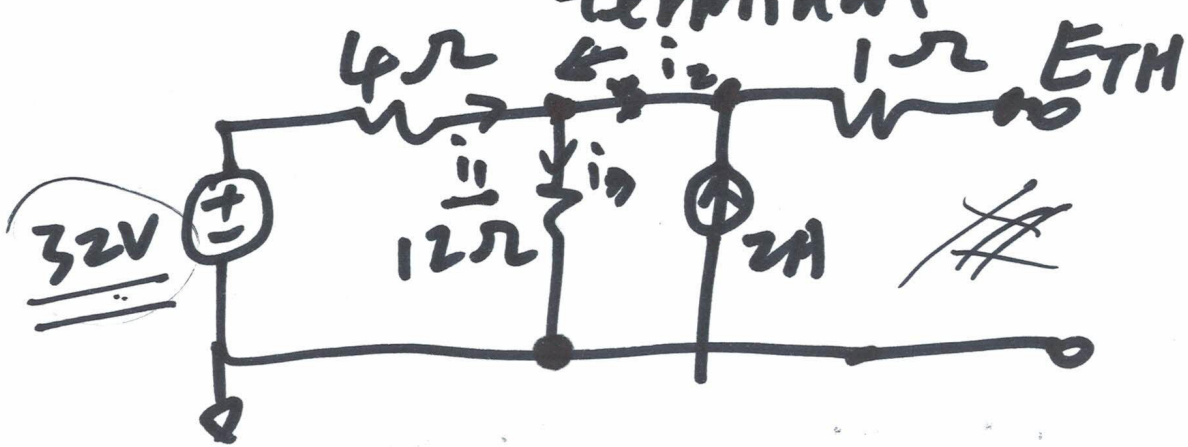


$$R_{TH} = 1\Omega + (4\Omega \| 12\Omega)$$

$$= 1 + \frac{4 \cdot 12}{4+12} = 4\Omega$$

For E_{TH}: step 1: remove R_L

step 2: E_{TH} is the voltage at the output terminal



$$\begin{cases} i_1 + i_2 = i_3 \quad ① \\ i_2 = 2 \quad ② \\ \dfrac{32 - E_{TH}}{4} + 2 = \dfrac{E_{TH}}{12} \quad ③ \end{cases}$$

From ③ $96 - 3E_{TH} + 24 = E_{TH}$

$$E_{TH} = \frac{120}{4} = 30\,V$$

⇔ the Thevenin's equivalent circuit is: