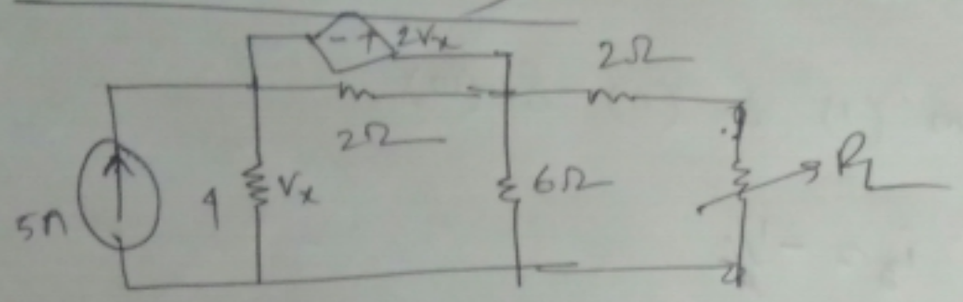
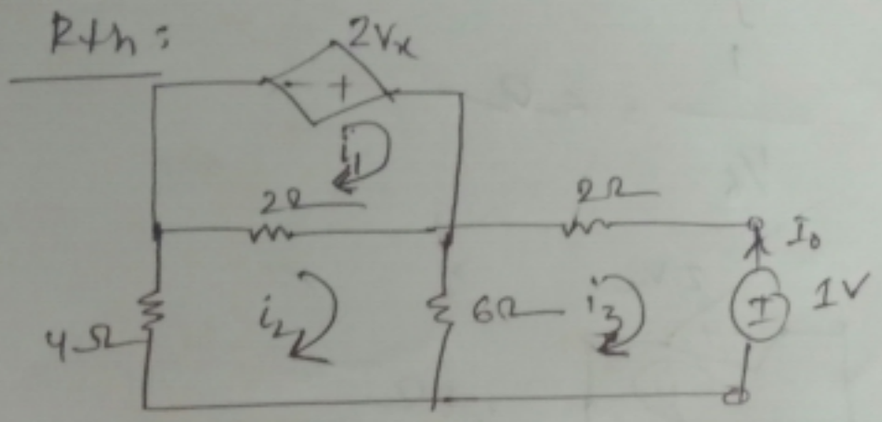
Example (Norton & Thevenin)

Ex: (Thevenin) → with dep. source.



Rth:



here, $V_x = -4i_2$

KVL at loop-1

$$2V_x - 2(i_1 - i_2) = 0$$

$$\Rightarrow 2x - 4i_2 - 2(i_1 - i_2) = 0$$

$$\Rightarrow i_1 + 3i_2 = 0 \quad \text{---(I)}$$

KVL at loop-2

$$-4i_2 - 2(i_2 - i_1) - 6(i_2 - i_3) = 0$$

$$\Rightarrow i_1 - 6i_2 + 3i_3 = 0 \quad \text{---(II)}$$

KVL at loop-3

$$-2i_3 - 1 - 6(i_3 - i_2) = 0$$

$\Rightarrow 6i_2 - 8i_3 = 1$ ——— (III)

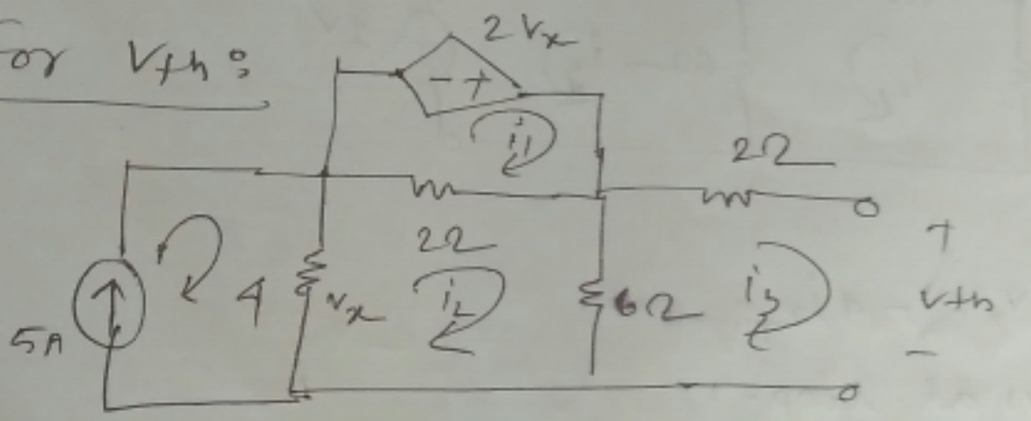
From (I) & (II) & (III)

$i_3 = -1/6$

$\therefore \quad i_0 = -(-1/6) = 1/6$

$\therefore R_{th} = \dfrac{1}{1/6} = 6\,\Omega$

For V_{th}:



KVL at loop-2

$-2(i_2 - i_1) - 6(i_2 - i_3) - 4(i_2 - 5) = 0$ ($i_3 \to 0$)

$\Rightarrow \quad i_1 - 6i_2 = -10$

KVL at loop-1

$2V_x - 2(i_1 - i_2)$

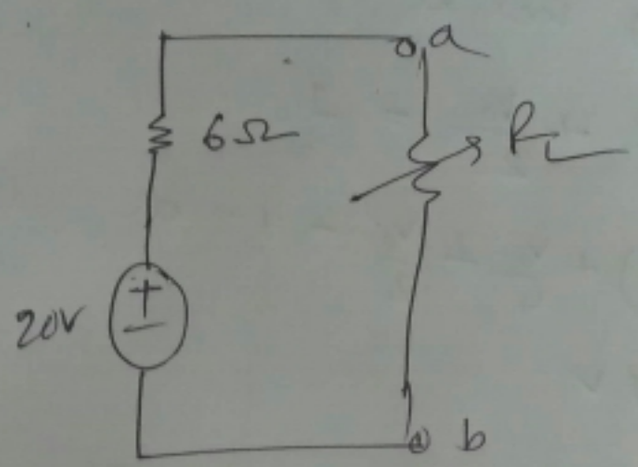
$\Rightarrow 2 - 4(i_2 - 5) - 2(i_1 - i_2) = 0$

$\Rightarrow i_1 + 3i_2 = 20$

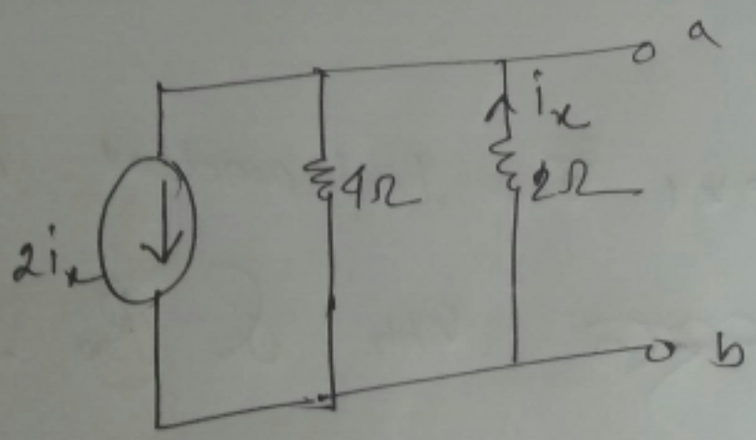
$\therefore i_1 = 10 \qquad i_2 = 10/3$

$\therefore V_{th} = V_{6\Omega} = 6 \times i_2 = 6 \times 10/3 = 20V$

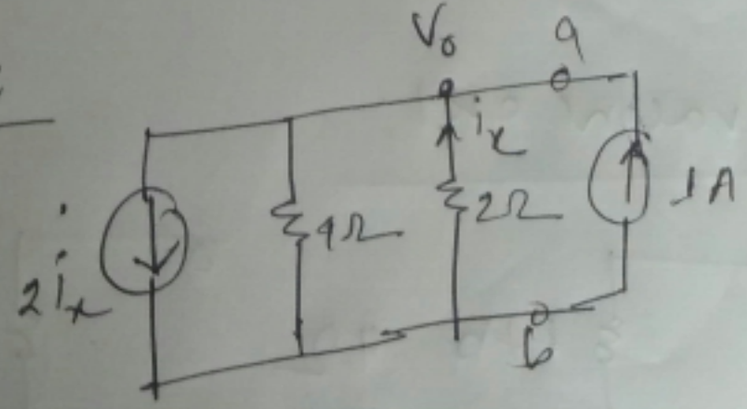
$\therefore$



Ex: Thevenin → with only dependent source



Rth:



here,

$$i_x = \frac{0 - V_0}{2} \Rightarrow i_x = -V_0/2$$

Applying KCL at node -

$$2 I_x + \frac{V_0}{4} + \frac{V_0}{2} = 1$$

$$\Rightarrow 2(-V_0/2) + \frac{V_0}{4} + \frac{V_0}{2} - 1 = 0$$

$$\Rightarrow V_0 = -4\,V$$

$$\therefore R_{Th} = 1 \times V_0 = 1 \times 4 = 4\,\Omega$$

V_{Th} :

এই ckt এ Independent source
না থাকলে V_{Th} & I_N
Zero.

Equivalent ckt: