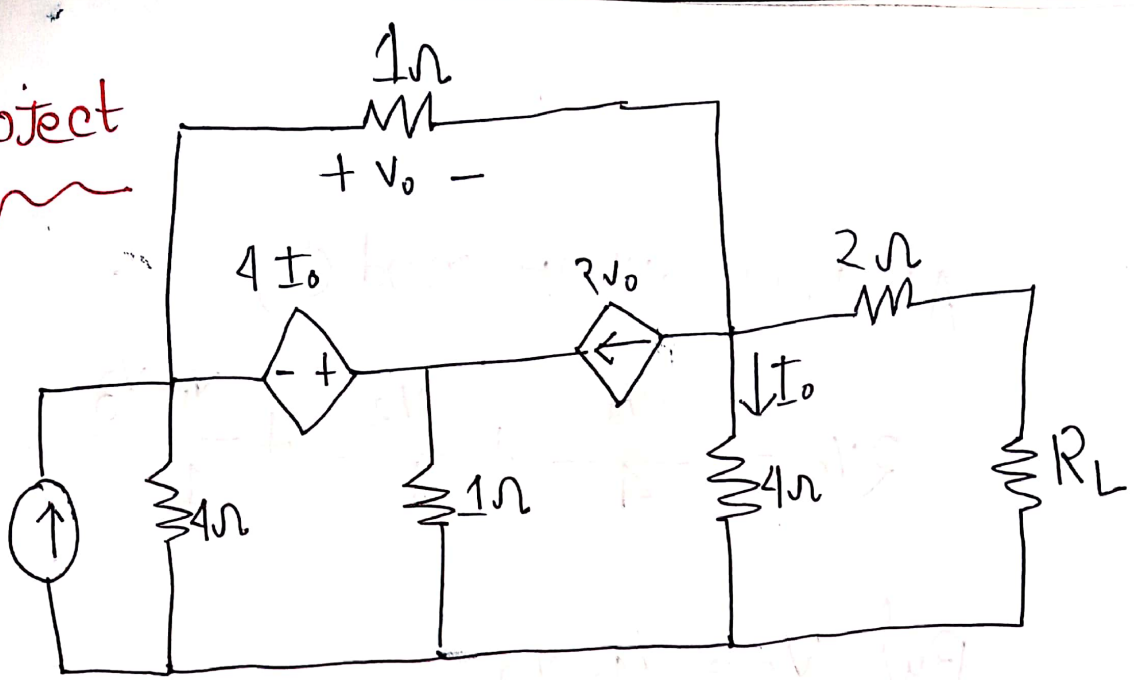
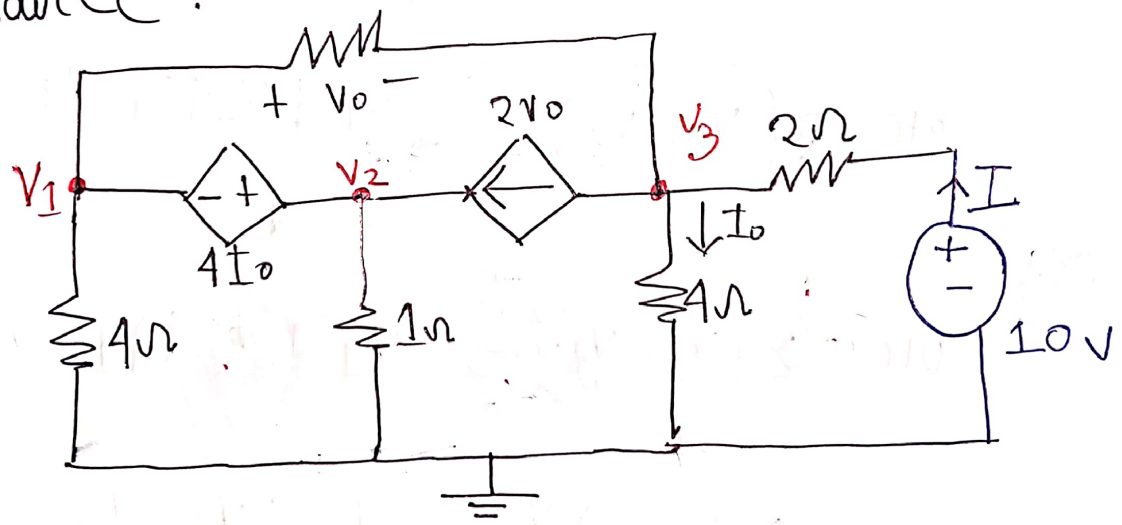
Project




First we disconnect the load to measure $R_{th}$ also disconnect all the independent source.




Applying KVL at mesh 1,

$$-4i_1 + 4I_o - 1(i_2 - i_2) = 0 \quad \text{——(1)}$$

Applying KVL at mesh 2;

$$-1(i_2 - i_1) - \text{——}$$

At the super node,

$$2V_o = \frac{V_1}{4} + \frac{V_2}{1} + \frac{V_1 - V_3}{1} \quad \text{---(1)}$$

But $V_o = V_1 - V_3$

Hence equation (1) becomes

$$2V_o = \frac{V_1 + 4V_2 + (V_1 - V_3)4}{4}$$

$$2(v_1 - v_3) = \frac{v_1 + 4v_2 + 4v_1 - 4v_3}{4}$$

or, $-3v_1 + 4v_2 + 4v_3 = 0$ ——— (2)

At node 3,

$$2v_o + \frac{v_3}{4} = v_1 - v_3 + \frac{10 - v_3}{2}$$

or, $20 = 4v_1 + 0v_2 - v_3$ ——— (3)

At the supernode

$$v_2 = v_1 + 4I_o$$

But $I_o = \frac{v_3}{4}$

Hence $v_2 = v_1 + v_3$ ——— (4)

Solving equation (2) to (4)

$v_1 = 4.848\,V$ $\quad v_3 = -0.6066V$

$v_2 = 4.242V$ $\quad = -606.06mV$

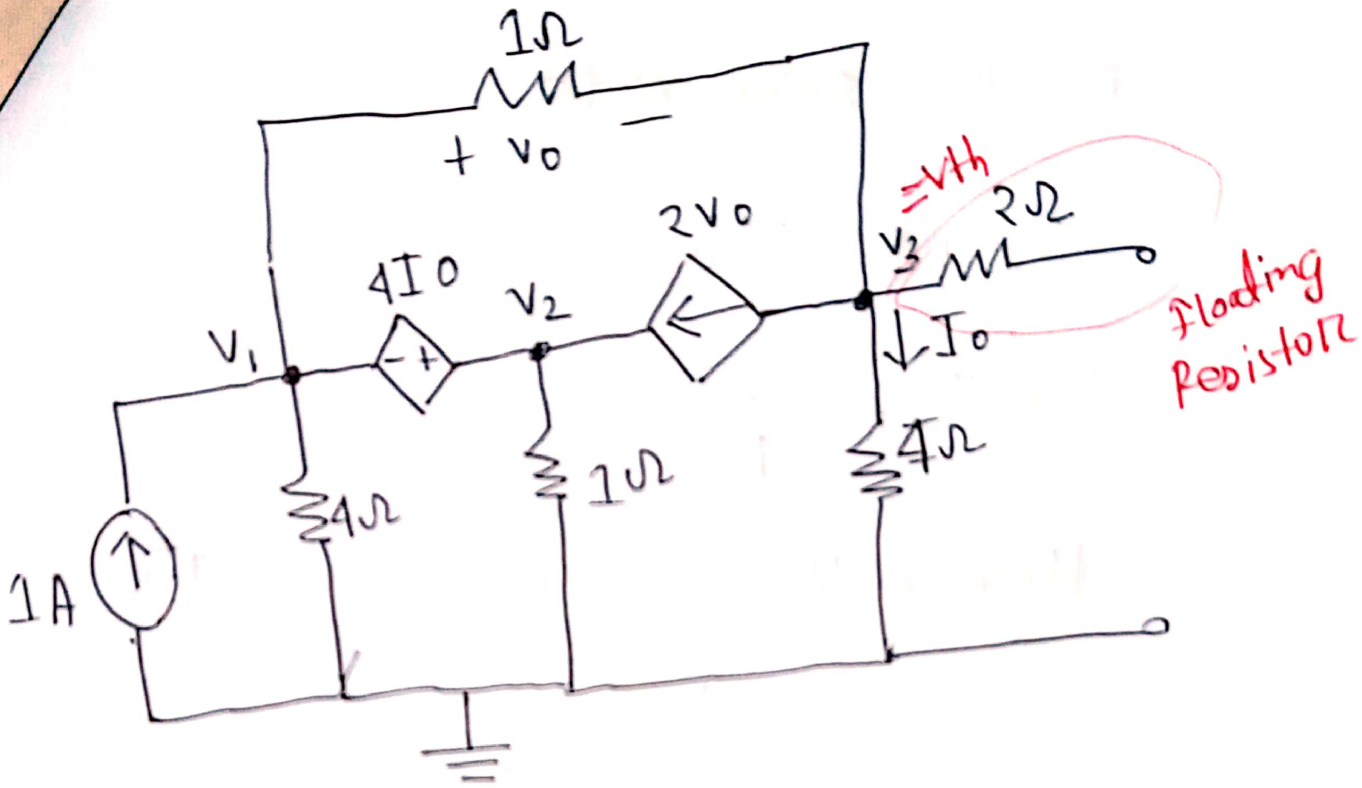
$$I = \frac{10 + 0.606}{2}$$

$$I = 5.303 \text{ A}$$

$$R_{th} = \frac{V}{I}$$

$$= \frac{10}{5.303}$$

$$= 1.89 \Omega .$$




At the supernode

$$1 + 2V_o = \frac{V_1}{4} + \frac{V_2}{1} + \frac{V_1 - V_3}{1} \quad \text{——(1)}$$

But $V_o = V_1 - V_3$

Hence (1) becomes,

$$4 = -3V_1 + 4V_2 + 4V_3 \quad \text{——(2)}$$

At the node 3,

$$2V_o + \frac{V_3}{4} = V_1 - V_3$$

$$2(V_1 - V_3) + \frac{V_3}{4} = V_1 - V_3 \quad \text{——(3)}$$

At the super node,

$$V_2 = V_1 + 9I_o$$

But $I_o = \frac{V_3}{4}$

Hence $V_2 = V_1 + V_3$ ——— (4)

Solving equation (2) to (4) we get

$$V_{th} = V_3 = 0.458\,V$$

0.9522V

$$P_{max} = \frac{V_{th}^2}{4R_{th}}$$

$$= \frac{(0.458)^2}{4*(1.89)}$$

$$P_{max} = 27.70 \text{mW att}$$