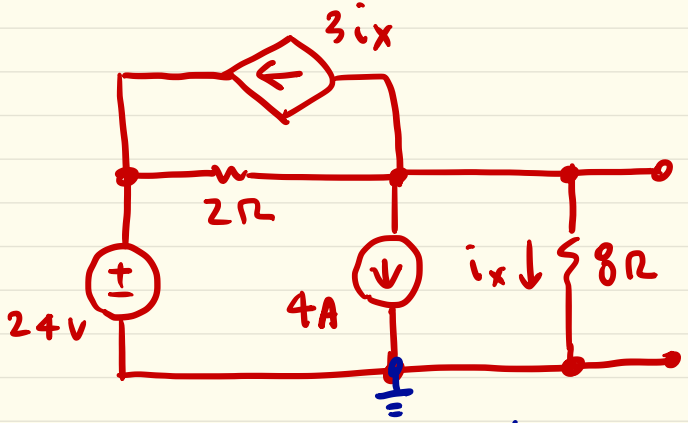
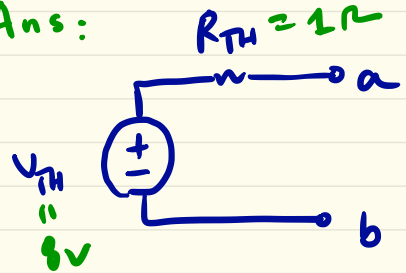
$3/27$ : Quiz 1
(wed)

# Example: Thevenin Equivalent (port at node a, b)




Ans:



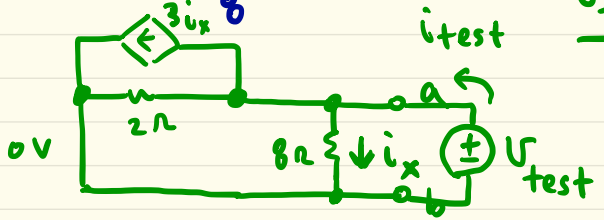

1) $V_{TH}$:

KCL @ a: $\frac{V_a - 24}{2} + 4 + 3i_x + i_x = 0$

$i_x = \frac{V_a}{8}$

$\Rightarrow V_a = 8\,V = V_{TH}$

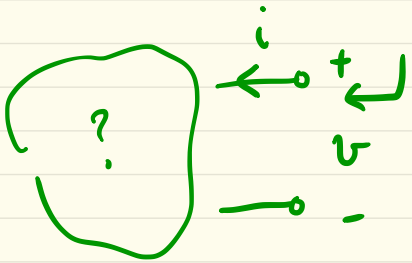
2) $R_{TH}$:

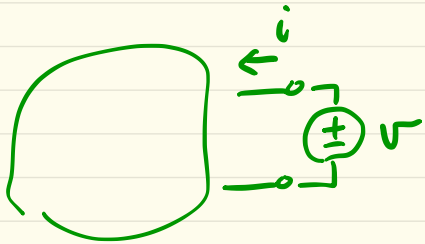



KCL@a:

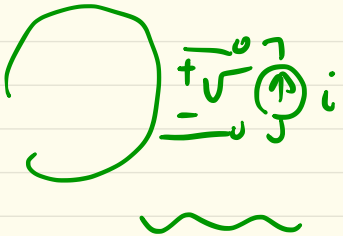
$\frac{V_{test}}{2} + 3 \cdot \frac{V_{test}}{8} + \frac{V_{test}}{8} - i_{test} = 0$

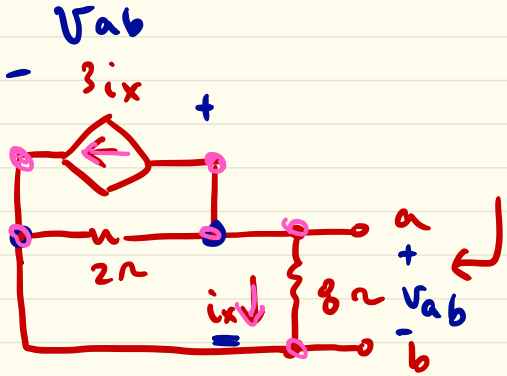
$\Rightarrow \frac{V_{test}}{i_{test}} = 1\,\Omega = R_{TH}$




$\frac{v}{i} = R$



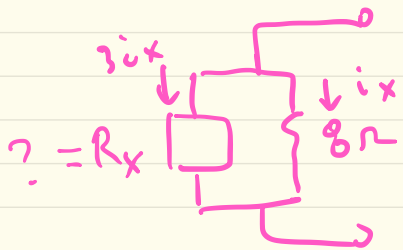



$$R_{TH} = 8 \parallel 2 \parallel (R_x)$$

$3i_x$ ↑

$R_x$ = $\frac{8}{3}$

$$= \frac{1}{\frac{1}{8}+\frac{3}{8}} \parallel 2 = 2 \parallel 2 = \underline{1\,\Omega}$$

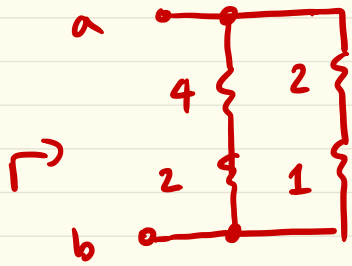



$8 \cdot i_x = R_x \cdot 3i_x$

$\Rightarrow R_x = \frac{8}{3}$

Lecture 2.

1)



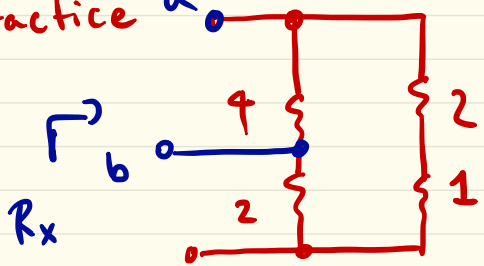

Find $R_{in}$


=

$R_{in} = 6 \| 3 = 2\ \Omega$

$R_{in}$

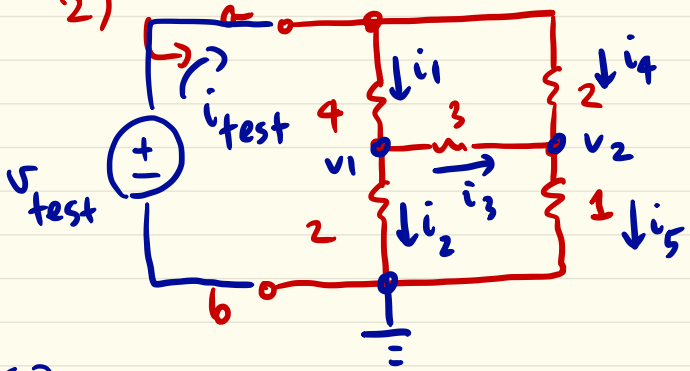
- Practice




$R_x$ = ?

Find Rin

2) Rin




① KCL:

$$\begin{cases} i_{test} = i_1 + i_4 \\ i_1 = i_2 + i_3 \\ i_3 + i_4 = i_5 \end{cases}$$

② 

$$i_1 = \frac{v_{test} - v_1}{4}$$

$$i_2 = \frac{v_1}{2}$$

$$i_3 = \frac{v_1 - v_2}{3}$$

$$i_4 = \frac{v_{test} - v_2}{2}$$

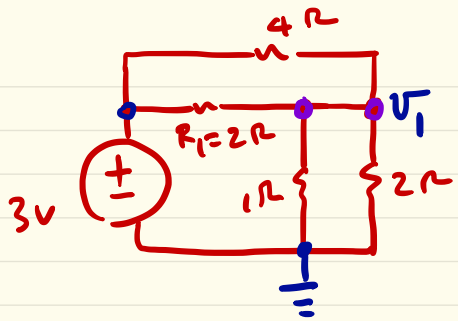
$$i_5 = \frac{v_2}{1}$$

$\left.\begin{matrix} \\ \\ \\ \\ \\ \end{matrix}\right\}$ 代入 ① $\Rightarrow$

$$v_1 = v_2 = \frac{v_{test}}{3}, \quad i_3 = 0\,A$$

$$\frac{v_{test}}{i_{test}} = R_{in} = 2\,\Omega$$

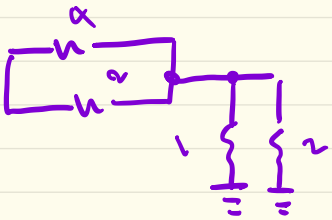
3)

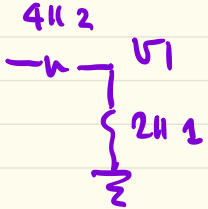



Find power dissipated by $R_1$

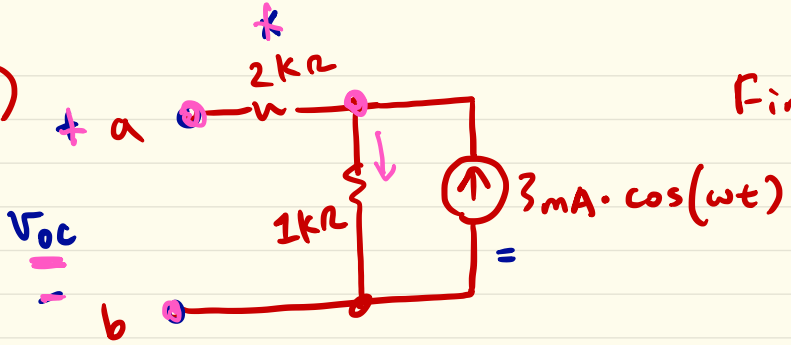
$$\frac{3 - V_1}{(4 \| 2)} = \frac{V_1}{(1 \| 2)} \Rightarrow V_1 = 1\,V$$

$$P = V \cdot i = (3-1) \cdot \frac{3-1}{2} = 2\,W$$

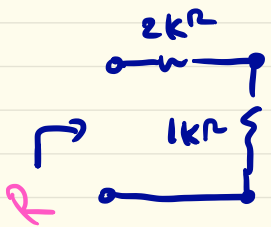


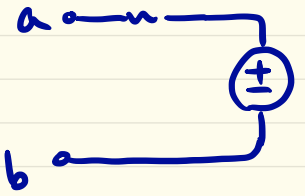
4)



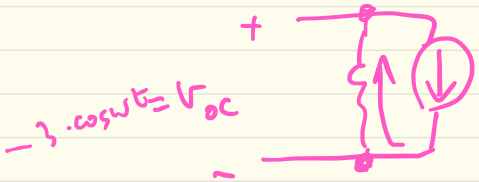

Find Thevenin equivalent.




$R_{TH} = 3k\Omega$

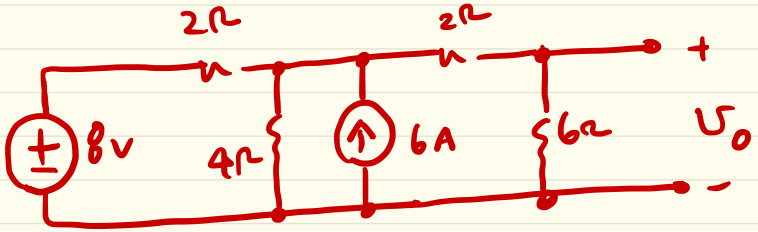



$V_{TH} = 3mA \cdot \cos(\omega t) \cdot 1k\Omega = 3 \cdot \cos(\omega t)$ (V)

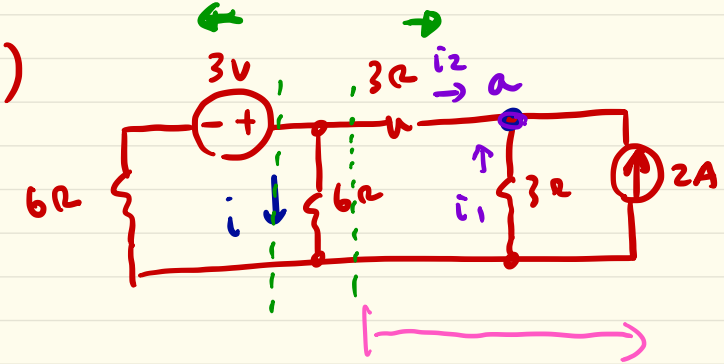


5) Practice. Find $v_o$ by ① node method, ② superposition

Ans. $v_o = 8.55\,V$

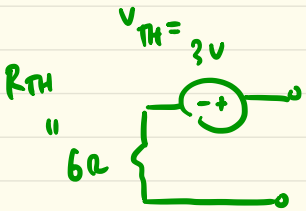


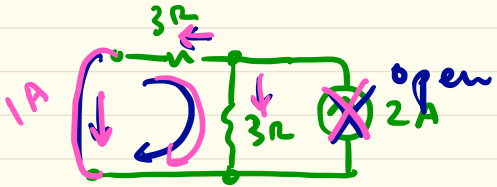
6)

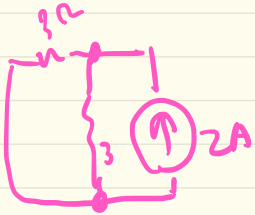


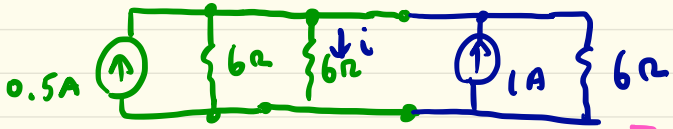

Find i. use Norton to simplify analysis.

$i_2 + i_1 + 2 = 0$




$$i = \frac{1.5A}{3} = \underline{0.5A}$$