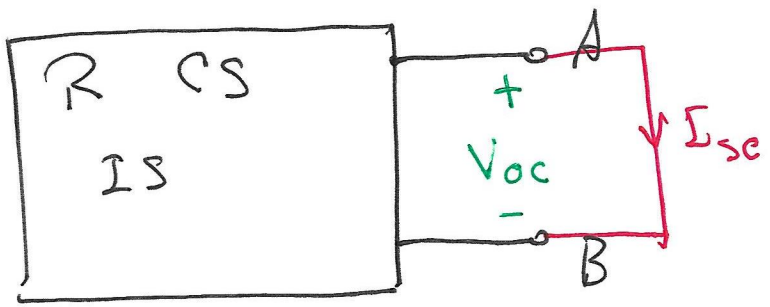
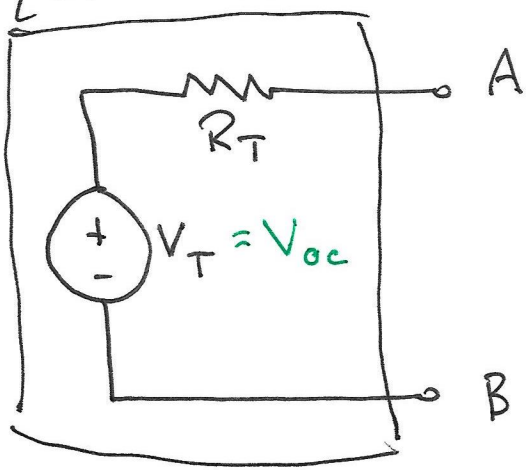
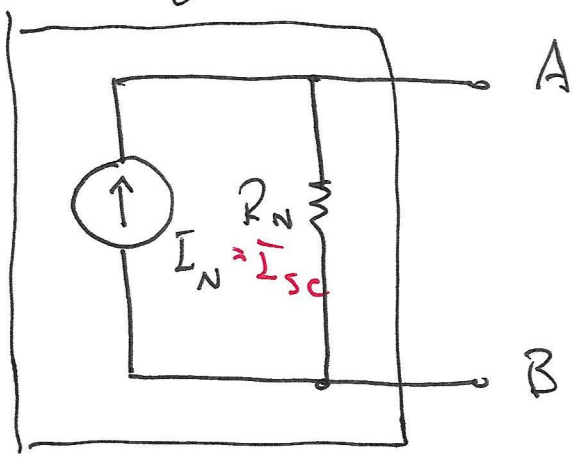
Final Exam is due Tuesday, December 14
by 9:30 AM.



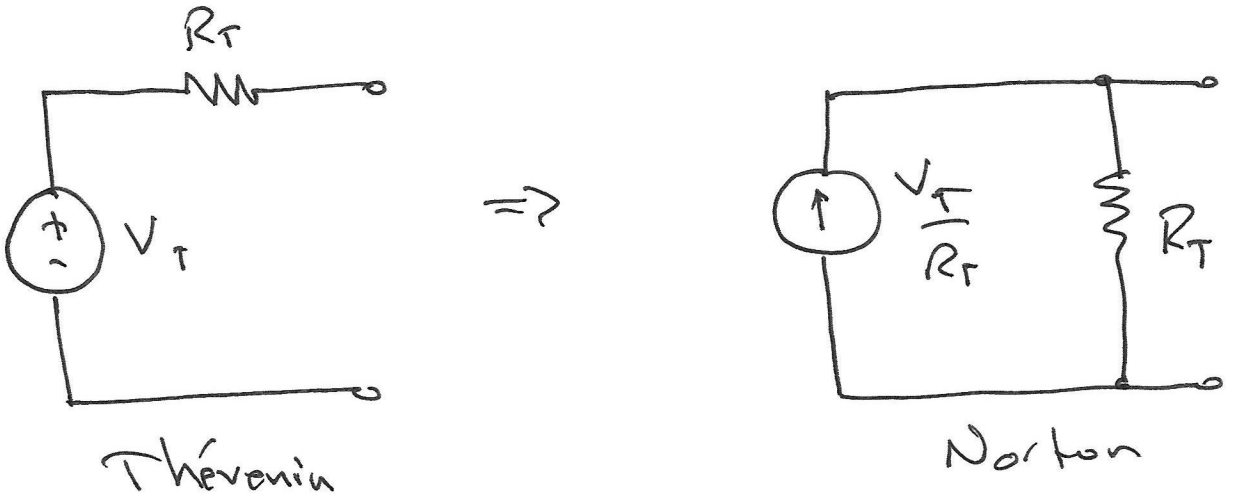
Thevenin Equivalent

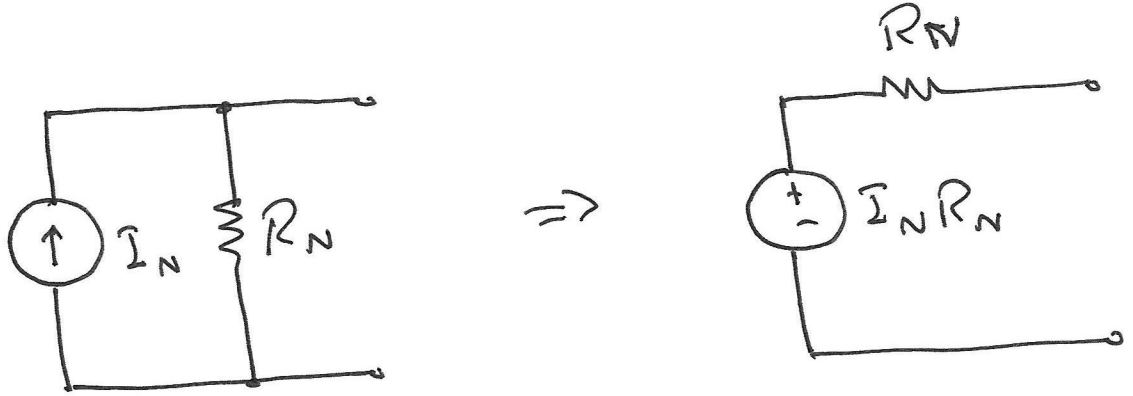


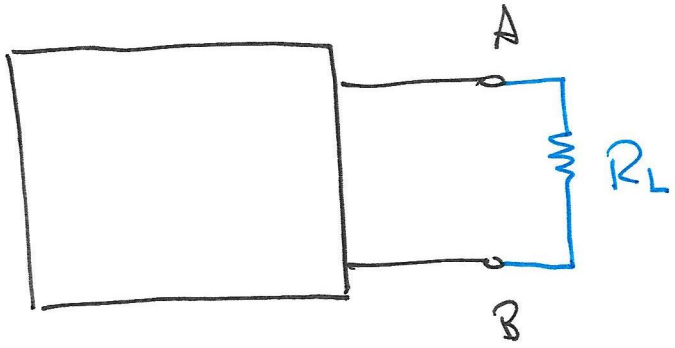
Norton Equivalent



$$\frac{V_{oc}}{I_{sc}} = R_N = R_T = \frac{V_{oc}}{I_{sc}}$$

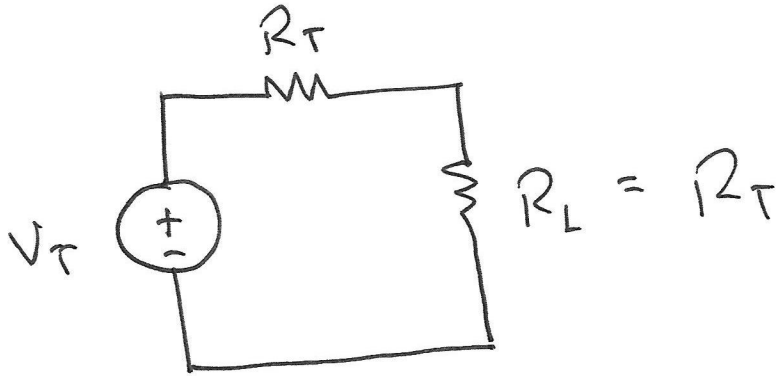

R_T
V_T
$\Rightarrow$
$\frac{V_T}{R_T}$
R_T
Thévenin
Norton

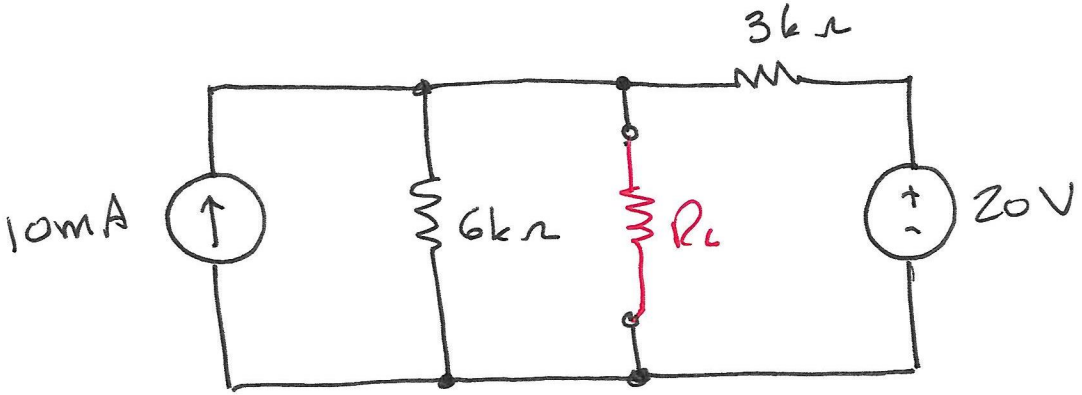

I_N
R_N
$\Rightarrow$
R_N
$I_N R_N$



To get maximum power delivered to the load, set

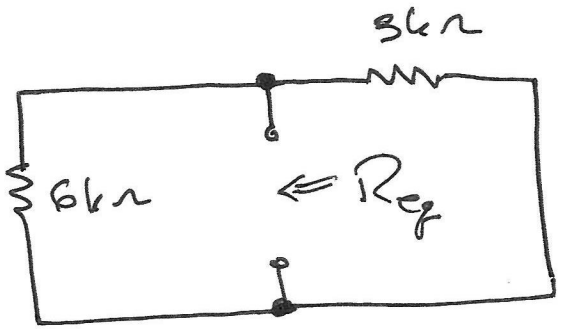
$$R_L = R_T = R_N$$





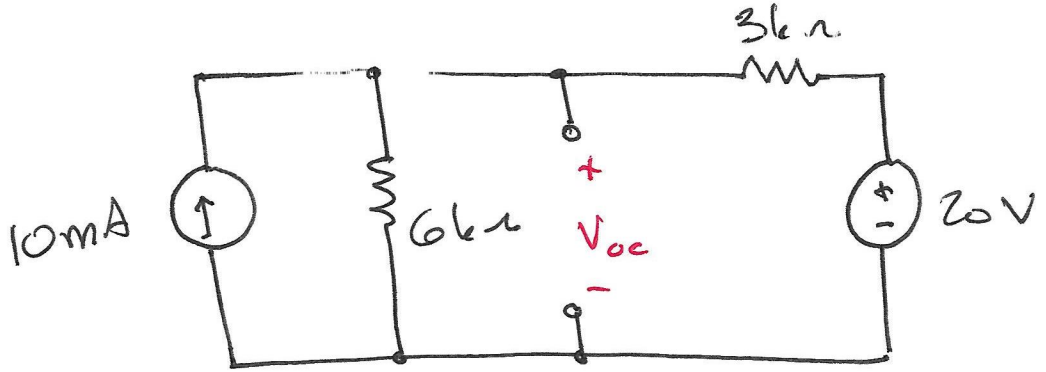
What value should I choose for R_L so that it absorbs maximum power?

To find R_T or R_N, turn off all independent sources and calculate the equivalent resistance w.r.t. the ~~load~~ load terminals.

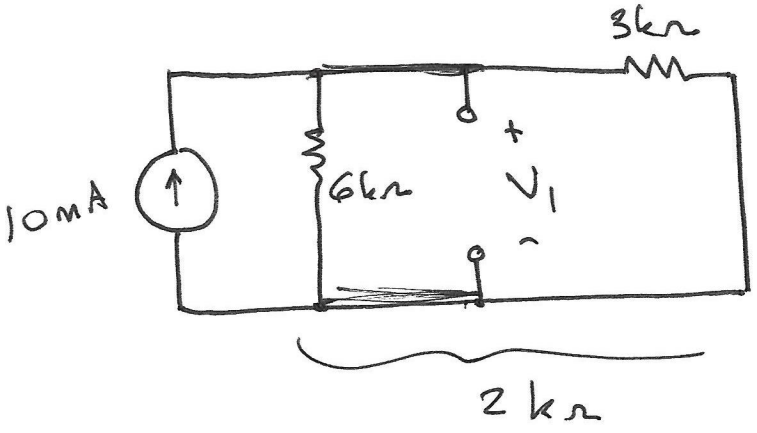


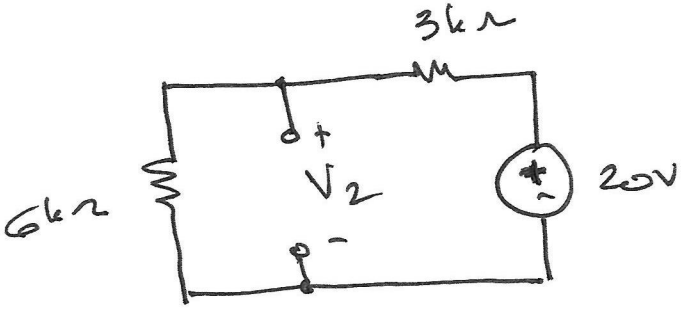
$$R_{eq} = 6k\Omega \,||\, 3k\Omega = 2k\Omega$$

$$R_T = R_N = 2k\Omega \Rightarrow R_L = 2k\Omega \text{ for max. power.}$$



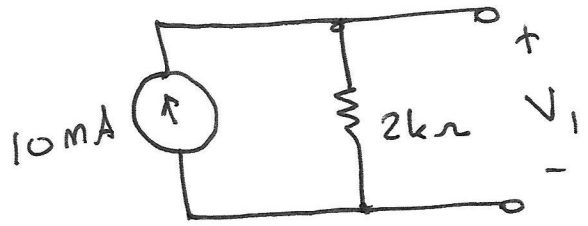
$V_T = V_{oc}$





$$V_2 = \frac{6}{9} \cdot 20V$$

$$= \frac{40}{3} V$$

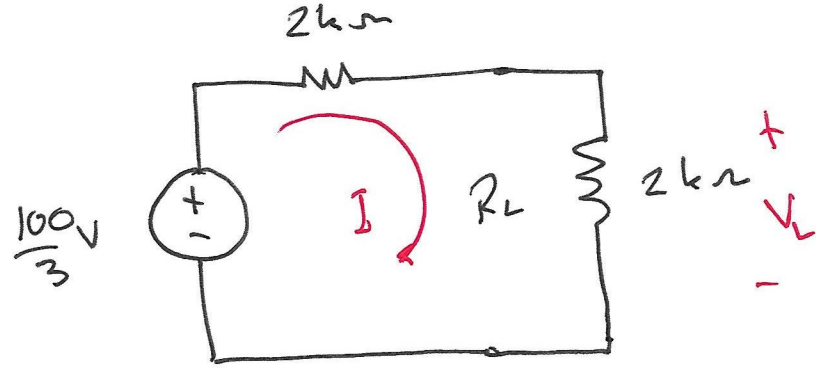


$$V_1 = (10mA \times 2k\Omega) = 20V$$

$$V_{oc} = V_1 + V_2$$

$$= 20 + \frac{40}{3}$$

$$= \frac{100}{3} V$$



$P_L = ?$

$I = \frac{25}{3}$ mA

$V_L = \frac{50}{3}$ V

$P_{abs.} = VI$ where V and I satisfy the PSC.

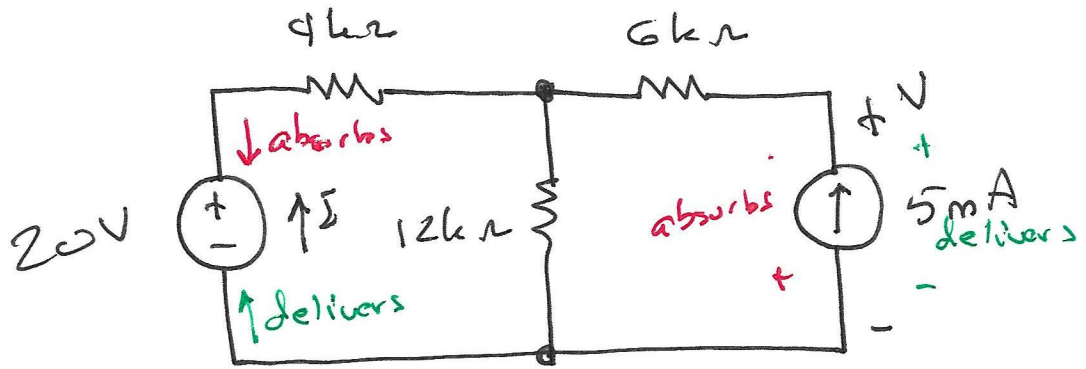
But $V = RI$

$= RI^2$

or $I = \frac{V}{R}$

$= \frac{V^2}{R}$

$P_L = \left(\frac{25}{3}\text{ mA}\right)^2 (2\text{k}\Omega)$ or $\frac{\left(\frac{50}{3}\right)^2}{2\text{k}\Omega}$



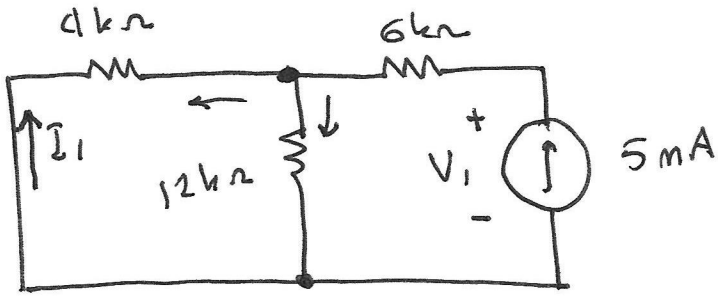
Which components absorb power, and which deliver power?

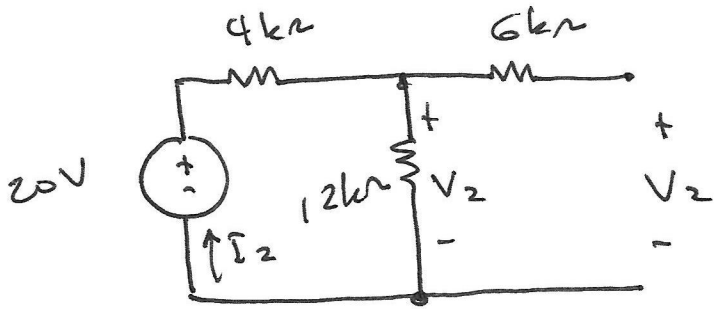
Do they satisfy the PSC, or not?

If yes, they absorb power.

If no, they deliver power.

Thy superposition:





$I = I_1 + I_2$ If $I > 0$, the voltage source delivers power

$V = V_1 + V_2$ If $V > 0$, the current source delivers power

$$I_1 = -\frac{12}{16} \cdot 5mA = -\frac{15}{4} mA$$

$$V_1 = (6k\Omega)(5mA) = 45V$$

$$I_2 = \frac{20V}{16k\Omega} = \frac{5}{4} mA$$

$$V_2 = \frac{12}{16} \cdot 20V = 15V$$

$$I = I_1 + I_2 = -\frac{15}{4} mA + \frac{5}{4} mA = -\frac{10}{4} mA = -\frac{5}{2} mA$$

$\Rightarrow$ the voltage source satisfies the PSC and
$\therefore$ absorbs power

$$V = V_1 + V_2 = 45V + 15V = 60V$$

$\Rightarrow$ the current source does not satisfy the PSC and delivers power.