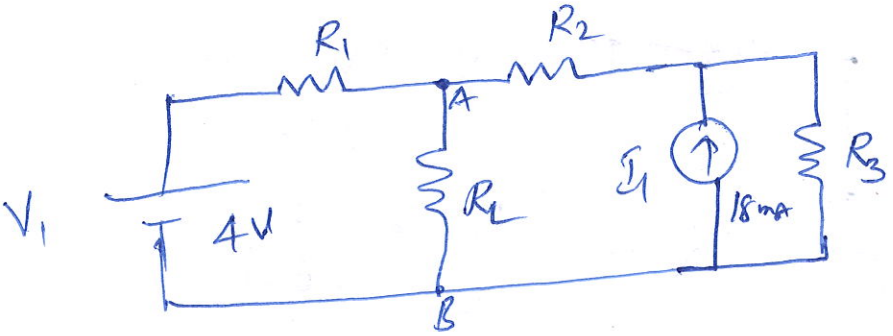
EECE105L END SEMESTER EXAM

1) For the circuit shown below, calculate the value of P_{R_L} (in kΩ) such that the power delivered to the resistor is maximized

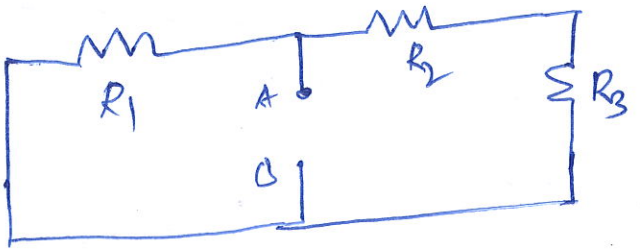


$R_2 = 7\,k\Omega$

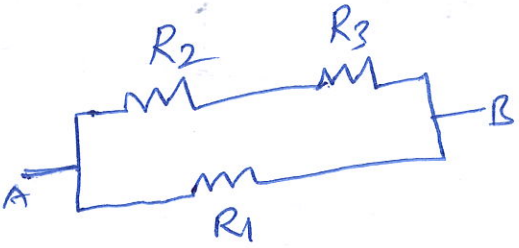
$R_3 = 9\,k\Omega$

$R_L = 2\,k\Omega$

To find R_{TH} between A and B nodes:



$\Rightarrow$



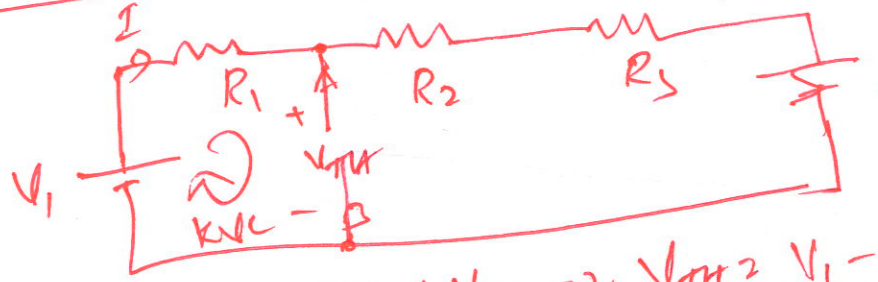
$R_{TH} = R_1 \,//\, (R_2 + R_3)$

$R_{TH} = R_L = 2k\Omega = R_1 \,//\, (16k\Omega)$

$\frac{1}{2} = \frac{1}{R_1} + \frac{1}{16} \qquad \frac{1}{R_1} = \frac{1}{2} - \frac{1}{16} = \frac{14}{2\times 16}$

$R_1 = \frac{16}{7}\,k\Omega$

To find V_{TH}: Use source transformation.



$I_1 \cdot R_3$ $\qquad I = \frac{4 - 18m \times 9 \times 10^3}{\left(\frac{16}{7} + 7 + 9\right)k} = -8.64\,mA$

KVL $\quad V_1 = IR_1 + V_{TH} \Rightarrow V_{TH} = V_1 - IR_1 = \frac{95}{4}V = -8.64\,mA$

$R_L = R_{TH} = 2k\Omega \qquad P_L = \frac{V_{TH}^2}{4R_L} = \underline{70.51\,mW}$