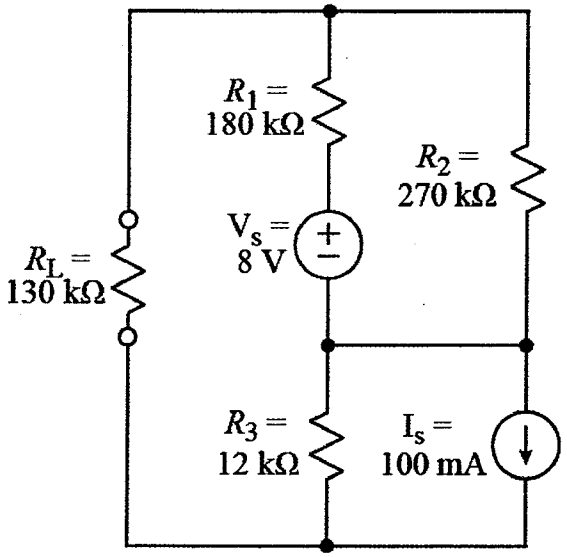
3. (25 points)

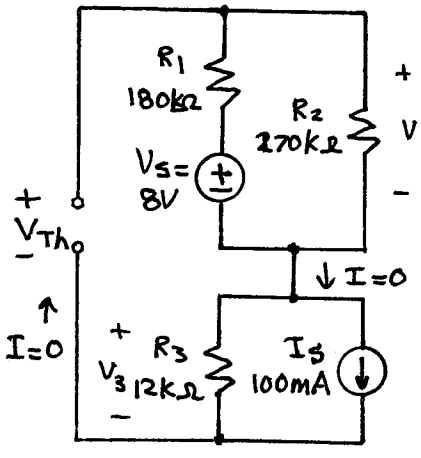


15 pts a) Find and draw the Thevenin equivalent of the circuit shown. The load resistor is R_L.

4 pts b) Find the voltage across R_L using your Thevenin equivalent circuit.

6 pts c) Choose a different value of R_L so as to maximize the power dissipated in R_L. Find that maximum power.

soln: a) V_{Th} = V across terminals for R_L with R_L removed from the circuit.



$V_2 = V_S \cdot \frac{R_2}{R_1+R_2} = 8V \cdot \frac{270k\Omega}{180k+270k\Omega}$

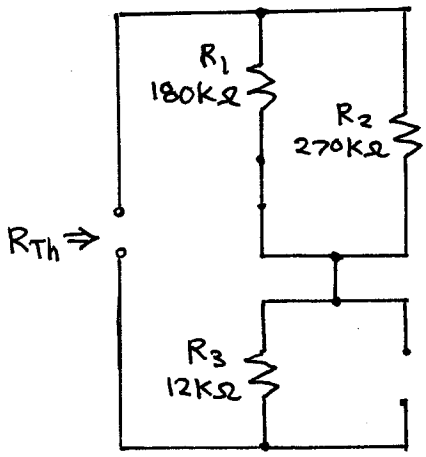
$V_2 = 8V \cdot \left(\frac{3}{5}\right) = 4.8V$

$V_3 = -I_S R_3 = -100mA \cdot 12k\Omega$

$V_3 = -1200V$

$V_{Th} = \frac{16}{3}V - 1200V = -1195.2V$

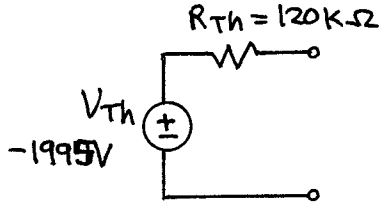
We turn off sources to find R_{Th}.



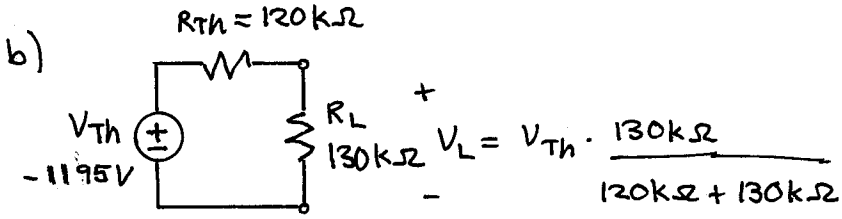
$$R_{Th} = 180k \| 270k\,\Omega + 12k\Omega$$

$$= 90k \cdot 2 \| 3\ \Omega + 12k\Omega$$

$$R_{Th} = 90k\left(\frac{2}{5}\right) + 12k\Omega = 108k\Omega + 12k\Omega = 120k\Omega$$



b)



$$V_L = V_{Th} \cdot \frac{130k\Omega}{120k\Omega + 130k\Omega}$$

$$V_L = -1195V \cdot \frac{13}{25} \approx -1200V \cdot \left(\frac{13}{25}\right)$$

$$V_L \approx -48(13) = -624V$$

c) Use $R_L = R_{Th} = 120k\Omega$ for max pwr.

$$\text{Max pwr} = \frac{V_{Th}^2}{4R_{Th}} \doteq \frac{1195^2\,W}{4(120k)} = 2.975\,W$$