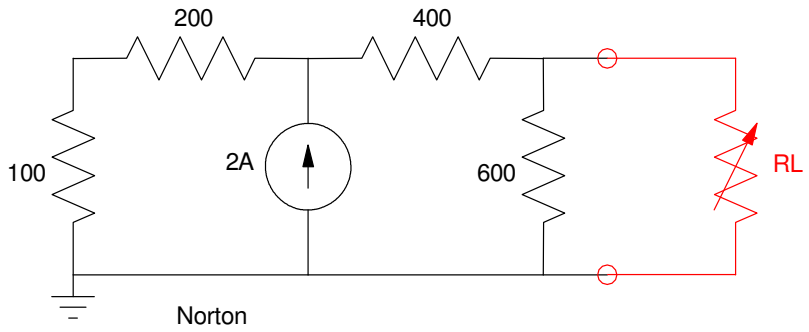
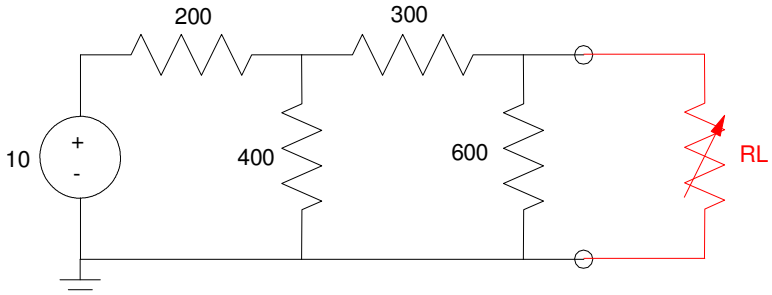
Maximum Power Transfer

EE 206 Practice Problems

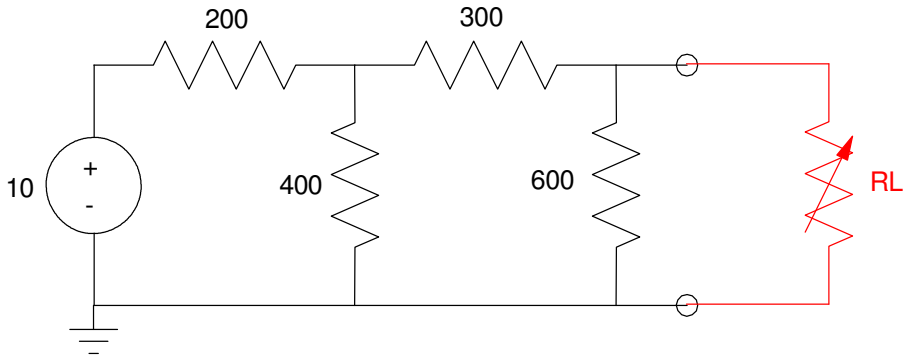
Determine the maximum power that can be delivered to RL.



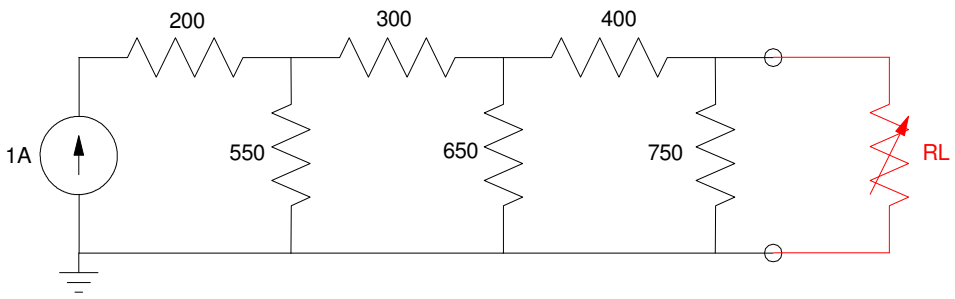
Problem 1



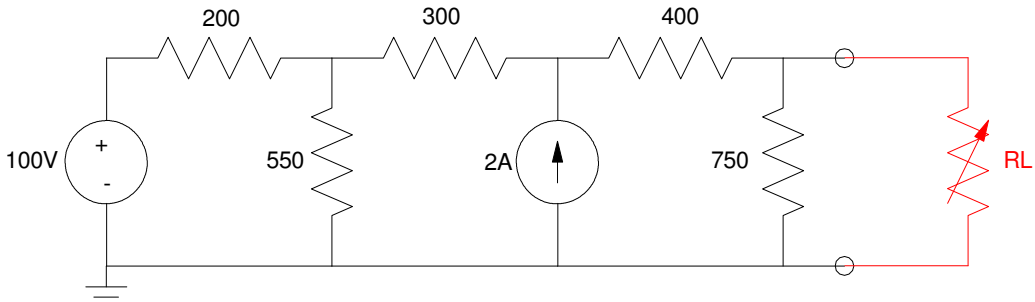
Problem 2



Problem 3



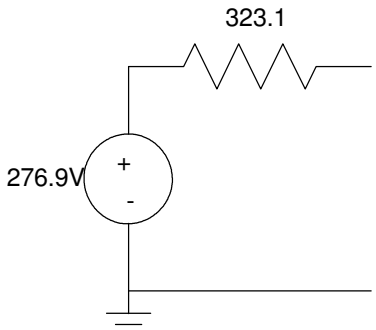
Problem 4



Problem 5

Solutions

Problem 1) Take the Thevenin equivalent (from before)



The value of RL which maximizes the power to the load is

$$R_L = R_{th} = 323.1\Omega$$

The maximum power is

$$V_L = \tfrac{1}{2} \cdot 276.9V = 138.45V$$

$$P = \tfrac{V^2}{R} = \tfrac{138.45^2}{323.1\Omega} = 59.327W$$

Problem 2) Take the Thevenin equivalent (from before)

$$V_{th} = 3.871V$$

$$R_{th} = 251.613\Omega$$

The maximum power to the load happens when

$$R_L = R_{th} = 251.613\Omega$$

The power is then

$$P_{\max} = \left(\frac{\left(\frac{V_{th}}{2}\right)^2}{R_L} \right) = \left(\frac{(1.936V)^2}{251.613\Omega} \right) 14.889mW$$

Problem 3) Take the Thevenin equivalent (from before)

- Vth = 2.304V
- Rth = 340.98 Ohms

Maximum power to the load is when

$$R_L = R_{th} = 340.98\Omega$$

$$P_{\max} = \left(\frac{\left(\frac{V_{th}}{2}\right)^2}{R_{th}} \right) = \left(\frac{1.152^2}{340.98} \right) = 3.892mW$$

Problem 4) Take the Thevenin equivalent (from before)

- Vth = 117.728V
- Rth = 379.528 Ohms

Maximum power to the load is when

$$R_L = R_{th} = 379.528\Omega$$

$$P_{\max} = \left(\frac{\left(\frac{V_{th}}{2}\right)^2}{R_{th}} \right) = \left(\frac{(58.864V)^2}{379.528\Omega} \right) = 9.130W$$

Problem 5) Take the Thevenin equivalent (from before)

- Vth = 454V
- Rth = 397.704 Ohms

Maximum power to the load is when

$$R_L = R_{th} = 397.528V$$

$$P_{\max} = \left(\frac{\left(\frac{V_{th}}{2}\right)^2}{R_{th}} \right) = \left(\frac{(227)^2}{397.528\Omega} \right) = 129.624W$$