Problem 3.65  What value of the load resistor $R_L$ will extract the maximum amount of power from the circuit in Fig. P3.65, and how much power will that be?

![Figure P3.65: Circuit for Problem 3.65.](image)

Solution: We start by obtaining the Thévenin equivalent circuit at terminals $(a,b)$, as if $R_L$ were not there. We first find $V_{oc}$:

$$\frac{V}{6} - 3 + \frac{V}{12} = 0$$

$$V = 12 \text{ V}.$$

Hence,

![Voltage division gives:](image)

$$V_{Th} = V_{oc} = \left(\frac{8}{4+8}\right) V = \frac{8}{12} \times 12 = 8 \text{ V}.$$

Next, we suppress the current source to find $R_{Th}$:

![Simplification leads to:](image)

$$R_{Th} = 10.44 \Omega.$$

Equivalent circuit:

For maximum power transfer to $R_L$, $R_L = R_{Th} = 10.44 \Omega$

$$I = \frac{8}{2 \times 10.44} = 0.38 \text{ A}$$

$$P_{max} = I^2R_L = (0.38)^2 \times 10.44 = 1.53 \text{ W}.$$