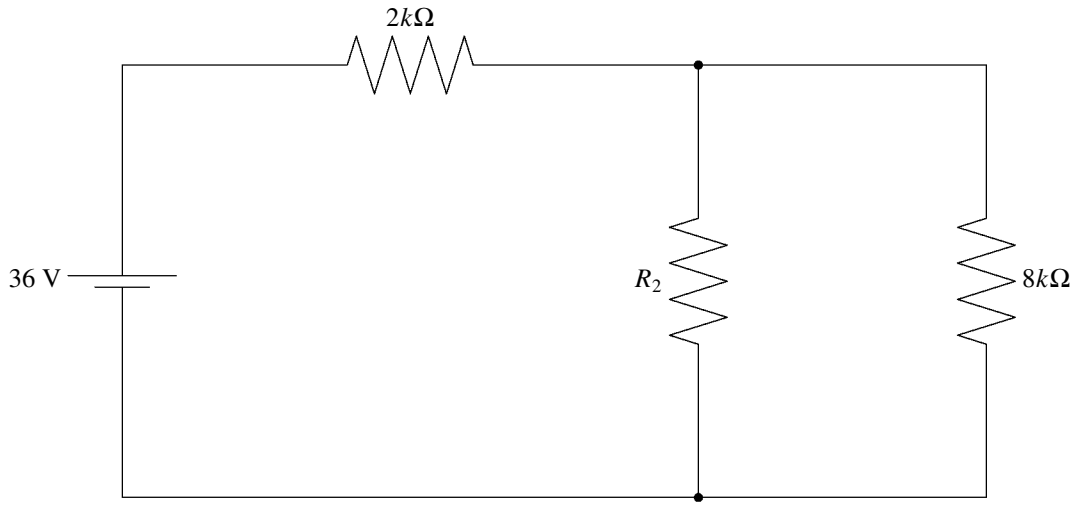
Problem 3: (30 pts.) In the circuit shown in the figure, energy is being dissipated in the 8.00 kΩ resistor at a rate of 80.7 mW.

a. (25 pts.) What is the resistance R_2?



b. (5 pts.) Now suppose R_2 were doubled. Would the power in the 8 kΩ resistor increase, decrease, or stay the same? Explain your answer briefly, but clearly.

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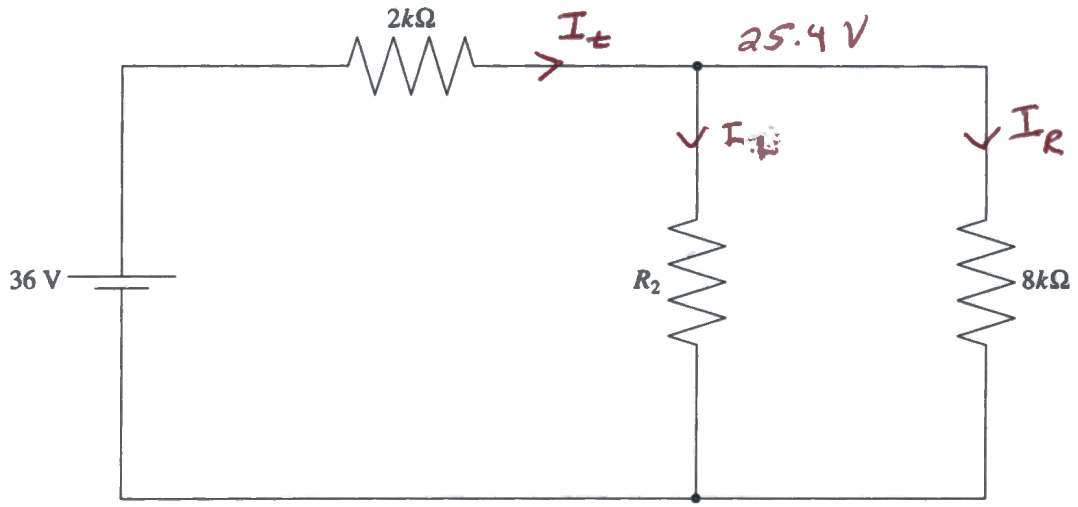

$P_R = 80.7\,mW = I_R^2 (8k\Omega) \Rightarrow I_R = 3.176\,mA.$

Then $V_R = I_R(8k\Omega) = 25.41\,V$

Then $I_t = \frac{36 - 25.4\ V}{2k\Omega} = 5.30\,mA$

Next, $I_2 = I_t - I_R = 2.12\,mA$

Finally, $25.4V = I_2 R_2 \Rightarrow R_2 = \frac{25.4V}{2.12mA} = \boxed{12.0k\Omega}$

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Increase. If R_2 doubles, less current is drawn. (The equivalent parallel resistance of R_2 and 8kΩ increases). Less current in total means the voltage drop V_1 over the 2kΩ resistor is less. Then the voltage across the 8kΩ resistor is now more than 25.4V, and the power, V^2/R, increases.