staple

August 18, 2004 — date

EE 331 Section 5521 — course & section

CDR Cameron — your name

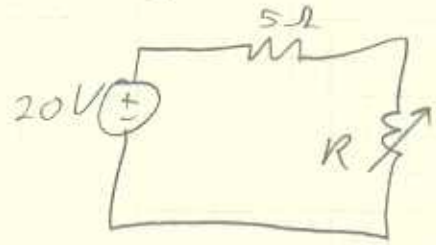
(1) — page #

Assignment 1 — Assignment #

Rizzoni 2.15 — Problem #

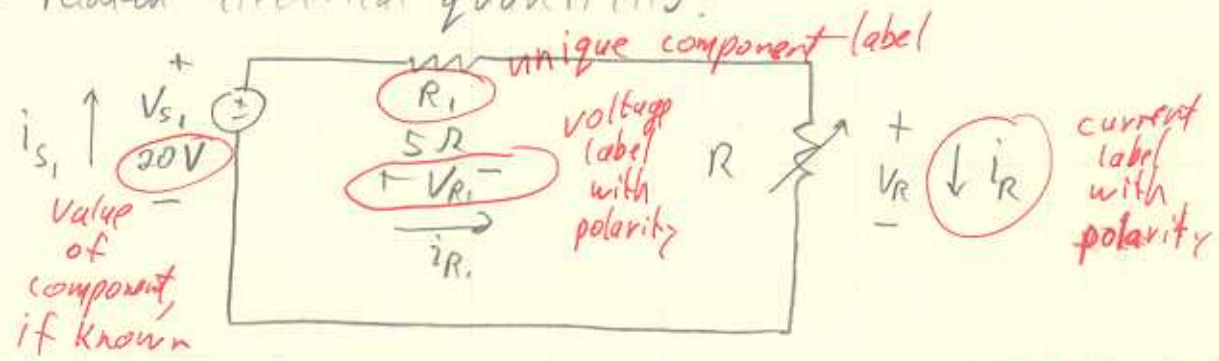
For the circuit shown in Figure P2.15, determine the power absorbed by the variable resistor R, ranging from 0 Ω to 20 Ω. Plot the power absorption as a function of R.

Restated problem



Solution

Redraw the schematic with labels for all components and related electrical quantities:



The power dissipated by R is given by

Explanation of the following mathematics (in English!)

$$P_R = V_R i_R$$

$$= V_R \left(\frac{V_R}{R} \right) \quad \text{if } R \neq 0$$

$$= \frac{V_R^2}{R}$$

By the voltage divider rule

$$V_R = \frac{R}{R_1 + R} V_{S_1}$$

So

$$P_R = \left(\frac{R}{R_1 + R} V_{S_1} \right)^2 \frac{1}{R}$$

$$= \frac{V_{S_1}^2}{R \left(1 + \frac{R_1}{R} \right)^2}$$

Algebraic solution. Defer getting arithmetic results (numerical answers) until after this step.

If $R = 0$; $i_R = i_{R_1} = \frac{V_{S1}}{R_1}$

$= \frac{20\,V}{5\,\Omega}$

$= 4\,A$.

Special case excluded earlier

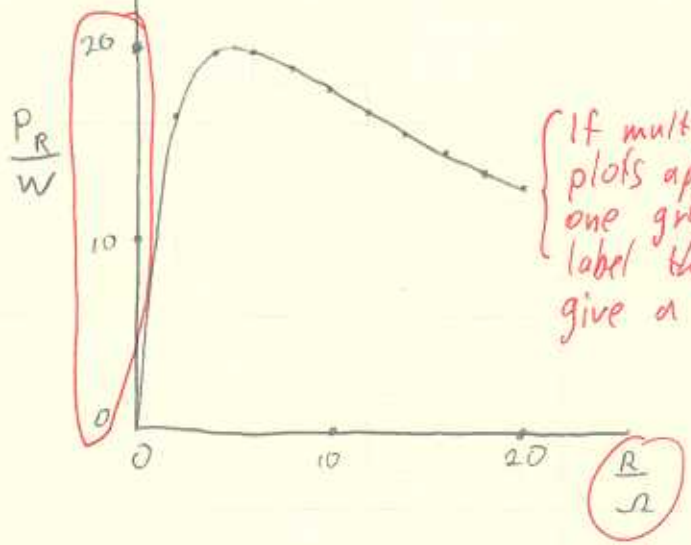
So $P_R = i_R R = (4A)(0\,\Omega) = 0\,W$

Label with units

R/Ω	P_R/W
0	0
2	16.3
4	19.8
6	19.8
8	18.9
10	17.8
12	16.6
14	15.5
16	14.5
18	13.6
20	12.8

Table of sample values

Axis Scale



If multiple plots appear in one graph, label them or give a legend.

Axis label with units