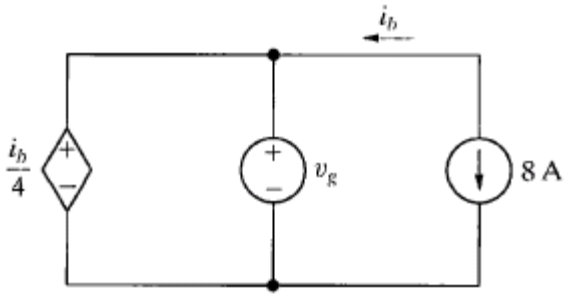
Mathcad Solutions to Assesment Problems from Nilsson and Riedel
Electric Circuits 9th edition, © 2012 R. Doering.
Chapter 2

AP 2.1 For the circuit shown,

a) What value of v_g is required in order for the interconnection to be valid?

b) For this value of v_g, find the power associated with the 8 A source.



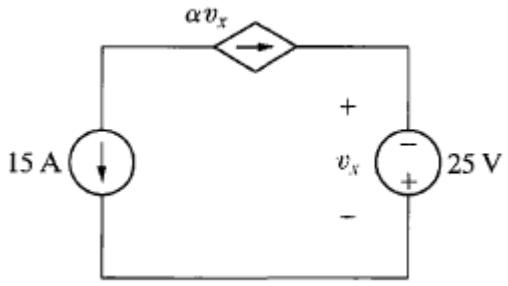
a) $i_b := -8\,A \qquad v_g := \frac{i_b}{4S} = -2\,V$

b) $P := -i_b \cdot v_g = -16\,W$ power is delivered by the current source

AP 2.2 For the circuit shown,

a) What value of α is required in order for the interconnection to be valid?

b) For the value of a calculated in part (a), find the power associated with the 25 V source.



a) $v_x := -25V$

$$\alpha \cdot v_x = -15A \text{ solve}, \alpha \rightarrow \frac{3 \cdot A}{5 \cdot V} = 0.6\,S$$

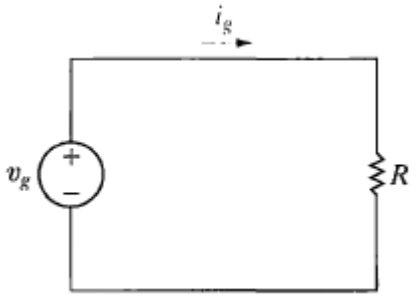
b) $P := -v_x \cdot 15A = 375\,W$ absorbed.

AP 2.3 For the circuit shown,

a) If v_g = 1 kV and i_g = 5 mA, find the value of R and the power absorbed by the resistor.

b) If i_g = 75 mA and the power delivered by the voltage source is 3 W, find v_g, R, and the power absorbed by the resistor.

c) If R = 300 Ω and the power absorbed by R is 480 mW, find i_g and v_g.



a) $v_g := 1\,\text{kV}$ $i_g := 5\,\text{mA}$ $R := \frac{v_g}{i_g} = 200\,\text{k}\Omega$ $P := v_g \cdot i_g = 5\,\text{W}$

b) $i_g := 75\,\text{mA}$ $P := 3\,\text{W}$ $v_g := \frac{P}{i_g} = 40\,\text{V}$ $R := \frac{v_g}{i_g} = 533.333\,\Omega$ $P = 3\,\text{W}$

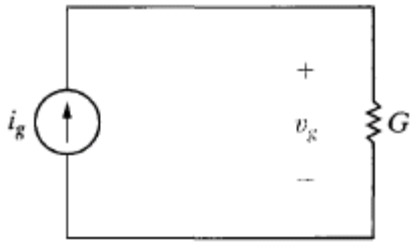
c) $R := 300\Omega$ $P := 480\,\text{mW}$ $i_g := \sqrt{\frac{P}{R}} = 40\,\text{mA}$ $v_g := \frac{P}{i_g} = 12\,\text{V}$

AP 2.4 For the circuit shown,

a) If i_g = 0.5 A and G = 50 mS, find v_g and the power delivered by the current source.

b) If v_g = 15 V and the power delivered to the conductor is 9 W, find the conductance G and the source current i_g.

c) If G = 200 μS and the power delivered to the conductance is 8 W, find i_g and v_g.



$mS \equiv 10^{-3} S$

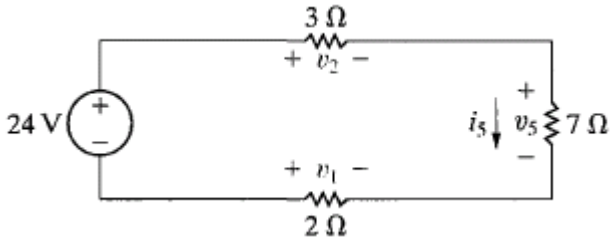
$\mu S \equiv 10^{-6} S$

a) $i_g := 0.5A \quad G := 50mS \quad v_g := \frac{i_g}{G} = 10\,V \quad P := i_g \cdot v_g = 5\,W$

b) $v_g := 15V \quad P := 9W \quad G := \frac{P}{v_g^{\,2}} = 40\,mS \quad i_g := \frac{P}{v_g} = 0.6\,A$

c) $G := 200\mu S \quad P := 8W \quad i_g := \sqrt{P \cdot G} = 40\,mA \quad v_g := \frac{P}{i_g} = 200\,V$

AP 2.5 For the circuit shown, calculate (a) i_5; (b) v_1; (c) v_2; (d) v_5; and (e) the power delivered by the 24 V source.



a) $i_5 := \frac{24\text{V}}{(3+7+2)\Omega} = 2\,\text{A}$

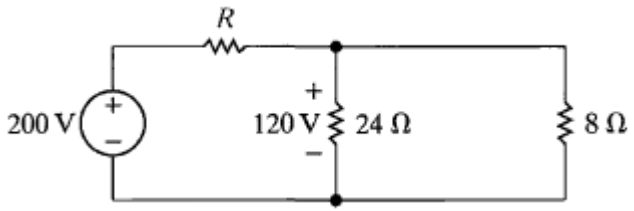
b) $v_1 := -i_5 \cdot 2\Omega = -4\,\text{V}$

c) $v_2 := i_5 \cdot 3\Omega = 6\,\text{V}$

d) $v_5 := i_5 \cdot 7\Omega = 14\,\text{V}$

e) $P := 24\text{V} \cdot i_5 = 48\,\text{W}$

AP 2.6 Use Ohm's law and Kirchhoff s laws to find the value of R in the circuit shown.



$$v_R := 200\text{V} - 120\text{V} = 80\,\text{V}$$

$$i := \frac{120\text{V}}{24\Omega} + \frac{120\text{V}}{8\Omega} = 20\,\text{A}$$

$$R := \frac{v_R}{i} = 4\,\Omega$$

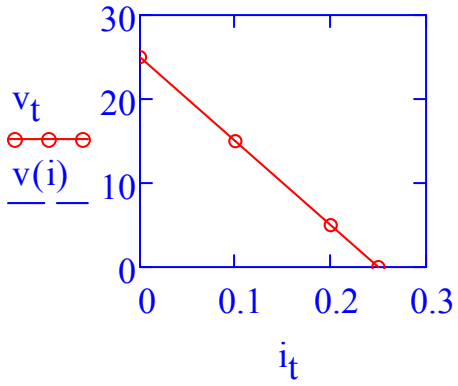
AP 2.7 a) The terminal voltage and terminal current were measured on the device shown. The values of v_t and i_t, are provided in the table. Using these values, create the straight line plot of v_t versus i_t. Compute the equation of the line and use the equation to construct a circuit model for the device using an ideal voltage source and a resistor.

b) Use the model constructed in (a) to predict the power that the device will deliver to a 25 Ω resistor.

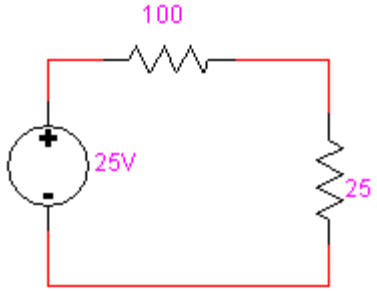
$$v_t := \begin{pmatrix} 25 \\ 15 \\ 5 \\ 0 \end{pmatrix} \Big| V \qquad i_t := \begin{pmatrix} 0 \\ .1 \\ .2 \\ .25 \end{pmatrix} \Big| A$$

$$v(i_t) := \frac{-25V}{.25A} \cdot i_t + 25V$$

$$\overrightarrow{v(i_t)} = \begin{pmatrix} 25 \\ 15 \\ 5 \\ 0 \end{pmatrix} \Big| V$$



a) $V_{th} := 25V \qquad I_{sc} := 0.25A \qquad R := \frac{V_{th}}{I_{sc}} = 100\,\Omega$



b) $R_L := 25\Omega \qquad V_L := \frac{25}{100 + 25} \cdot V_{th} = 5\,V \qquad P := \frac{V_L^{\,2}}{R_L} = 1\,W$

AP 2.8 Repeat Assessment Problem 2.7 but use the equation of the graphed line to construct a circuit model containing an ideal current source and a resistor.