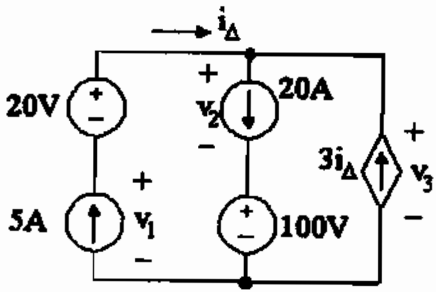
P 2.7 [a] Yes, each of the voltage sources can carry the current required by the interconnection, and each of the current sources can carry the voltage drop required by the interconnection. (Note that $i_\Delta = 5$ A.)

[b] No, because the voltage drop between the top terminal and the bottom terminal cannot be determined. For example, define v_1, v_2, and v_3 as shown:

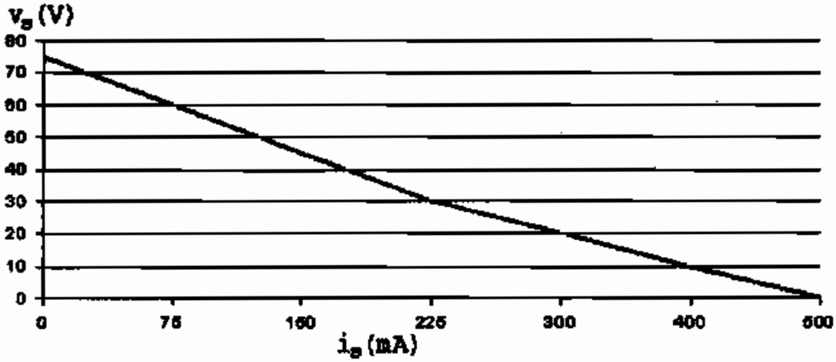


The voltage drop across the left branch, the center branch, and the right branch must be the same, since these branches are connected at the same two terminals. This requires that

$$20 + v_1 = v_2 + 100 = v_3$$

But this equation has three unknown voltages, so the individual voltages cannot be determined, and thus the power of the sources cannot be determined.

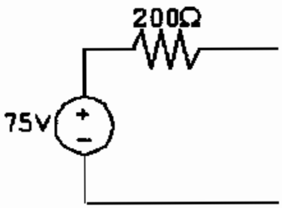
17 [a] Begin



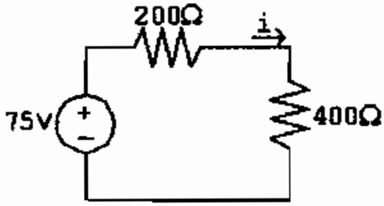
[b] Since the plot is linear for $0 \le i_s \le 225$ mA amd since $R = \Delta v/\Delta i$, we can calculate R from the plotted values as follows:

$$R = \frac{\Delta v}{\Delta i} = \frac{75 - 30}{0.225 - 0} = \frac{45}{0.225} = 200\,\Omega$$

We can determine the value of the ideal voltage source by considering the value of v_s when $i_s = 0$. When there is no current, there is no voltage drop across the resistor, so all of the voltage drop at the output is due to the voltage source. Thus the value of the voltage source must be 75 V. The model, valid for $0 \le i_s \le 225$ mA, is shown below:



[c] The circuit is shown below:

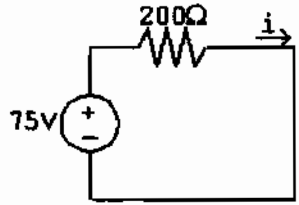


Write a KVL equation in the clockwise direction, starting below the voltage source. Use Ohm's law to express the voltage drop across the resistors in terms of the current i:

$$-75\,\text{V} + 200i + 400i = 0 \qquad \text{so} \qquad 600i = 75\,\text{V}$$

Thus, $\quad i = \dfrac{75\,\text{V}}{600\,\Omega} = 125\,\text{mA}$

[d] The circuit is shown below:



Write a KVL equation in the clockwise direction, starting below the voltage source. Use Ohm's law to express the voltage drop across the resistors in terms of the current i:

$-75\,\text{V} + 200i = 0 \qquad \text{so} \qquad 200i = 75\,\text{V}$

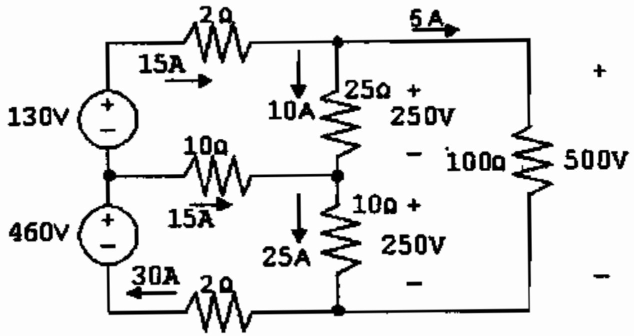
Thus, $\quad i = \dfrac{75\,\text{V}}{200\,\Omega} = 375\,\text{mA}$

[e] The short circuit current can be found in the table of values (or from the plot) as the value of the current i_s when the voltage $v_s = 0$. Thus,

$i_{sc} = 500\,\text{mA} \qquad$ (from table)

[f] The plot of voltage versus current constructed in part (a) is not linear (it is piecewise linear, but not linear for all values of i_s). Since the proposed circuit model is a linear model, it cannot be used to predict the nonlinear behavior exhibited by the plotted data.

P 2.26 [a] Start by calculating the voltage drops due to the currents i_1 and i_2. Then use KVL to calculate the voltage drop across and 100 Ω resistor, and Ohm's law to find the current in the 100 Ω resistor. Finally, KCL at each of the middle three nodes yields the currents in the two sources and the current in the middle 10 Ω resistor. These calculations are summarized in the figure below:



$$p_{130} = -(130)(15) = -1950 \text{ W}$$

$$p_{460} = -(460)(30) = -13{,}800 \text{ W}$$

[b]

$$\sum P_{\text{dis}} = (15)^2(2) + (15)^2(10) + (30)^2(2) + (10)^2(25) + (25)^2(10) + (5)^2(100)$$

$$= 450 + 2250 + 1800 + 2500 + 6250 + 2500 = 15{,}750 \text{ W}$$

$$\sum P_{\text{sup}} = 1950 + 13{,}800 = 15{,}750 \text{ W}$$

Therefore, $\sum P_{\text{dis}} = \sum P_{\text{sup}} = 15{,}750$ W

P 2.30 $50i_2 + \frac{0.250}{50} + \frac{0.250}{12.5} = 0; \quad i_2 = -0.5 \text{ mA}$

$$v_1 = 100i_2 = -50 \text{ mV}$$

$$20i_1 + \frac{(-0.050)}{25} + (-0.0005) = 0; \quad i_1 = 125\,\mu\text{A}$$

$$v_g = 10i_1 + 40i_1 = 50i_1$$

Therefore, $v_g = 6.25$ mV.