EEng 281 Homework #1 Solutions
Fall 2013

P 1.14 Assume we are standing at box A looking toward box B. Then, using the passive sign convention $p = -vi$, since the current i is flowing into the $-$ terminal of the voltage v. Now we just substitute the values for v and i into the equation for power. Remember that if the power is positive, B is absorbing power, so the power must be flowing from A to B. If the power is negative, B is generating power so the power must be flowing from B to A.

[a] $p = -(125)(10) = -1250$ W 1250 W from B to A

[b] $p = -(-240)(5) = 1200$ W 1200 W from A to B

[c] $p = -(480)(-12) = 5760$ W 5760 W from A to B

[d] $p = -(-660)(-25) = -16{,}500$ W 16,500 W from B to A

P 1.26 We use the passive sign convention to determine whether the power equation is $p = vi$ or $p = -vi$ and substitute into the power equation the values for v and i, as shown below:

$$p_{\rm a} = v_{\rm a}i_{\rm a} = (150 \times 10^3)(0.6 \times 10^{-3}) = 90 \text{ W}$$
$$p_{\rm b} = v_{\rm b}i_{\rm b} = (150 \times 10^3)(-1.4 \times 10^{-3}) = -210 \text{ W}$$
$$p_{\rm c} = -v_{\rm c}i_{\rm c} = -(100 \times 10^3)(-0.8 \times 10^{-3}) = 80 \text{ W}$$
$$p_{\rm d} = v_{\rm d}i_{\rm d} = (250 \times 10^3)(-0.8 \times 10^{-3}) = -200 \text{ W}$$
$$p_{\rm e} = -v_{\rm e}i_{\rm e} = -(300 \times 10^3)(-2 \times 10^{-3}) = 600 \text{ W}$$
$$p_{\rm f} = v_{\rm f}i_{\rm f} = (-300 \times 10^3)(1.2 \times 10^{-3}) = -360 \text{ W}$$

Remember that if the power is positive, the circuit element is absorbing power, whereas is the power is negative, the circuit element is developing power. We can add the positive powers together and the negative powers together — if the power balances, these power sums should be equal:

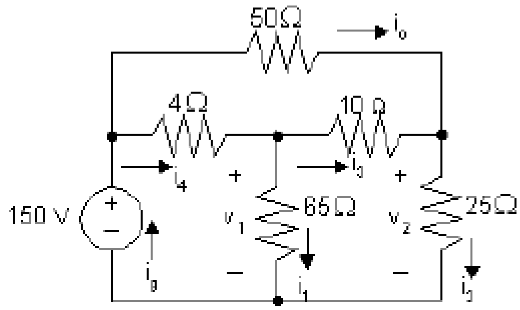
$\sum P_{\rm dev} = 210 + 200 + 360 = 770$ W;

$\sum P_{\rm abs} = 90 + 80 + 600 = 770$ W

Thus, the power balances and the total power developed in the circuit is 770 W.

P 2.7 The interconnection is invalid. In the middle branch, the value of the current i_Δ must be -25 A, since the 25 A current source supplies current in this branch in the direction opposite the direction of the current i_Δ. Therefore, the voltage supplied by the dependent voltage source in the left hand branch is $6(-25) = -150$ V. This gives a voltage drop from the top terminal to the bottom terminal in the left hand branch of $50 - (-150) = 200$ V. But the voltage drop between these same terminals in the right hand branch is 250 V, due to the voltage source in that branch. Therefore, the interconnection is invalid.

P 2.21 [a]



$$v_2 = 150 - 50(1) = 100\text{V}$$

$$i_2 = \frac{v_2}{25} = 4\text{A}$$

$$i_3 + 1 = i_2, \qquad i_3 = 4 - 1 = 3\text{A}$$

$$v_1 = 10i_3 + 25i_2 = 10(3) + 25(4) = 130\text{V}$$

$$i_1 = \frac{v_1}{65} = \frac{130}{65} = 2\text{A}$$

Note also that

$$i_4 = i_1 + i_3 = 2 + 3 = 5\,\text{A}$$

$$i_g = i_4 + i_o = 5 + 1 = 6\,\text{A}$$

[b]

$$p_{4\Omega} = 5^2(4) = 100 \text{ W}$$

$$p_{50\Omega} = 1^2(50) = 50 \text{ W}$$

$$p_{65\Omega} = 2^2(65) = 260 \text{ W}$$

$$p_{10\Omega} = 3^2(10) = 90 \text{ W}$$

$$p_{25\Omega} = 4^2(25) = 400 \text{ W}$$

[c] $\sum P_{\text{dis}} = 100 + 50 + 260 + 90 + 400 = 900\,\text{W}$

$$P_{\text{dev}} = 150i_g = 150(6) = 900\,\text{W}$$