P 3.26 $i_{300\Omega} = \frac{1000 + 200}{1000 + 200 + 300 + 300}(15 \times 10^{-3}) = 10 \text{ mA}$

$v_{300\Omega} = (300)(10 \times 10^{-3}) = 3 \text{ V}$

$i_{200\Omega} = i_{1\ \text{k}\Omega} = 15 \times 10^{-3} - i_{300\Omega} = 5 \text{ mA}$

$v_{1\text{k}} = (1000)(5 \times 10^{-3}) = 5 \text{ V}$

$v_o = 3 - 5 = -2 \text{ V}$

P 3.24 **[a]** $v_{20\text{k}} = \dfrac{20}{20+5}(45) = 36\text{ V}$

$$v_{90\text{k}} = \frac{90}{90+60}(45) = 27\text{ V}$$

$$v_x = v_{20\text{k}} - v_{90\text{k}} = 36 - 27 = 9\text{ V}$$

[b] $v_{20\text{k}} = \dfrac{20}{25}(V_s) = 0.8V_s$

$$v_{90\text{k}} = \frac{90}{150}(V_s) = 0.6V_s$$

$$v_x = 0.8V_s - 0.6V_s = 0.2V_s$$

P 3.56 $18 + 2 = 20\,\Omega$

$$20\|80 = 16\,\Omega$$

$$16 + 4 = 20\,\Omega$$

$$20\|30 = 12\,\Omega$$

$$12 + 8 = 20\,\Omega$$

$$20\|60 = 15\,\Omega$$

$$15 + 5 = 20\,\Omega$$

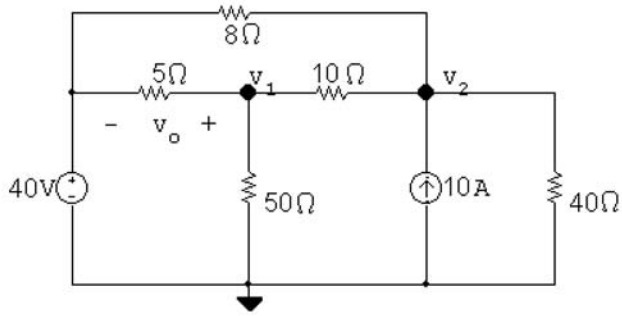
$$i_g = \frac{240\text{ V}}{20\,\Omega} = 12\text{ A}$$

$$i_o = \frac{60}{60 + 20}(12\text{ A}) = 9\text{ A}$$

$$i_{30\Omega} = \frac{20}{20 + 30}(9\text{ A}) = 3.6\text{ A}$$

$$p_{30\Omega} = (30)(3.6)^2 = 388.8\text{ W}$$

P 4.21



The two node voltage equations are:

$$\frac{v_1 - 40}{5} + \frac{v_1}{50} + \frac{v_1 - v_2}{10} = 0$$

$$\frac{v_2 - v_1}{10} - 10 + \frac{v_2}{40} + \frac{v_2 - 40}{8} = 0$$

Place these equations in standard form:

$$v_1\left(\frac{1}{5} + \frac{1}{50} + \frac{1}{10}\right) + v_2\left(-\frac{1}{10}\right) = \frac{40}{5}$$

$$v_1\left(-\frac{1}{10}\right) + v_2\left(\frac{1}{10} + \frac{1}{40} + \frac{1}{8}\right) = 10 + \frac{40}{8}$$

Solving, $v_1 = 50$ V; $\quad v_2 = 80$ V.

Thus, $v_o = v_1 - 40 = 50 - 40 = 10$ V.

POWER CHECK:

$$i_g = (50 - 40)/5 + (80 - 40)/8 = 7 \text{ A}$$

$$p_{40\text{V}} = (40)(7) = 280 \text{ W} \quad \text{(abs)}$$

$$p_{5\Omega} = (50 - 40)^2/5 = 20 \text{ W} \quad \text{(abs)}$$

$$p_{8\Omega} = (80 - 40)^2/8 = 200 \text{ W} \quad \text{(abs)}$$

$$p_{10\Omega} = (80 - 50)^2/10 = 90 \text{ W} \quad \text{(abs)}$$

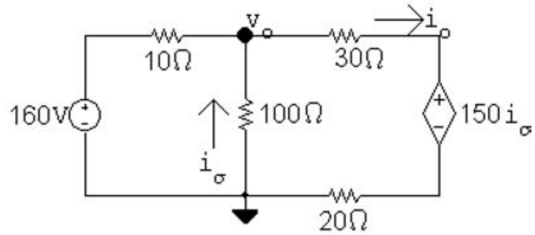
$$p_{50\Omega} = 50^2/50 = 50 \text{ W} \quad \text{(abs)}$$

$$p_{40\Omega} = 80^2/40 = 160 \text{ W} \quad \text{(abs)}$$

$$p_{10\text{A}} = -(80)(10) = -800 \text{ W} \quad \text{(del)}$$

$$\sum p_{\text{abs}} = 280 + 20 + 200 + 90 + 50 + 160 = 800 \text{ W} = \sum p_{\text{del}}$$

P 4.19



The node voltage equation is

$$\frac{v_o - 160}{10} + \frac{v_o}{100} + \frac{v_o - 150 i_\sigma}{30 + 20} = 0$$

The dependent source constraint equation is:

$$i_\sigma = -\frac{v_o}{100}$$

Place these equations in standard form:

$$v_o\left(\frac{1}{10} + \frac{1}{100} + \frac{1}{50}\right) + i_\sigma\left(-\frac{150}{50}\right) = \frac{160}{10}$$

$$v_o\left(\frac{1}{100}\right) + i_\sigma(1) = 0$$

Solving, $v_o = 100$ V; $i_\sigma = -1$ A

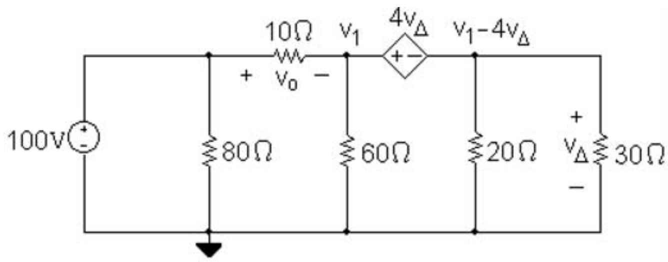
Now find the power:

$$i_o = \frac{160 - 100}{10} - 1 = 5 \text{ A}$$

$p_{\mathrm{ds}} = [150(-1)](5) = -750$ W.

Thus, the dependent source delivers 750 W

P 4.27



The supernode equation is:

$$\frac{v_1 - 100}{10} + \frac{v_1}{60} + \frac{v_1 - 4v_\Delta}{20} + \frac{v_1 - 4v_\Delta}{30} = 0$$

The constraint equation for the dependent source is:

$4v_\Delta = v_1 - v_\Delta$

Place these equations in standard form:

$$v_1\left(\frac{1}{10} + \frac{1}{60} + \frac{1}{20} + \frac{1}{30}\right) \quad + \quad v_\Delta\left(-\frac{4}{20} - \frac{4}{30}\right) \quad = \quad \frac{100}{10}$$

$$v_1(1) \quad + \quad v_\Delta(-5) \quad = \quad 0$$

Solving, $v_1 = 75$ V; $v_\Delta = 15$ V

Thus, $v_o = 100 - v_1 = 25$ V