3.8 a)

$5//20 = \frac{100}{25} = 4\,\Omega$, $5//20 + 9//18 + 10 = 20\,\Omega$

$9//18 = \frac{162}{27} = 6\,\Omega$, $20//30 = \frac{600}{50} = 12\,\Omega$

$R_{ab} = 5 + 12 + 3 = 20\,\Omega$

3.12

$60//30 = 20\,\Omega$

$i_{30\Omega} = \frac{25(75)}{125} = 15A$

$v_o = 15(20) = 300V$

$v_o + 30 i_{30} = 750V$

$v_g - 12(25) = 750$

$\therefore v_g = 1050V$

3.15 a)

$v_{9\Omega} = 1(9) = 9V$, $i_{2\Omega} = \frac{9}{2+1} = 3A$

$i_{4\Omega} = 1 + 3 = 4A$, $v_{25\Omega} = 4(4) + 9 = 25V$

$i_{25\Omega} = \frac{25}{25} = 1A$, $i_{3\Omega} = i_{25\Omega} + i_{9\Omega} + i_{20\Omega} = 1+1+3 = 5A$

$v_{40\Omega} = v_{25\Omega} - v_{3\Omega} = 25 - (-5)(3) = 40V$

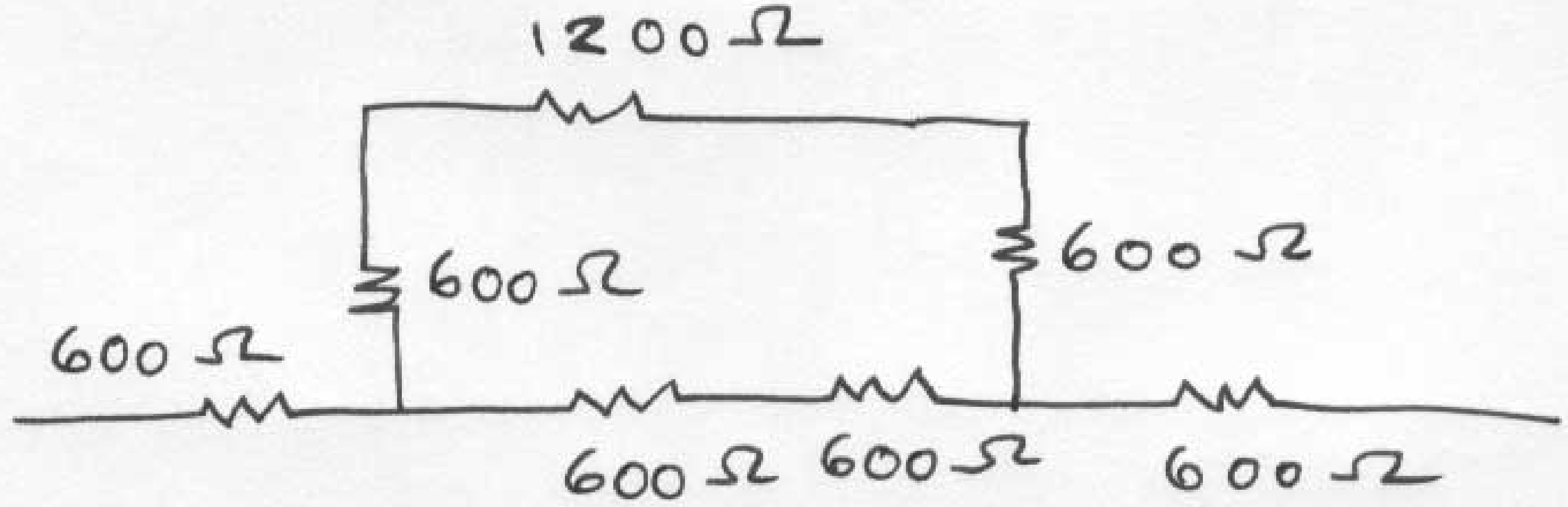
$i_{40\Omega} = \frac{40}{40} = 1A$, $i_{5//20\Omega} = i_{40\Omega} + i_{25\Omega} + i_{4\Omega} = 1+1+4 = 6A$

$v_{5//20\Omega} = 4(6) = 24V$, $v_{32\Omega} = v_{40\Omega} + v_{5//20\Omega} = 40 + 24 = 64V$

$i_{32\Omega} = \frac{64}{32} = 2A$, $i_{10\Omega} = i_{32\Omega} + i_{5//20\Omega} = 2 + 6 = 8A$

$v_g = 10(8) + v_{32\Omega} = 80 + 64 = 144V$

b) $P_{20\Omega} = (24)^2/20 = 28.8W$



Now the 2400 Ω is in parallel with 1200 Ω.
This combination reduces to:

$$1200 // 2400 = \frac{1200(2400)}{1200+2400} = 800\ \Omega$$

$$\therefore \quad R_{ab} = 600 + 800 + 600 = 2000 = 2K\ \Omega.$$

3.46

Note the bridge structure is balanced, because
$15 \times 5 = 25 \times 3$.

$\therefore$ There is no current in the $5k\Omega$ resistor.

This means the equivalent resistance of the circuit is:

$$R_{eq} = 0.375 + \frac{15(25)}{40} + \frac{(3)(5)}{8} = 11,625\ \Omega$$

The source current is $\frac{60}{11,625} = 5.16\,mA$, from left to right through the $375\ \Omega$ resistor.

The current down through the $3k\Omega$ resistor is:

$$i_{3K} = 5.16 \times \frac{5}{8} = 3.23\,mA$$

$$\therefore\ P_{3K} = (3.23 \times 10^{-3})^2 (3000) = 31.2\,mW$$

3.51 The top of the pyramid can be replaced by a resistor equal to:

$$R_1 = \frac{3.6(1.8)}{5.4} = 1.2\,k\Omega$$

The lowest left right deltas can be replaced by wyes. Each resistance in the wye equals $600\ \Omega$. Thus the circuit can be reduced to: