EENG 281 Homework #2 Solutions
Fall 2013

P 3.7 [a] For circuit (a)

$$R_{ab} = 4\|(3+7+2) = 4\|12 = 3\,\Omega$$

For circuit (b)

$$R_{ab} = 6+2+[8\|(7+5\|2.5\|7.5\|5\|(9+6))] = 6+2+8\|(7+1)$$

$$= 6+2+4 = 12\,\Omega$$

For circuit (c)

$$144\|(4+12) = 14.4\,\Omega$$

$$14.4+5.6 = 20\,\Omega$$

$$20\|12 = 7.5\,\Omega$$

$$7.5+2.5 = 10\,\Omega$$

$$10\|15 = 6\,\Omega$$

$$14+6+10 = 30\,\Omega$$

$$R_{ab} = 30\|60 = 20\,\Omega$$

[b] $P_a = \dfrac{15^2}{3} = 75$ W

$P_b = \dfrac{48^2}{12} = 192$ W

$P_c = 5^2(20) = 500$ W

P 3.10 $R_{eq} = 10\|[6 + 5\|(8 + 12)] = 10\|(6 + 5\|20) = 10\|(6 + 4) = 5\,\Omega$

$v_{10A} = v_{10\Omega} = (10\ \text{A})(5\,\Omega) = 50\ \text{V}$

Using voltage division:

$$v_{5\Omega} = \frac{5\|(8+12)}{6+5\|(8+12)}(50) = \frac{4}{6+4}(50) = 20\ \text{V}$$

Thus, $p_{5\Omega} = \dfrac{v_{5\Omega}^2}{5} = \dfrac{20^2}{5} = 80\ \text{W}$

P 3.25 The equivalent resistance of the circuit to the right of the $90\,\Omega$ resistor is

$R_{eq} = [(150\|75) + 40]\|(30 + 60) = 90\|90 = 45\,\Omega$

Use voltage division to find the voltage drop between the top and bottom nodes:

$$v_{\text{Req}} = \frac{45}{45+90}(3) = 1\ \text{V}$$

Use voltage division again to find v_1 from v_{Req}:

$$v_1 = \frac{150\|75}{150\|75+40}(1) = \frac{50}{90}(1) = \frac{5}{9}\ \text{V}$$

Use voltage division one more time to find v_2 from v_{Req}:

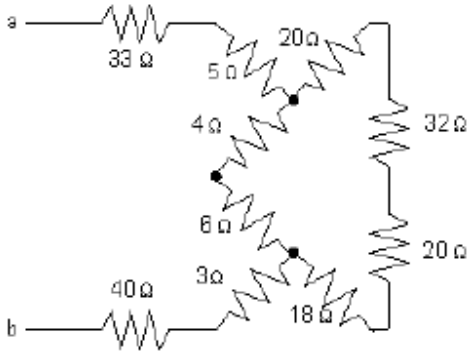
$$v_2 = \frac{30}{30+60}(1) = \frac{1}{3}\ \text{V}$$

P 3.58 Replace the upper and lower deltas with the equivalent wyes:

$$R_{1U} = \frac{(10)(50)}{100} = 5\,\Omega; R_{2U} = \frac{(50)(40)}{100} = 20\,\Omega; R_{3U} = \frac{(10)(40)}{100} = 4\,\Omega$$

$$R_{1L} = \frac{(10)(60)}{100} = 6\,\Omega; R_{2L} = \frac{(60)(30)}{100} = 18\,\Omega; R_{3L} = \frac{(10)(30)}{100} = 3\,\Omega$$

The resulting circuit is shown below:



Now make series and parallel combinations of the resistors:

$$(4+6)\|(20+32+20+18) = 10\|90 = 9\,\Omega$$

$$R_{ab} = 33+5+9+3+40 = 90\,\Omega$$