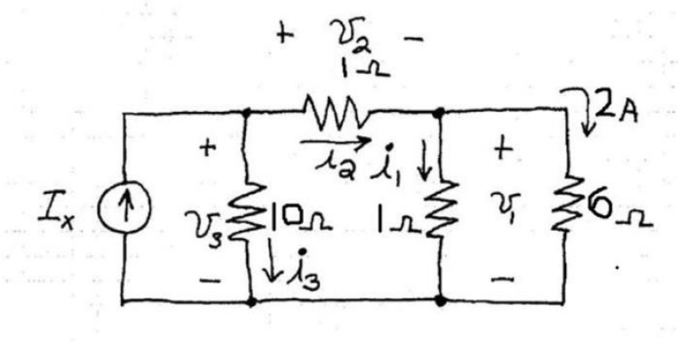
P1.42* Summing voltages for the lower left-hand loop, we have $-5+v_a+10=0$, which yields $v_a=-5$ V. Then for the top-most loop, we have $v_c-15-v_a=0$, which yields $v_c=10$ V. Finally, writing KCL around the outside loop, we have $-5+v_c+v_b=0$, which yields $v_b=-5$ V.

P1.69



Ohm's law for the 6-Ω resistor yields: $v_1=12$ V Then, we have $i_1=v_1/1=12$ A. Next, KCL yields $i_2=i_1+2=14$ A. Then for the top 2-Ω resistor, we have $v_2=14\times1=14$ V. Using KVL, we have $v_3=v_2+v_1=26$ V. Next, applying Ohms law, we obtain $i_3=v_3/10=2.6$ A. Finally applying KCL, we have $I_x=i_2+i_3=16.6$ A.

P1.78 (a) $4=i_1+i_2$

(b) $i_1=v/15$

$i_2=v/10$

(c) $4=v/15+v/10$

$v=24$ V

(d) $P_{currentsource}=-I_s v=-96$ W (Power is supplied by the source.)

$P_1=v^2/R_1=38.4$ W (Power is absorbed by R_1.)

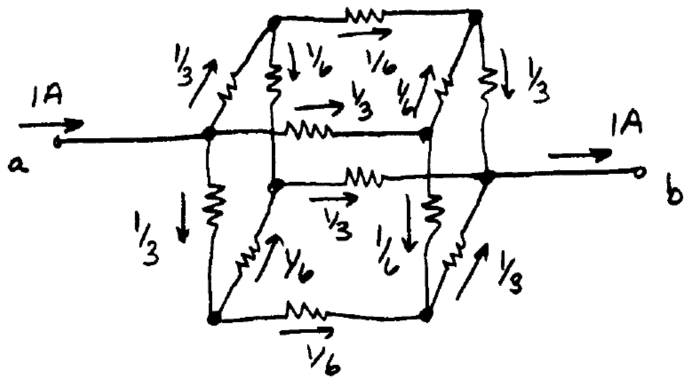
$P_2=v^2/R_2=57.6$ W (Power is absorbed by R_2.)

However i_3 and i_y are the same current: $i_y=i_3$. Simplifying and solving, we find that $i_3=i_y=2.31$ A.

P2.4* The 12-Ω and 6-Ω resistances are in parallel having an equivalent resistance of 4 Ω. Similarly, the 18-Ω and 9-Ω resistances are in parallel and have an equivalent resistance of 6 Ω. Finally, the two parallel combinations are in series, and we have

$$R_{ab} = 4 + 6 = 10\ \Omega$$

P2.17 By symmetry, we find the currents in the resistors as shown below:

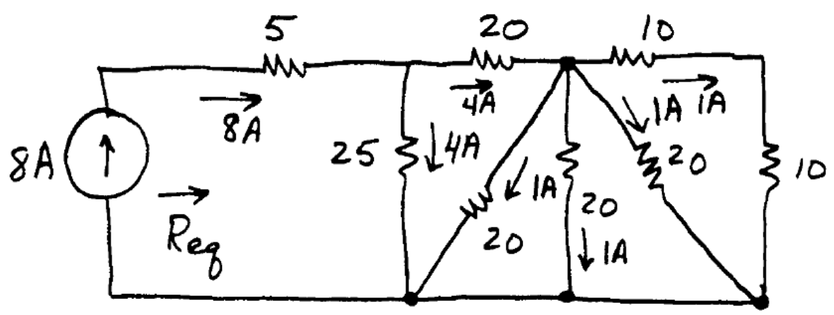


Then, the voltage between terminals a and b is

$$v_{ab} = R_{eq} = 1/3 + 1/6 + 1/3 = 5/6$$

P2.25* Combining resistors in series and parallel, we find that the equivalent resistance seen by the current source is $R_{eq} = 17.5\ \Omega$.

Thus, $v = 8 \times 17.5 = 140$ V. Also, $i = 1$ A.



P2.34 $i = \dfrac{P}{v} = \dfrac{4.5\text{ W}}{15\text{ V}} = 0.3A \qquad R_{eq} = R + \dfrac{1}{1/R + 1/R} + R = 2.5R$

$i = 0.3 = \dfrac{15}{R_{eq}} = \dfrac{15}{2.5R} \qquad$ R= 20 Ω

P2.51 Writing KCL equations at nodes 1, 2, and 3, we have

$$\frac{v_1}{R_4} + \frac{v_1 - v_2}{R_2} + \frac{v_1 - v_3}{R_1} = 0$$

$$\frac{v_2 - v_1}{R_2} + \frac{v_2 - v_3}{R_3} = I_s$$

$$\frac{v_3}{R_5} + \frac{v_3 - v_2}{R_3} + \frac{v_3 - v_1}{R_1} = 0$$

In standard form, we have:

$$0.6167v_1 - 0.20v_2 - 0.25v_3 = 0$$

$$-0.20v_1 + 0.325v_2 - 0.125v_3 = 4$$

$$-0.25v_1 - 0.125v_2 + 0.50v_3 = 0$$

Using Matlab, we have

```
G = [0.6167 -0.20 -0.25; -0.20 0.325 -0.125; -0.25 -0.125 0.500];
I = [0; 4; 0];
V = G\I

V =
  13.9016
  26.0398
  13.4608
```

P2.53* Writing a KVL equation, we have $v_1 - v_2 = 10$.

At the reference node, we write a KCL equation: $\frac{v_1}{5} + \frac{v_2}{10} = 1$.

Solving, we find $v_1 = 6.667$ and $v_2 = -3.333$.

Then, writing KCL at node 1, we have $i_s = \frac{v_2 - v_1}{5} - \frac{v_1}{5} = -3.333$ A.

P2.58*

$$v_x = v_2 - v_1$$

Writing KCL at nodes 1 and 2:

$$\frac{v_1}{5} + \frac{v_1 - 2v_x}{15} + \frac{v_1 - v_2}{10} = 1$$

$$\frac{v_2}{5} + \frac{v_2 - 2v_x}{10} + \frac{v_2 - v_1}{10} = 2$$

Substituting and simplifying, we have

$15v_1 - 7v_2 = 30$ and $v_1 + 2v_2 = 20$.

Solving, we find $v_1 = 5.405$ and $v_2 = 7.297$.