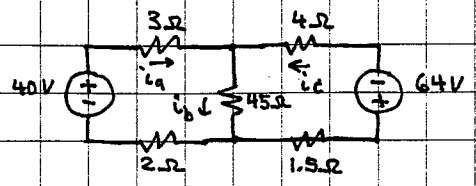
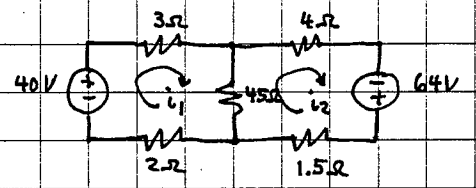
ex:



a) Use mesh-current method to find branch currents i_a, i_b, i_c.

We define the mesh currents around the loops:



Now we write eq'ns for V-drops around loops:

Loop 1: $40V - i_1 \cdot 3\Omega - (i_1 - i_2)\,45\Omega - i_1 \cdot 2\Omega = 0V$

Loop 2: $64V - i_2 \cdot 1.5\Omega - (i_2 - i_1)\,45\Omega - i_2 \cdot 4\Omega = 0V$

or Loop 1: $40V = i_1 \cdot (\underbrace{3\Omega + 45\Omega + 2\Omega}_{50\Omega}) - i_2 \cdot 45\Omega$

Loop 2: $64V = -i_1\,45\Omega + i_2\,(\underbrace{1.5\Omega + 45\Omega + 4\Omega}_{50.5\Omega})$

or $40V = i_1 \cdot 50\Omega - i_2 \cdot 45\Omega$

$64V = -i_1 \cdot 45\Omega + i_2 \cdot 50.5\Omega$

or $45 \cdot 40V = i_1 \cdot 50 \cdot 45\Omega - i_2\,45 \cdot 45\Omega$

$50 \cdot 64V = -i_1\,45 \cdot 50\Omega + i_2\,50.5 \cdot 50\Omega$

sum $45 \cdot 40 + 50 \cdot 64\,V = 0 + i_2\,[(50.5)50 - 45(45)]\Omega$

$$i_2 = \frac{1800 + 3200}{2525 - 2025}\,A = \frac{5000}{500}\,A = 10A$$

$$i_1 = (40V + 10A \cdot 45\Omega)\,/\,50\Omega = 490V/50\Omega = 9.8\,A$$

Now we observe that $i_a = i_1 = 9.8A$ $\quad i_c = -i_2 = -10A$

$$i_b = i_a + i_c = 9.8A - 10A = -0.2A$$

b) Repeat part (a) for polarity of 64V source reversed.

Just replace 64V with −64V in loop 2 eq'n:

$$45 \cdot 40 + 50(-64)V = 0 + i_2[\underbrace{(50.5)50 - 45(45)}_{500 \text{ as before}}]\,\Omega$$

$$i_2 = \frac{1800 - 3200}{500} = \frac{-1400}{500} = -2.8\ A$$

$$i_1 = \frac{40V + -2.8A \cdot 45\,\Omega}{50} = -1.72\ A$$

Note: For Node-V method our consistency check is to calculate all currents flowing in circuit and to verify that sum of currents out of nodes = 0.

For Mesh-i method, our consistency check is to calculate all voltage drops in circuit and to verify that sum of voltage drops around loop = 0.