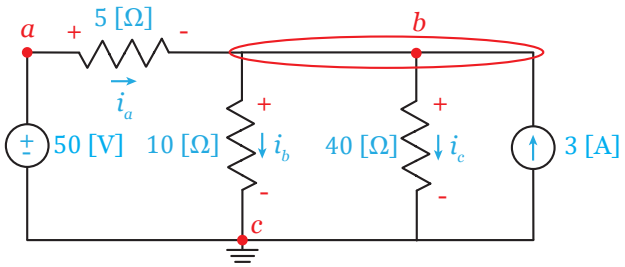
MEMS 0031 - Electrical Circuits
Quiz #4

Name: Solutions

Problem #1

Determine the branch currents i_a, i_b and i_c using NVA.



Step 1:
Identify number of nodes (3, shown in red), number of voltage sources (1) and number of KCL equations (1, which will be applied at node b)

Step 2:
Apply passive sign convention to sinks (shown in red)

Step 3:
Apply KCL equation to most logical node (b, for c is ground, V_c=0, and a is known, V_a=50 [V])

$$i_a + 3 = i_b + i_c$$

Step 4:
Apply Ohm's Law to KCL equation in terms of node voltages

$$\frac{\cancel{V_a}^{50} - V_b}{5\,[\Omega]} + 3\,[\text{A}] = \frac{V_b - \cancel{V_c}^{0}}{10\,[\Omega]} + \frac{V_b - \cancel{V_c}^{0}}{40\,[\Omega]} \implies V_b = 40\,[\text{V}]$$

Therefore,

$$i_a = 2\,[\text{A}]; \qquad i_b = 4\,[\text{A}]; \qquad i_c = 1\,[\text{A}]$$