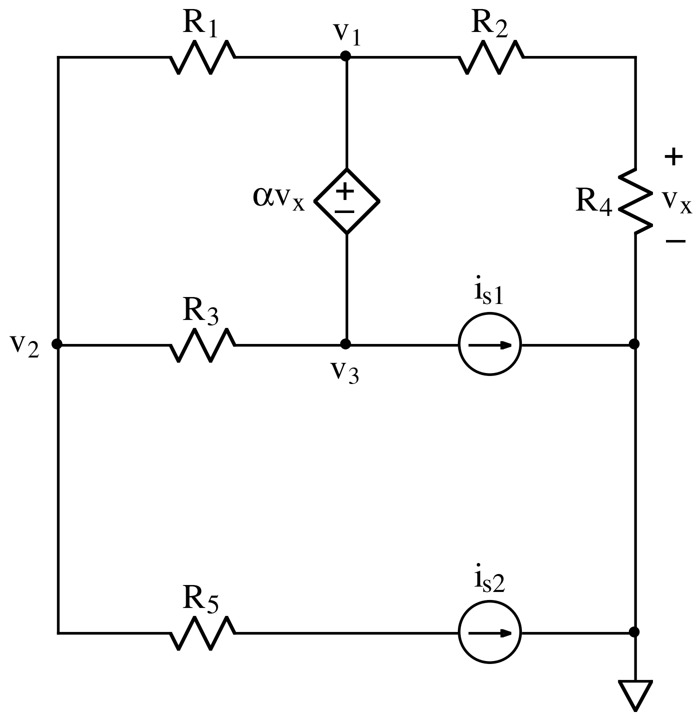
Ex:



$$v_1\left(\frac{1}{R_1}+\frac{1}{R_2+R_4}\right)-v_2\left(\frac{1}{R_3}+\frac{1}{R_1}\right)+v_3\frac{1}{R_3}+i_{s1}=0\text{ A}$$

$$v_1-v_3=\alpha v_1\left(\frac{R_4}{R_2+R_4}\right)$$

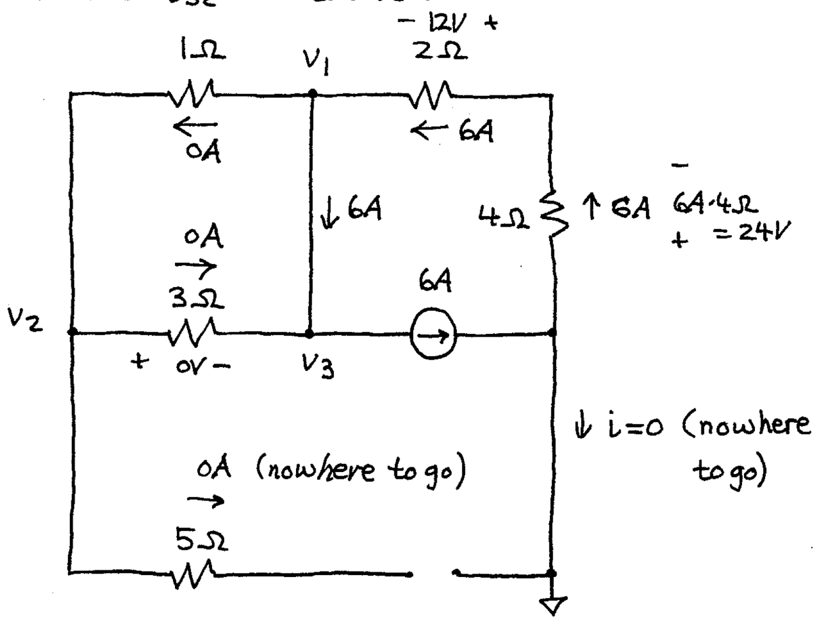
$$-v_1\left(\frac{1}{R_1}\right)+v_2\left(\frac{1}{R_1}+\frac{1}{R_3}\right)-v_3\frac{1}{R_3}+i_{s2}=0\text{ A}$$

Make a consistency check on the above node-voltage equations for the circuit by setting resistors and sources to values for which the values of v_1, v_2, and v_3 are obvious. State the values of resistors, sources, and v_1, v_2, v_3 for your consistency check, and show that the node-voltage equations are satisfied for these values. (In other words, plug the values into the node-voltage equations and show that they yield values of zero Amps.)

sol'n: Many consistency checks are possible.

One possible is to set $i_{S2} = 0A$ and $\alpha = 0$. Let $i_S = 6A$ and set $R_1 = 1\Omega$, $R_2 = 2\Omega$, ..., $R_5 = 5\Omega$.

With $\alpha = 0$, our v-src becomes a wire. With $i_{S2} = 0A$ we have an open circuit where i_{S2} is located.



All the current will flow thru the wire between v_1 and v_3, (path of least resistance).

The 6A flows thru $R_2 + R_4$, giving v-drop of $6A \cdot (2\Omega + 4\Omega) = 36V$ from reference to v_1.

Thus, $v_1 = -36V$. $v_3 = v_1 = -36V$ (wire connects v_1 to v_3)

Also, $v_2 = v_3 = -36V$ (0V across R_3; no current)

Now we plug our component values and v_1, v_2, v_3 values into the node-voltage eq'ns to see if the eq'ns are valid, (i.e. that left side of eq'n = right side of eq'n).

$$-36V\left(\frac{1}{1\Omega}+\frac{1}{2\Omega+4\Omega}\right)-(-36V)\left(\frac{1}{3\Omega}+\frac{1}{1\Omega}\right)+(-36V)\frac{1}{3\Omega}$$

$$+\ 6A$$

$$= -36A - 6A + 12A + 36A - 12A + 6A$$

$$= 0A \quad \text{eq'n satisfied } \checkmark$$

Now we check 2^{nd} eq'n.

$$-36V-(-36V) \stackrel{?}{=} 0\cdot(-36V)\frac{4\Omega}{2\Omega+4\Omega}$$

$$0 = 0 \quad \checkmark$$

Now we check 3^{rd} eq'n.

$$-(-36V)\left(\frac{1}{1\Omega}\right)+(-36V)\left(\frac{1}{1\Omega}+\frac{1}{3\Omega}\right)-(-36V)\frac{1}{3\Omega}+0A$$

$$= 36A - 36A - 12A + 12A$$

$$= 0A \quad \checkmark$$

This check worked. In practice we would perform others.