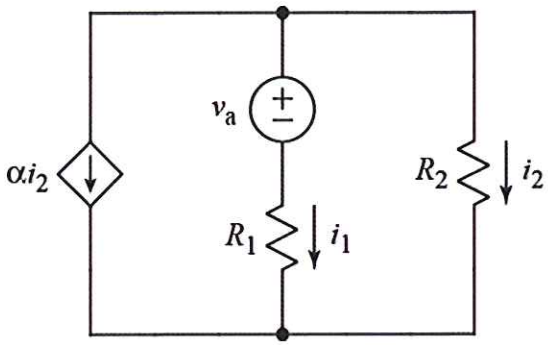
Ex:



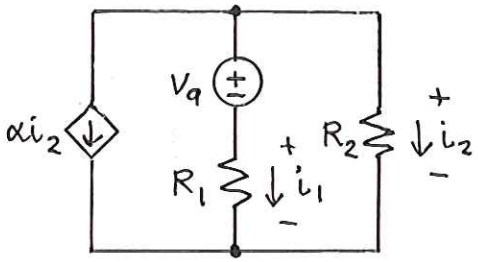

Derive an expression for $i_1$. The expression must not contain more than the circuit parameters $v_a$, $R_1$, $R_2$, and $\alpha$. **Note:** $\alpha > 0$.

sol'n: We use Kirchhoff's laws.

We have no R's in series having the same i, so we move on to a current sum at the top node.

$$\alpha i_2 + i_1 + i_2 = 0\ A$$

We have one v-loop that doesn't pass thru a current source. It is on the right.




The voltage drops are $v_1 = i_1 R_1$ and $v_2 = i_2 R_2$.

$$i_1 R_1 + v_a - i_2 R_2 = 0V$$

The current sum for the top node gives a second equation.

$$\alpha i_2 + i_1 + i_2 = 0\ A$$

We eliminate $i_2$ by using the second eq'n and substituting for $i_2$ in the first eq'n.

$$i_2(1+\alpha) = -i_1$$

or

$$i_2 = \frac{-i_1}{1+\alpha}$$

Substituting into the first eq'n, we have

$$i_1 R_1 + V_a - \frac{-i_1}{1+\alpha} R_2 = 0\ V$$

or

$$i_1 \left( R_1 + \frac{R_2}{1+\alpha} \right) = -V_a$$

or

$$i_1 = \frac{-V_a}{R_1 + \frac{R_2}{1+\alpha}}$$