1. Passive Sign Convention and Power

(a) We have made four copies of a circuit below. Following passive sign convention, there are four different possible labelings of current directions and voltage polarities for the circuit. For each copy, label each circuit’s voltage source and resistor with current direction and voltage polarity labelings, keeping with passive sign convention.
(b) Suppose we consider one of the possible labelings you have found above. Calculate the power dissipated or supplied by every element in the circuit. Let $V_s = 5\, \text{V}$ and let $R_1 = 5\, \Omega$.

\[ V_s = 5\, \text{V} \quad R_1 = 5\, \Omega \]
(c) Suppose we choose a second labeling of the circuit as shown below. Calculate the power dissipated or supplied by every element in the circuit. Let $V_s = 5$ V and let $R_1 = 5\, \Omega$.

\[
\begin{align*}
V_s & \quad + \quad V_1 \\
& \quad + \quad \downarrow \quad i_1 \\
& \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\
& \quad - \quad R_1 \\
& \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\
& \quad + \quad V_{R_1} \\
& \quad + \quad \downarrow \quad i_2
\end{align*}
\]
(d) Did the values of the element voltages and element currents change with the different labeling? Did the power for each circuit element change? Did the node voltages change? If a quantity didn’t change with a difference in labeling, discuss what would have to change for quantity to change.
2. Circuit Analysis

Provided the circuit below...

(a) ...use nodal analysis to solve for all node voltages.
(b) ...find the current $I_{R_3}$ flowing through resistor $R_3$. 
3. (PRACTICE) Current Divider

So far we’ve shown that for the circuit below to the left, the voltage across the resistor $R_2$ is expressed

$$V_{R_2} = \left( \frac{R_2}{R_1 + R_2} \right) V_s.$$ 

Let us derive a similar formula for the right circuit below, relating the current $I_{R_2}$ through $R_2$ to the current through the current source $I_s$. 

![Circuit Diagram](image-url)