Problem 1: Use Mesh Analysis
Given the circuit below, that $I_{S1}$, $I_{S2}$ and R's are known.

1. Which mesh current(s) are known?
2. Which mesh current(s) are unknown?
3. Which mesh current(s) are dependent?
4. Write the equation(s) to solve the circuit by mesh analysis.
5. Box the equation(s) you would use to solve the system and list the unknowns for which you are solving.
   a. Reduce to the form of: $[R_1 + R_2]i_1 + [R_3]i_2 = V_{S1}$ (just an example)
6. Write an equation to solve for the voltage across $R_2$ in terms of mesh currents and resistors. Make sure to indicate polarity.

**Solution**

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\begin{align*}
\text{KVL M1} \\
R_S i_4 + R_2 (i_4 - i_2) &= 0 \\
-R_2 i_2 + (R_2 + R_2)i_4 &= 0 \quad \text{Eqn 2}
\end{align*}
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\begin{align*}
\text{KVL M2} \\
R_4 (i_2 - i_1) + R_2 (i_2 - i_4) + V_{S2} &= 0 \\
-V_{S2} + R_3 i_3 &= 0 \\
\text{KVL M3} \\
R_4 (i_2 - i_1) + R_2 (i_2 - i_4) + R_3 i_3 &= 0 \\
-R_4 i_1 + (R_5 + R_4) i_2 + R_3 i_3 - R_2 i_4 &= 0
\end{align*}
\]

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\begin{align*}
\text{Conserved M2/M3 or Supermesh} \\
R_4 (i_2 - i_1) + R_2 (i_2 - i_4) + R_3 i_3 &= 0 \\
-R_4 i_1 + (R_5 + R_4) i_2 + R_3 i_3 - R_2 i_4 &= 0 \\
R_4 I_{S1} &= (R_2 + R_4) i_2 + R_3 i_3 - R_2 i_4 \quad \text{Eqn 3}
\end{align*}
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