Problem 1:

Given:
- $R_1 = 2 \, \Omega, \, R_2 = 2 \, \Omega, \, R_3 = 2 \, \Omega$
- $R_4 = 1$ to $3 \, \Omega, \, V_a = 10 \, V$

Find:
- The equivalent resistance as seen by the source. No need to calculate numbers.
- An equation for $V_a$
- An equation for $V_b$
- Find the range of voltages across $V_{ab}$ as $R_4$ varies from 1 to 3 $\Omega$

\[ V_a = V_{b2} = \frac{R_5}{R_5 + R_4} \cdot V_5 = V_a \]
\[ V_a = \frac{5}{2} \cdot 10 \]
\[ V_a = \frac{5}{2} \cdot 10 \]

\[ V_b = \frac{R_6}{R_6 + R_4} \cdot V_6 \]
\[ V_b = \frac{R_6}{2 + R_4} \cdot 10 \]
\[ V_b = \frac{R_6}{2 + R_4} \cdot 10 \]

\[ V_a - V_b = \left( \frac{1}{2} - \frac{R_6}{2 + R_4} \right) V_5 \]

Problem 2 is on the back side
**Problem 2: Node Analysis**

1. Identify all of the nodes. Assume the ground node is the reference node and that its voltage is known to be zero. Assume $I_s$ and $R_1$ are given.

2. List the node voltages that are known (if any).

3. List the node voltages that are unknown (if any).

4. Write the equations to solve for all of the unknown node voltages by **node analysis**.

5. Box the equations you would use to solve the system.
   a. Reduce to the form of: $[1/R_1 + 1/R_2]V_1 + [1/R_3]V_2 = V_{s1}/R_4$ (this is not one of the equations – just an example of the level of reduction desired in solution)

6. List the unknown quantities you are solving for.

7. Write an equation to solve for the current through $R_3$ in terms of node voltages.

8. Write an equation to solve for the voltage across $R_3$ in terms of node voltages.