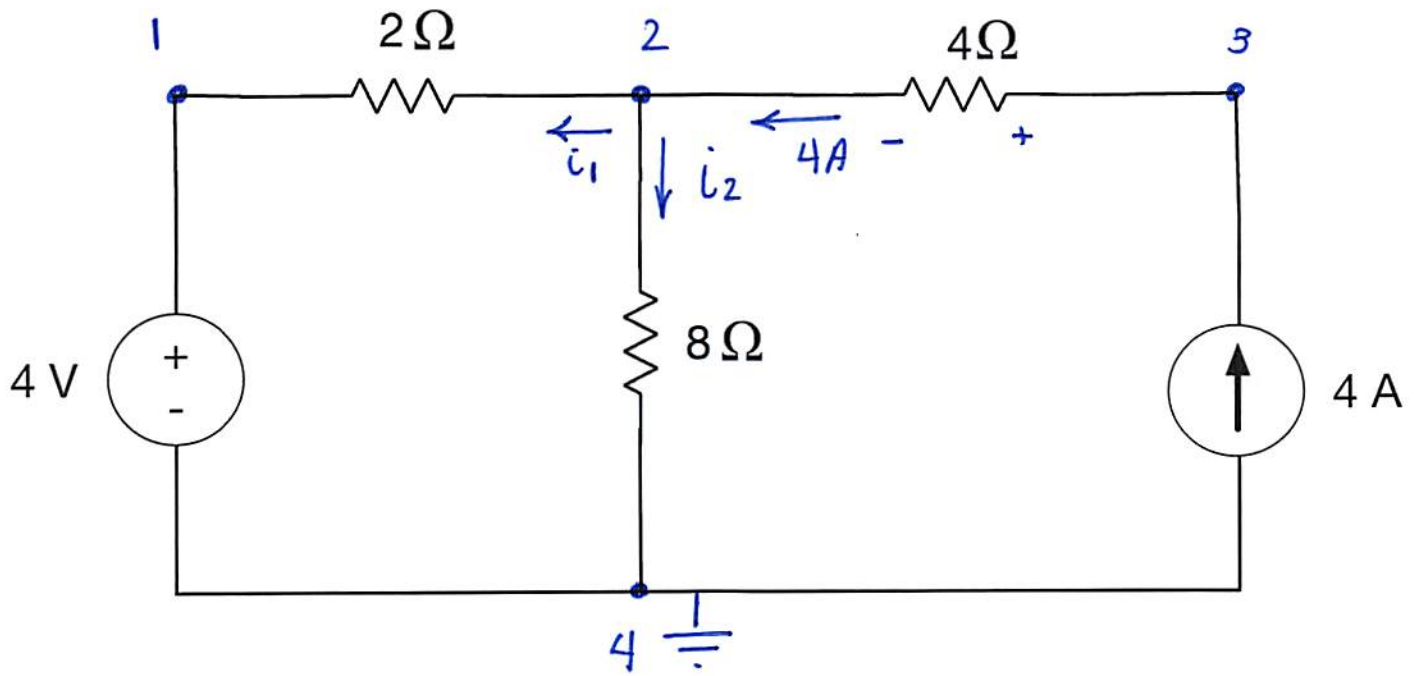
**ECE-210 Circuits I**
**Electrical & Computer Engineering Department**
**Boise State University**

**STUDENT (FIRST & LAST):**

**1** – Find the voltages at all the nodes.




$v_4 = 0V$

kcl @ 2 $\quad i_1 + i_2 = 4$

$v_1 = 4V$

$$\Rightarrow \frac{V_2 - 4}{2} + \frac{V_2}{8} = 4$$

$$\Rightarrow V_2 = 9.6V$$

Alternate approach

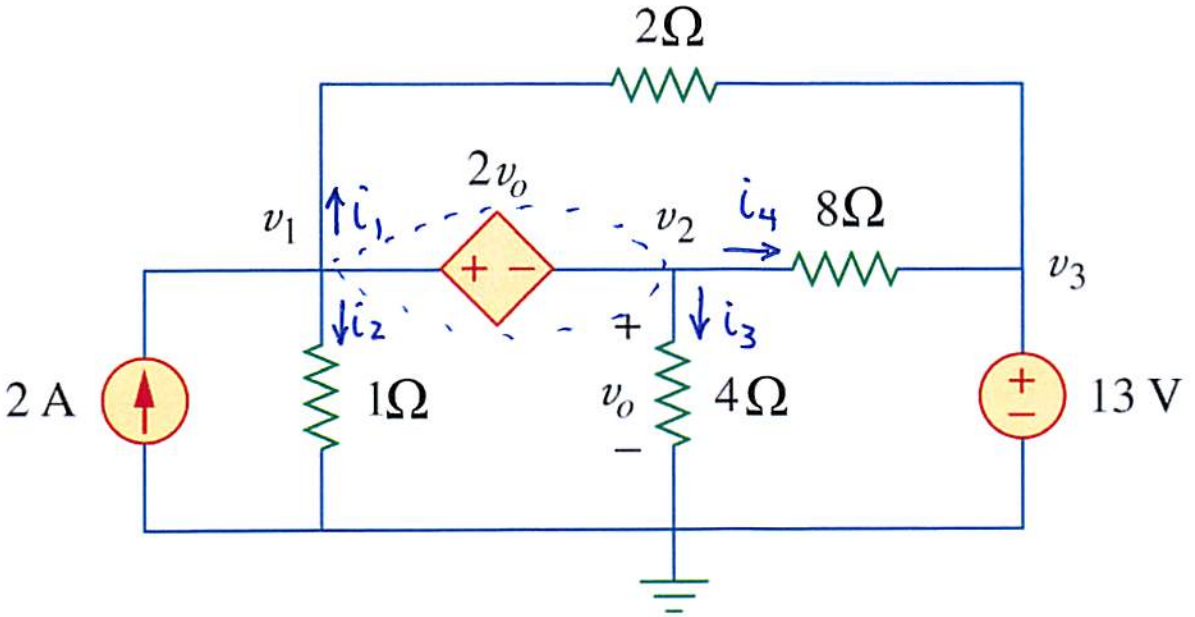
$$\frac{V_3 - V_2}{4} = 4 \Rightarrow$$

$V_3 = 4 \times 4 + V_2 = 25.6V$

$V_3 = V_2 +$ Voltage drop across the 4Ω resistor

$= V_2 + 4 \times 4 = 25.6V$

**2** –Find $v_1$, $v_2$, and $v_3$




KCL @ SN $2 = i_1 + i_2 + i_4 + i_3$

$$\boxed{2 = \frac{V_1 - 13}{2} + \frac{V_1}{1} + \frac{V_2}{4} + \frac{V_2 - 13}{8}} \quad (2)$$

at the super node

$$V_2 + 2V_o = V_1$$

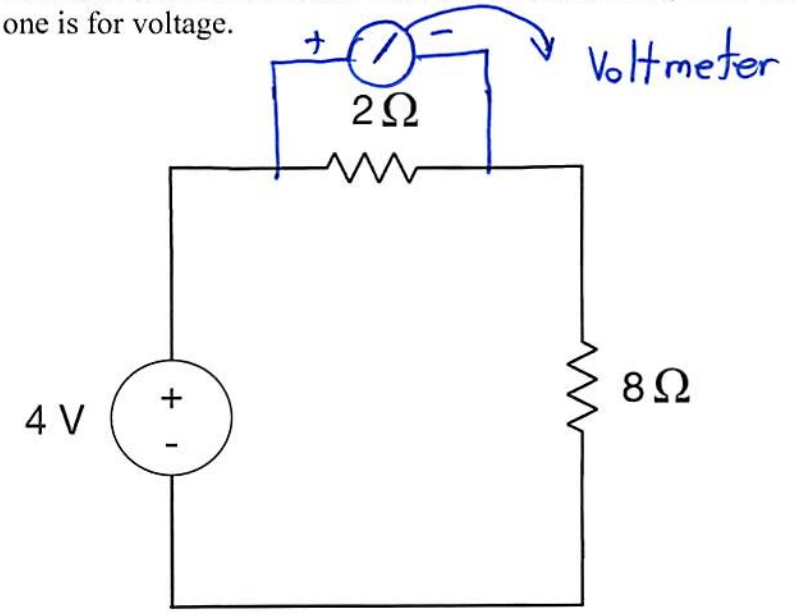
$$V_2 + 2V_2 = V_1$$

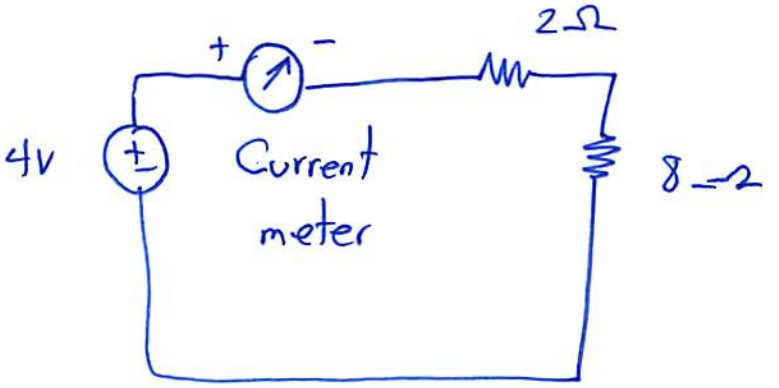
$$\boxed{3V_2 = V_1} \quad (1)$$

(1), (2) Solved gives

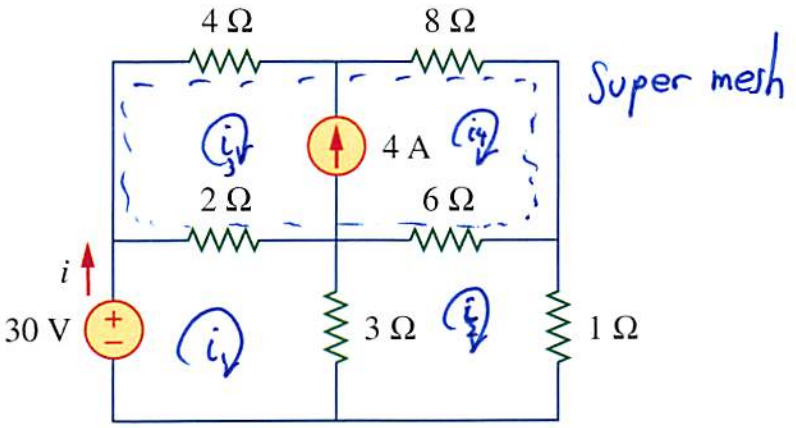
$$V_1 = \frac{243}{39} V \qquad V_2 = \frac{81}{39} V \qquad V_3 = 13V$$

**3 –** How do you connect a voltmeter and current meter to measure the voltage across and the current through the 2 ohm resister, respectively? Make sure you draw a very clear diagram and show were the terminals of the voltmeter and current meter will be connected. Also, label which diagram is for measuring current and which one is for voltage.



**4** – Find current *I* in the circuit




Super mesh

Super mesh : $2(i_3 - i_1) + 4i_3 + 8i_4 + 6(i_4 - i_2) = 0$

mesh 1 : $2(i_1 - i_3) + 3(i_1 - i_2) - 30 = 0$

mesh 2 : $3(i_2 - i_1) + 6(i_2 - i_4) + i_2 = 0$

Super mesh: $6i_3 + 14i_4 - 2i_1 - 6i_2 = 0$

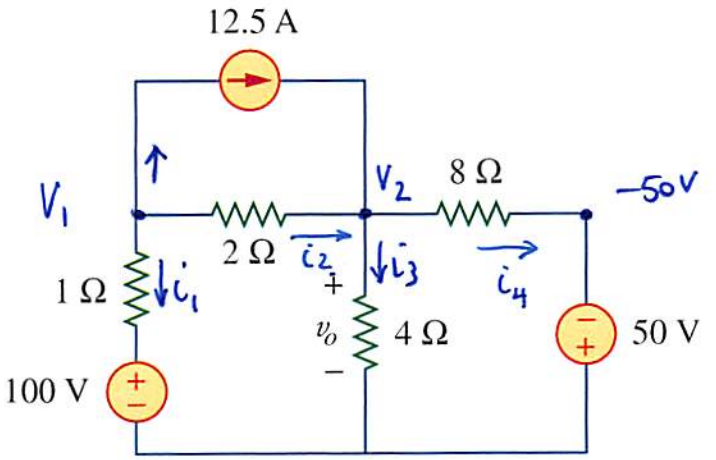
mesh 1 : $5i_1 - 3i_2 - 2i_3 = 30$

mesh 2 : $10i_2 - 3i_1 - 6i_4 = 0$

KCL : $i_4 - i_3 = 4$

Solving for $i_1 = 8.561$ A

5. Use nodal analysis to find $v_0$




Node 1: $i_1 + i_2 + 12.5 = 0$

$$\frac{V_1 - 100}{1} + \frac{V_1 - V_2}{2} + 12.5 = 0 \Rightarrow \boxed{3V_1 - V_2 = 175}$$

Node 2: $i_2 + 12.5 = i_3 + i_4$

$$\frac{V_1 - V_2}{2} + 12.5 = \frac{V_2}{4} + \frac{V_2 + 50}{8}$$

$$\boxed{4V_1 - 7V_2 = -50}$$

$V_1 = 47\,V$

$\boxed{V_2 = 34V = V_o}$