wlg **Version A**

ECE 301
Test #1

(1) You are given the circuit of Figure 1.

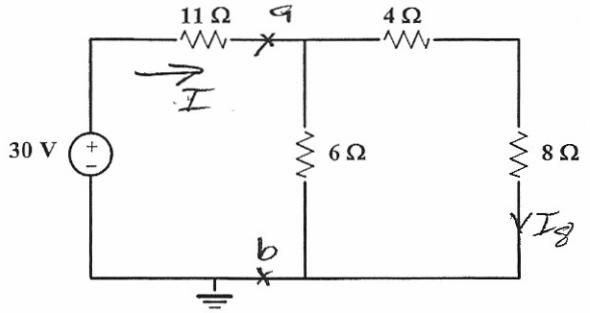


Figure 1: Circuit for problem 1.

(a) Find the power supplied by the 30 V source.
(b) Find the power absorbed by the 8 Ω resistor.

Resistance to the right of a-b is

$$R_{ab} = 6 \| 12 = \frac{6 \times 12}{6+12} = 4\,\Omega$$

$$I = \frac{30}{11+4} = 2A$$

Using current division

$$I_8 = \frac{I \times 6}{6+12} = \frac{2 \times 6}{18} = \frac{2}{3} A$$

$$P_{sup_{30}} = 30 \times 2 = 60\,W$$

$$P_{abs_8} = \left(\frac{2}{3}\right)^2 8 = 3.56\,W$$

(2) You are given the circuit of Figure 2. Solve for R_{eq}, resistance looking into terminals a-b.

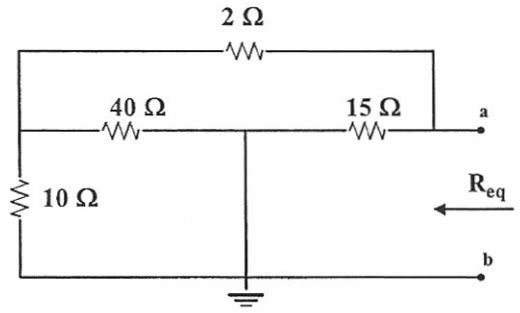
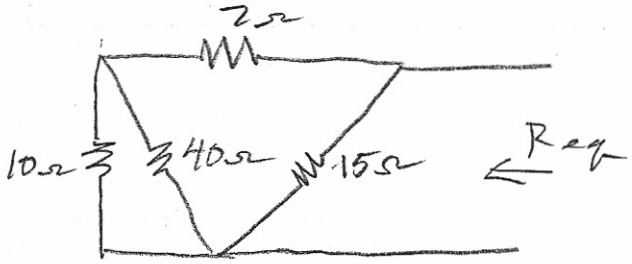


Figure 2: Circuit for problem 2.

Redraw the circuit:



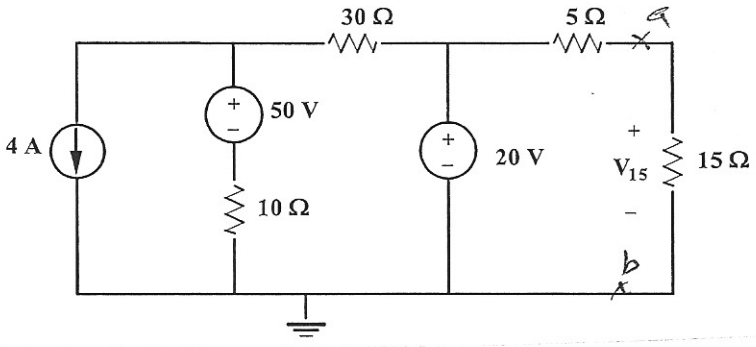
$R_{eq} = 15 \parallel (2 + 10 \parallel 40)$

$10 \parallel 40 = \frac{400}{50} = 8\,\Omega$

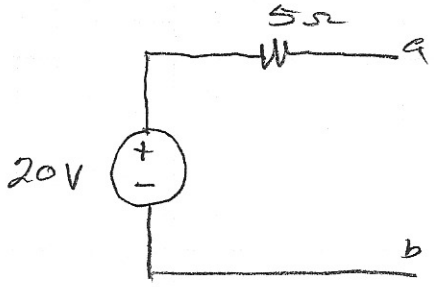
$15 \parallel (2+8) = \frac{15 \times 10}{25} = \frac{150}{25}$

$\therefore \boxed{R_{eq} = 6\,\Omega}$

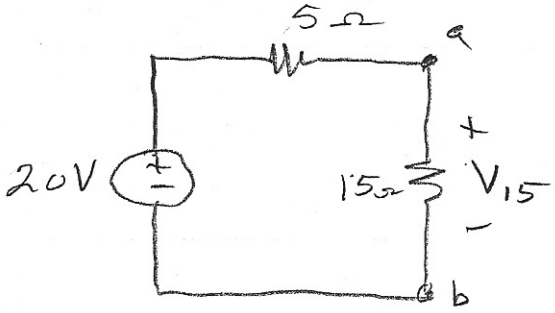
(3) You are given the circuit of Figure 3. Use any method (your choice) to find V_{15}.



The Thevenin circuit to the left of a-b is



Re-connect the load

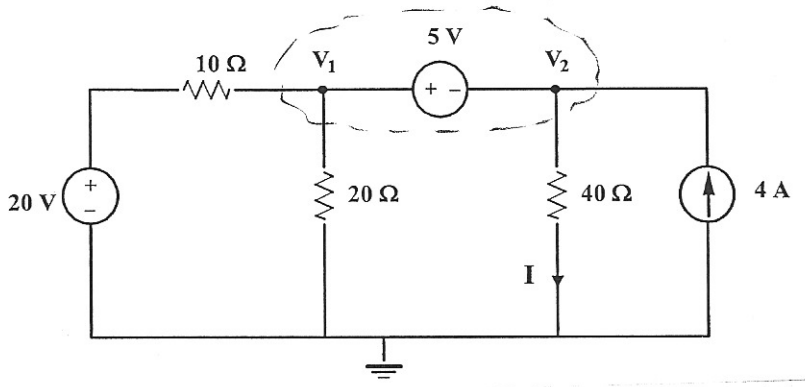


Use Voltage Division:

$$V_{15} = \frac{20 \times 15}{15+5} = 15\,V$$

$$\boxed{V_{15} = 15\,V}$$

(4) You are given the circuit of Figure 4. Use nodal analysis to find the current I as indicated.



At the supernode

$$\frac{V_1 - 20}{10} + \frac{V_1}{20} + \frac{V_2}{40} = 4$$

$$4V_1 - 80 + 2V_1 + V_2 = 160$$

$$\boxed{6V_1 + V_2 = 240}$$

Constraint Eq

$$V_1 - 5 - V_2 = 0$$

OR

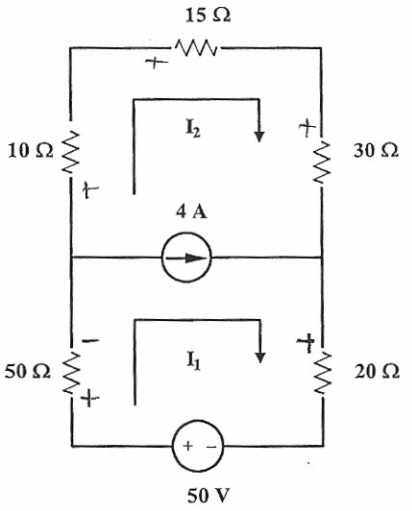
$$\boxed{V_1 - V_2 = 5}$$

$$\begin{bmatrix} 6 & 1 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} 240 \\ 5 \end{bmatrix} \qquad V_1 = 35\,V \qquad V_2 = 30\,V$$

$$\therefore \quad I = \frac{V_2}{40} = \frac{30}{40}$$

$$\boxed{I = 0.75\ A}$$

(5) You are given the circuit of Figure 5. Use mesh analysis to solve for I_1 and I_2.



Around the super mesh:

$$50I_1 + 10I_2 + 15I_2 + 30I_2 + 20I_1 - 50 = 0$$

$$\boxed{70I_1 + 55I_2 = 50}$$

Constraint Equation:

$$\boxed{I_1 - I_2 = 4}$$

$$\begin{bmatrix} 70 & 55 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 50 \\ 4 \end{bmatrix}$$

$$\boxed{I_1 = 2.16 \text{ A}}$$

$$\boxed{I_2 = -1.84 \text{ A}}$$