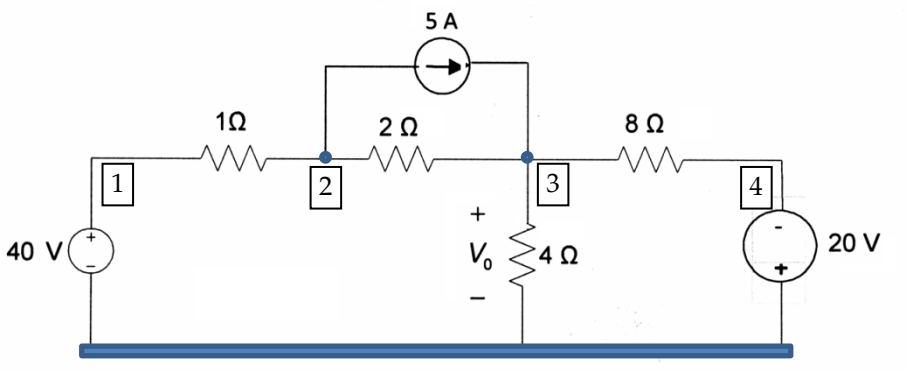
EE 101 Tutorial Problems 2 Solutions
(14 August 2014)

Q 1. The reference node is shown bold.



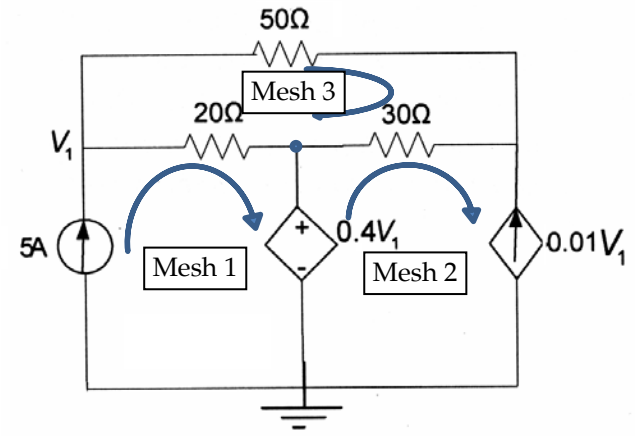
At node 1, $v_1 = 40$ V, At node 4, $v_4 = -20$ V

Node equation at node 2, $\frac{v_2 - 40}{1} + \frac{v_2 - v_3}{2} + 5 = 0$ (1)

Node equation at node 3, $\frac{v_3 - v_2}{2} + \frac{v_3}{4} + \frac{v_3 - (-20)}{8} - 5 = 0$ (2)

Solving (1) and (2), $v_3 = 20$ V $= V_0$

Q 2.



Mesh 1: $i_1 = 5$ A

Mesh 2: $i_2 = -0.01V_1$ A

KVL in Mesh 3: $(50+30+20)\, i_3 - 20\, i_1 - 30\, i_2 = 0$ (1)

KVL in Mesh 1: $V_1 - 20(5-i_3) - 0.4\, V_1 = 0$ (2)

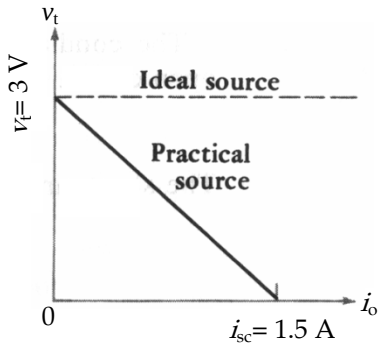
Solving (1) and (2), $V_1 = 148$ V

Voltage across dependent source = $0.4\, V_1 = 59.2$ V

Current through dependent source = $i_2 - i_1 = 5$ A $-0.01V_1$ A $= 6.48$ A

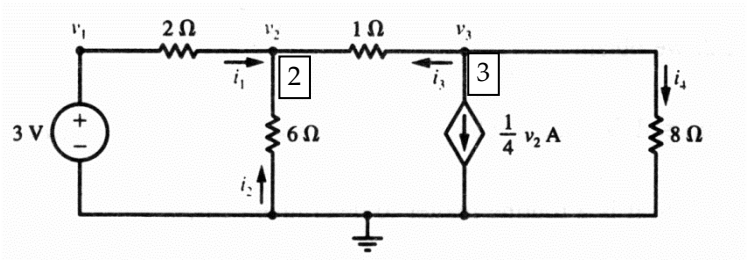
Therefore, power output = $59.2 \times 6.48 = 383.6$ W

Q 3. From figure 3b,



Open circuit voltage of the source = 3 V
Internal resistance of the source = 3/1.5 = 2 Ω

Therefore the circuit may be redrawn as shown with $(0 \le i_1 \le 1.5\ \text{A})$



KCL at node 2, $$\frac{v_1 - v_2}{2} + \frac{-v_2}{6} + \frac{v_3 - v_2}{1} = 0$$

$$\Rightarrow \quad -10V_2 + 6v_3 = -9 \qquad (1)$$

KCL at node 3, $$\frac{v_2}{4} + \frac{v_3 - v_2}{1} + \frac{v_3}{8} = 0$$

$$\Rightarrow \quad -6v_2 + 9v_3 = 0 \qquad (2)$$

Solving, (1) and (2),

v_2 = 1.5 V, and v_3 = 1 V

Then, i_1 = 0.75 A i_2 = -0.25 A

i_3 = - 0. 5 A i_4 = 0.125 A