Test I

(1) For the circuit in Figure 1 use node analysis to find the voltage v_X and the power supplied by the dependent current source. (10)

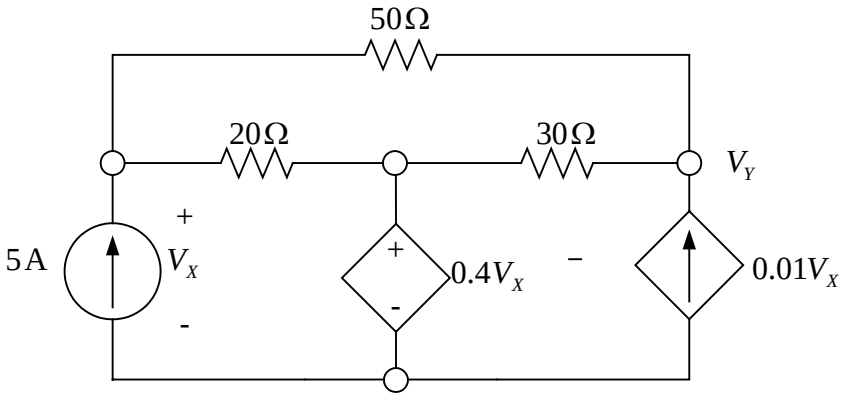

Figure 1

Sol.
KCL left node

$$\frac{V_X - V_Y}{50} + \frac{0.6V_X}{20} = 5$$

or

$$2V_X - 2V_Y + 3V_X = 500 \rightarrow 5V_X - 2V_Y = 500 \qquad (1)$$

KCL right node

$$\frac{V_X - V_Y}{50} + \frac{V_Y - 0.4V_X}{30} - 0.01V_X = 0$$

or

$$3V_Y - 3V_X + 5V_Y - 2V_X - 1.5V_X = 0 \rightarrow -6.5V_X + 8V_Y = 0 \qquad (2)$$

Solve

$$V_X = \frac{\begin{vmatrix} 500 & -2 \\ 0 & 8 \end{vmatrix}}{\begin{vmatrix} 5 & -2 \\ -6.5 & 8 \end{vmatrix}} = \frac{4000}{27} = 148.15 \text{ V}$$

From (1) or (2),

$$V_Y = \frac{5V_X - 500}{2} = 120.37 \text{ V} \text{ or } V_Y = \frac{6.5}{8}V_X = 120.37 \text{ V}$$

(2) For the circuit in Figure 2 find values for i_L and v_X at : (10)

- $t = 0^-$
- $t = 0^+$
- t = infinity (∞)
- t = 0.2 ms

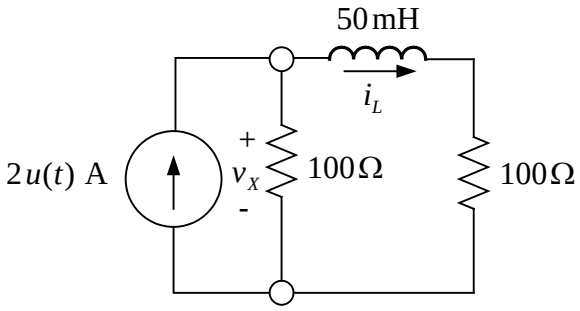

Figure 2

Sol.

- $t = 0^-$, i_L = 0 A, v_X = 0 V
- $t = 0^+$, i_L = 0 A, v_X = 200 V
- t = infinity (∞), i_L = 1 A, v_X = 100 V

$$\tau = \frac{50 \times 10^{-3}}{200} = \frac{1}{4} \text{ ms}$$

$$\therefore i_L = 1(1 - e^{-4000t})u(t) \text{ A}$$

$$i_L(0.2\text{ms}) = 1(1 - e^{-4000(0.2\times10^{-3})})(1) = 0.5507 \text{ A}$$

$$v_X(0.2\text{ms}) = 100(100 - e^{-4000(0.2\times10^{-3})})(1) = 144.93 \text{ V}$$

(1) For the circuit in Figure 1 use superposition to find the voltage *V*. (10)

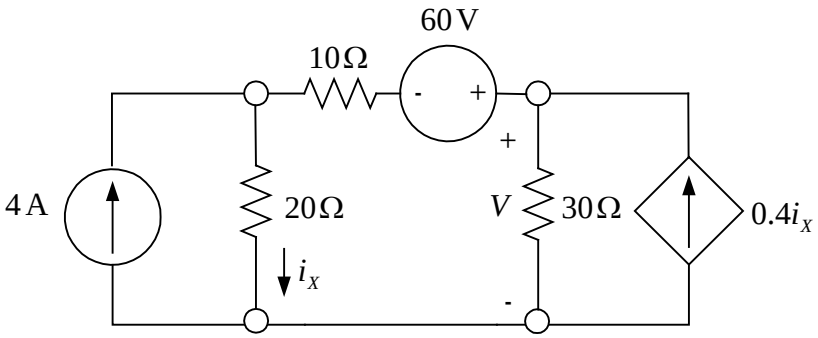

Figure 1