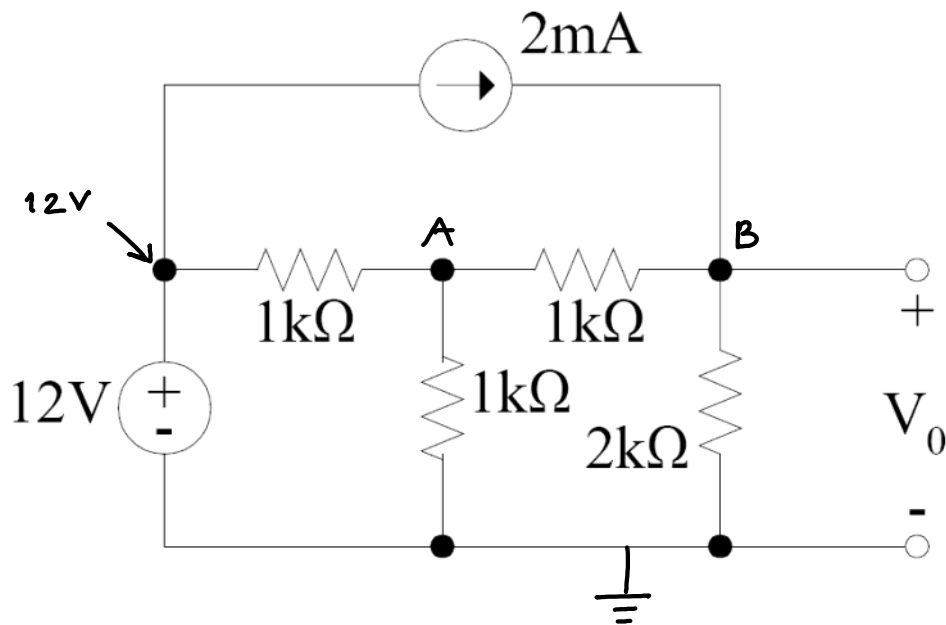


Quiz 1 Solution

Tuesday, December 22, 2009
9:53 PM

① Nodal Analysis



At Node A :

$$\frac{V_A - 12}{1k} + \frac{V_A - 0}{1k} + \frac{V_A - V_B}{1k} = 0$$

$$3V_A - V_B = 12$$

$$\frac{V_B - V_A}{1k} - 2m + \frac{V_B - 0}{2k} = 0$$

$$2V_B - 2V_A - 4 + V_B = 0$$

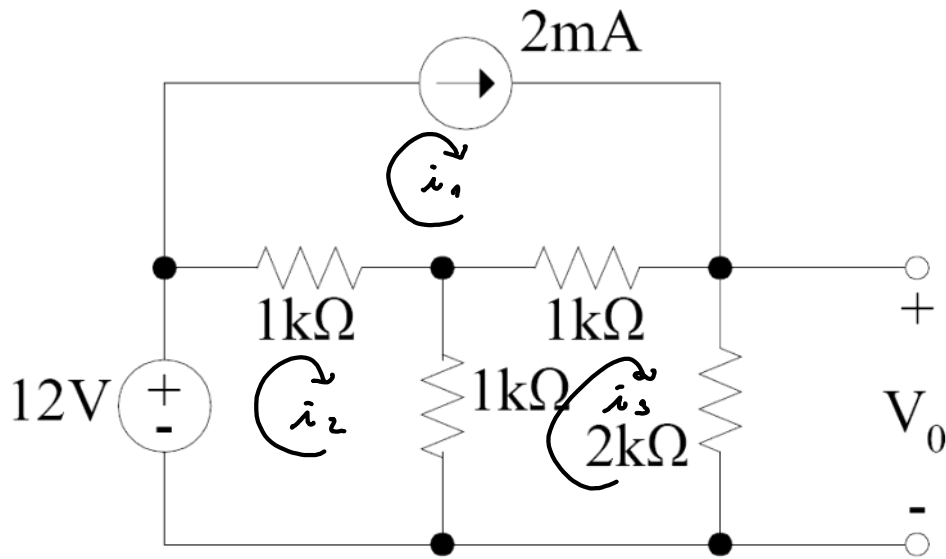
$$-2V_A + 3V_B = 4$$

$$6V_A - 2V_B = 24$$

$$V_A = \frac{\begin{vmatrix} 4 & 3 \\ 24 & -2 \end{vmatrix}}{\begin{vmatrix} -2 & 3 \\ 6 & -2 \end{vmatrix}} = \frac{-8 - 72}{4 - 18} = \frac{-80}{-14} = \boxed{\frac{40}{7} \text{ V}}$$

$$V_B = \frac{\begin{vmatrix} -2 & 4 \\ 6 & 24 \end{vmatrix}}{\begin{vmatrix} -2 & 3 \\ 6 & -2 \end{vmatrix}} = \frac{-48 - 24}{-14} = \frac{72}{14} = \boxed{\frac{36}{7} = V_0}$$

② Mesh Analysis



Loop 1

$$i_1 = 2 \text{ mA}$$

Loop 2

$$12 - (i_2 - i_1) \times 1k - (i_2 - i_3) \times 1k = 0$$

$$-2i_2 + i_1 + i_3 = -12 \text{ mA}$$

$$i_3 - 2i_2 = -14 \text{ mA}$$

$$\uparrow i_1 = 2 \text{ mA}$$

Loop 3

$$-(i_3 - i_2) \times 1k - (i_3 - i_1) \times 1k - i_3 \times 2k = 0$$

$$-4i_3 + i_2 + i_1 = 0$$

$$-4i_3 + i_2 = -2 \text{ mA}$$

$$\uparrow i_1 = 2 \text{ mA}$$

$$i_3 = \begin{vmatrix} -14 & -2 \\ -2 & 1 \\ 1 & -2 \\ -4 & 1 \end{vmatrix} = \frac{-14 - 4}{1 - 8} = \boxed{\frac{18}{7}} \text{ mA}$$

$$i_2 = \begin{vmatrix} 1 & -14 \\ -4 & -2 \end{vmatrix} = \frac{-2 - 56}{1} = \boxed{\frac{58}{2}} \text{ mA}$$

$$i_2 = \frac{\begin{vmatrix} 1 & -2 \\ -4 & -2 \end{vmatrix}}{\begin{vmatrix} 1 & -2 \\ -4 & 1 \end{vmatrix}} = \frac{-2 - 56}{-7} = \boxed{\frac{58}{7}} \text{ mA}$$

$$V_o = i_3 \times 2k = \boxed{\frac{36}{7} \text{ V}}$$