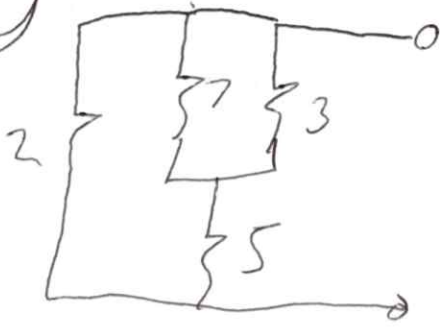


MT # 2 Sols

①

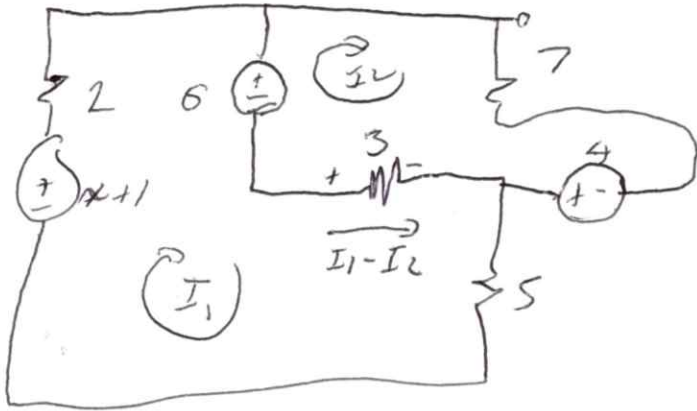
$$\bar{Z}_{AB} = 3 + 1.5j$$

2



$$R_{th} = (3 \parallel 7 + 5) \parallel 2$$

$$= 1.56 \Omega$$



Loop 1:

$$x+1 - 2I_1 - 6 - 3(I_1 - I_2) - 5I_1 = 0$$

$$x - 5 - 10I_1 + 3I_2 = 0 \quad (1)$$

Loop 2:

$$6 - 7I_2 + 4 + 3(I_1 - I_2) = 0$$

$$10 - 10I_2 + 3I_1 = 0$$

$$I_2 = \frac{3}{10}I_1 + 1 \quad (2)$$

Sub (2) into (1)

$$x - 5 - 10I_1 + \frac{9}{10}I_1 + 3 = 0$$

$$\frac{91}{10}I_1 = x - 2$$

$$I_1 = \frac{10}{91}(x - 2)$$

$$\Rightarrow I_2 = \frac{3}{10} \left(\frac{10}{91}(x - 2) \right) + 1$$

$$= \frac{3}{91}(x - 2) + 1$$

$$\therefore V_{th} = 5I_1 - 4 + 7I_2$$

3)

$$Z_{AB} = -j + X \parallel [2 + 6j \parallel -3j]$$

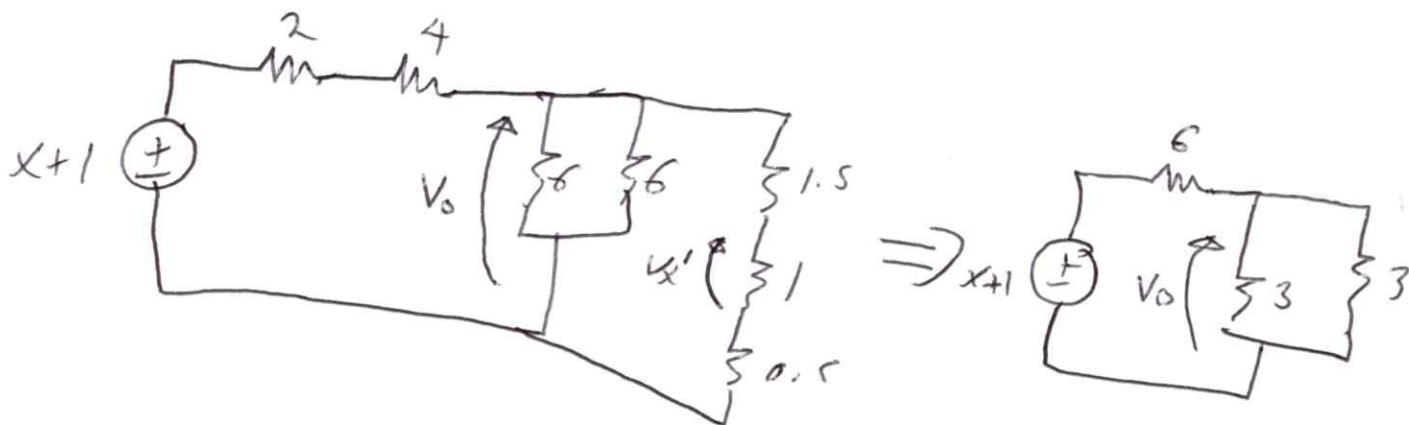
$$= -j + X \parallel [2 - 6j]$$

$$= -j + \left(\frac{1}{X} + \frac{1}{2-6j} \right)^{-1}$$

$$= -j + \left(\frac{2-6j+X}{2X-6Xj} \right)^{-1}$$

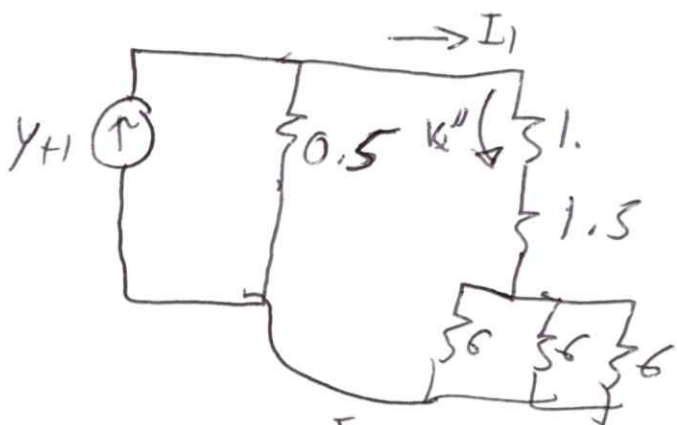
$$= -j + \frac{2X-6Xj}{X+2-6j}$$

④ Using Sup



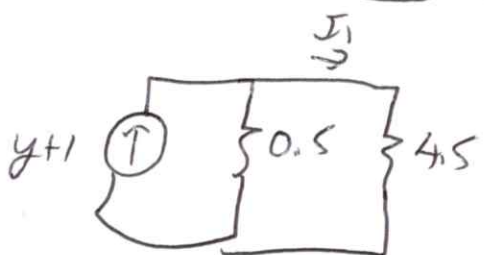
$$V_o = (x+1) \left(\frac{1.5}{7.5} \right) = 0.2x + 0.2$$

$$V_{x'} = V_o \left(\frac{1}{3} \right) = \frac{0.2(x+1)}{3} = 0.067(x+1)$$



$$I_1 = (y+1) \left(\frac{0.5}{5} \right) = \frac{y+1}{10}$$

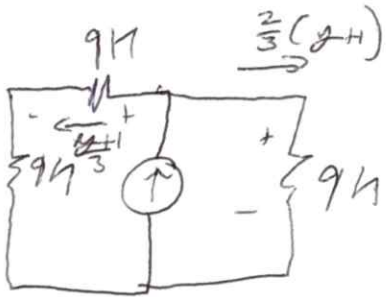
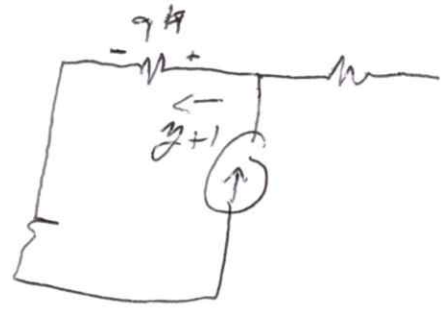
$$V_{x''} = -\frac{y+1}{10}$$



$$\therefore V_x = 0.067(x+1) - \frac{y+1}{10}$$

5

$$V_{xint} = -9(y+1)$$



$$V_{x final} = \frac{2}{3}(y+1)9 - \frac{1}{3}(y+1)9$$

$$= 3(y+1)$$

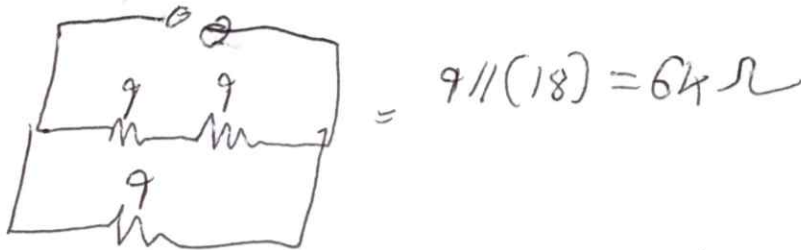
$$V_x(t) = K_1 + K_2 e^{-\frac{t}{\tau}}$$

$$V_x(0) = K_1 + K_2 = -9(y+1)$$

$$V_x(\infty) = K_1 = 3(y+1)$$

$$\therefore K_2 = -12(y+1)$$

Resistance seen by cap:



$$\frac{1}{\tau} = \frac{1}{RC} = \frac{1}{(6\Omega)(100\mu F)} = \frac{1}{(6\Omega)(0.1mF)} = \frac{1}{0.6} = 1.67$$

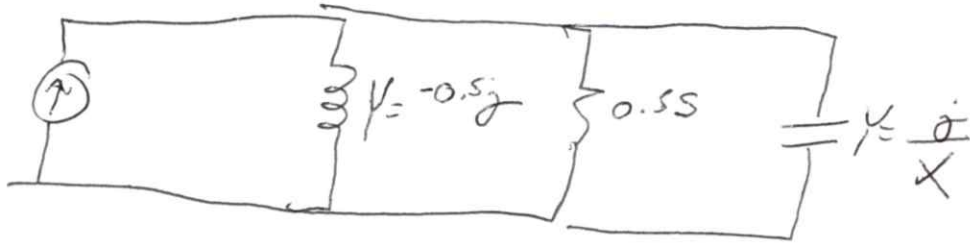
~~$$\therefore V_x(t) = 9(y+1)$$~~

$$V_x(t) = 3(y+1) - 12(y+1) e^{-1.67t}$$

3

~~XXXXXXXXXX~~

6



$$Y_{tot} = 0.5 + (\frac{1}{X} - 0.5j) \quad Z_{tot} = \frac{1}{Y_{tot}}$$

~~XXXXXXXXXX~~

$$V = 4 \angle 45^\circ \cdot Z_{tot}$$

$$I_c = \frac{V}{-jX}$$

7

$$i(t) = 1.5t$$

$$E = \frac{1}{2} L i^2(t)$$

$$= \frac{1}{2} (2H) (1.5t)^2$$

$$= \frac{1}{2} (2H) (0.5)(4)$$

$$E = 18(2H)$$