

# MARK YOUR CALENDARS!

## REVIEW SESSION:

Location: E229A

Time: 1:30-2:30pm 10/31/01 Wednesday

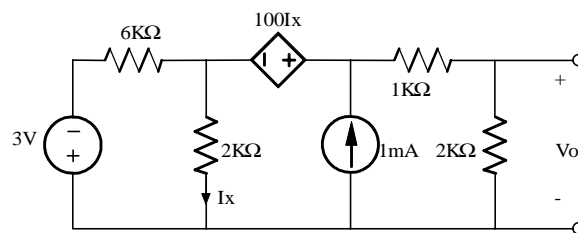
## QUIZ :

Location: Pierce 116

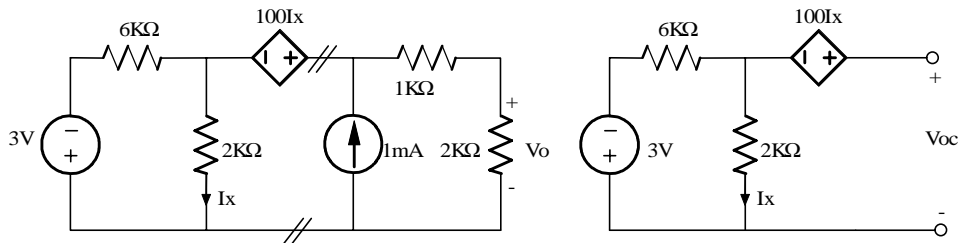
Time: 11:00am-12:15pm 11/06/01 Tuesday

### Problem 4.58

Find  $V_o$  in the network shown using Thevenin's Theorem.



### Suggested Solution



$$I_x = -3/8K = -0.38 \text{ mA}$$

$$3 + (6K)I_x - (1K)I_x + V_{oc} = 0$$

$$V_x = 2000I_x$$

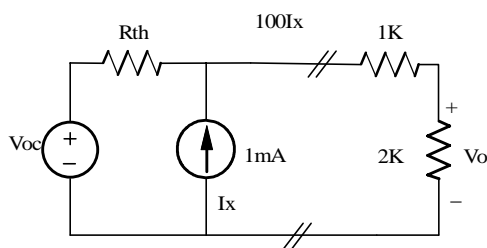
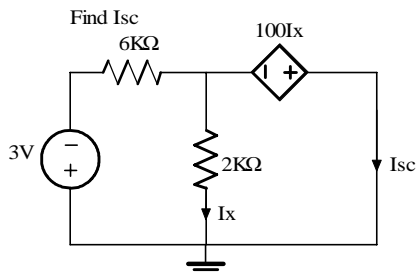
$$V_x = -1000I_x$$

$$V_x = 0 \text{ and } I_x = 0A$$

$$\text{Now, } -3/6K = I_{sc} \Rightarrow I_{sc} = -0.5mA$$

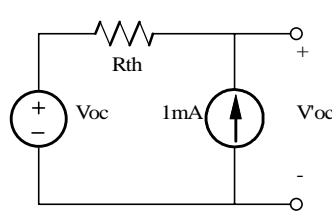
$$V_{oc} = -1.13V$$

$$R_{th} = V_{oc} / I_{sc} = 2.25 \text{ K}\Omega$$



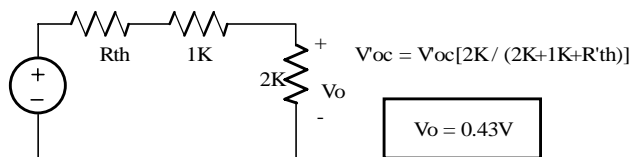
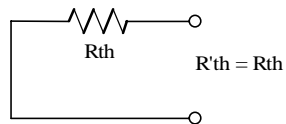
$$V_{oc} = -1.13V, R_{th} = 2.25K$$

Find  $V_{oc}$



$$V'_{oc} = (1m)R_{th} + V_{oc}$$

$$V_{oc} = 1.13V$$

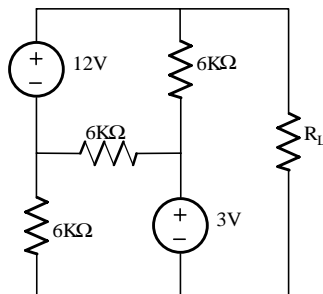


$$V_{oc} = V_{oc}[2K / (2K+1K+R'_{th})]$$

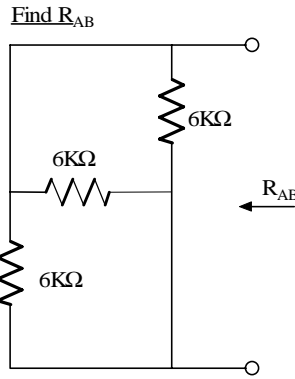
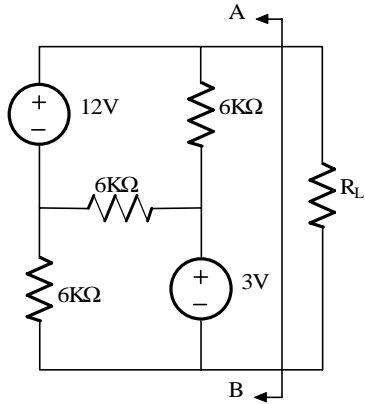
$$V_o = 0.43V$$

### Problem 4.70

Find  $R_L$  for maximum power transfer and the maximum power that can be transferred in the network shown.



### Suggested Solution

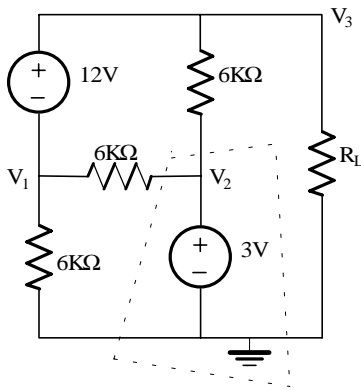


All 3 Resistors are attached to both node A and node B, so,

$$R_{AB} = 6K \parallel 6K \parallel 6K$$

$$R_{AB} = 2K\Omega$$

Find maximum load transfer



$$V_3 - V_1 = 12V$$

$$V_2 = 3V$$

At supernode:

$$(V_3 - V_2) / 6K + (V_1 - V_2) / 6K + V_3 / 2K + V_1 / 6K = 0$$

Yields:

$$V_3 = 5V$$

$$P_L = V_3^2 / R_{AB}$$

$$P_L = 12.5 \text{ mW}$$

### Problem 5.18

Draw the waveform for the current in a  $12\text{-}\mu\text{F}$  capacitor when the capacitor voltage is as described in Figure.

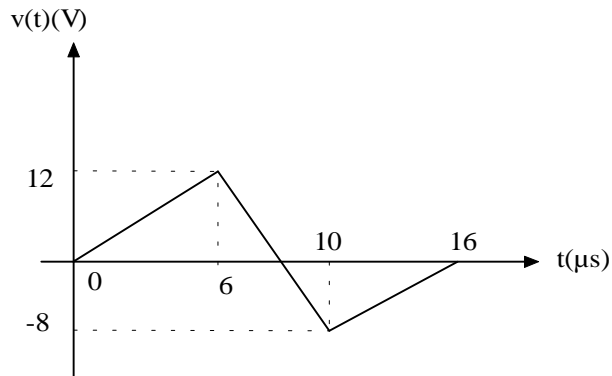
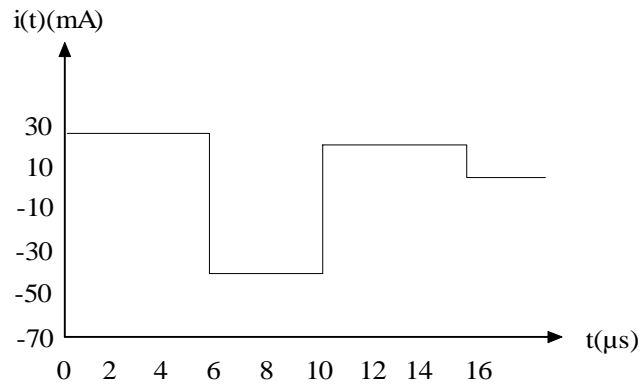
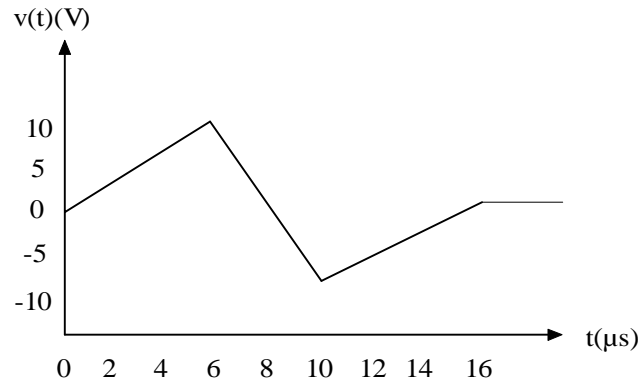


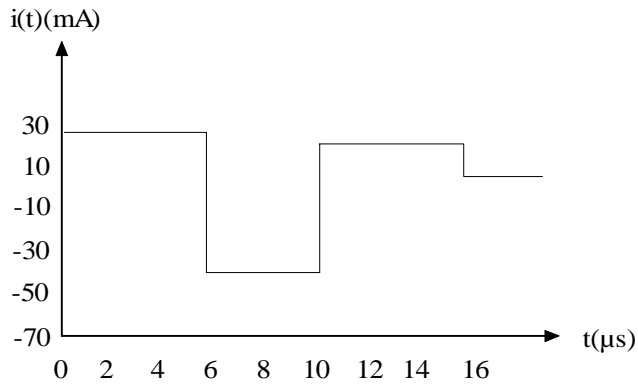
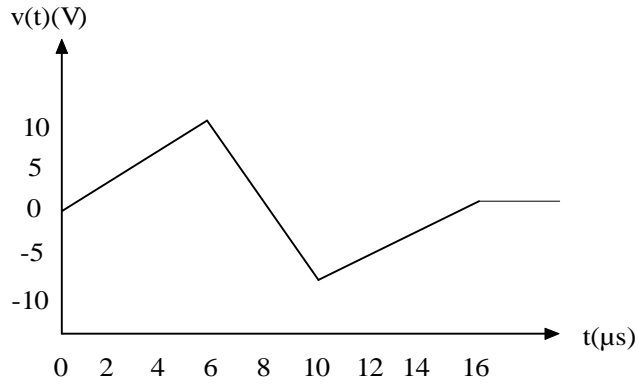
Figure P5.16

### Suggested Solution

$$C = 12\mu F \quad i(t) = C \frac{dv}{dt}$$

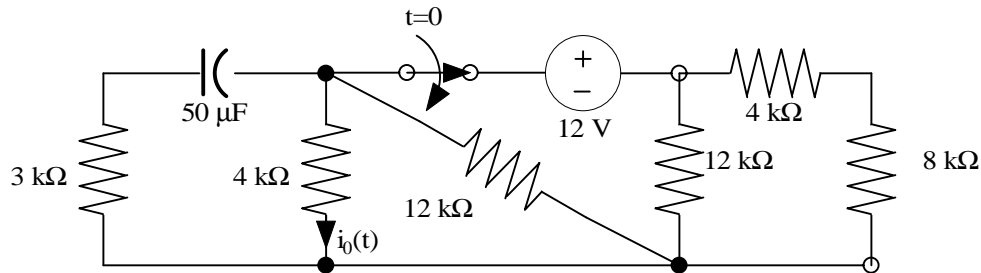
Time ( $\mu s$ )	$\frac{dv}{dt}$ (V/ $\mu s$ )	$i(t)$ (A)
$0 \leq t$	2	24
$6 \leq t \leq 10$	-5	-60
$10 \leq t \leq 16$	1.33	16
$t > 16$	0	0



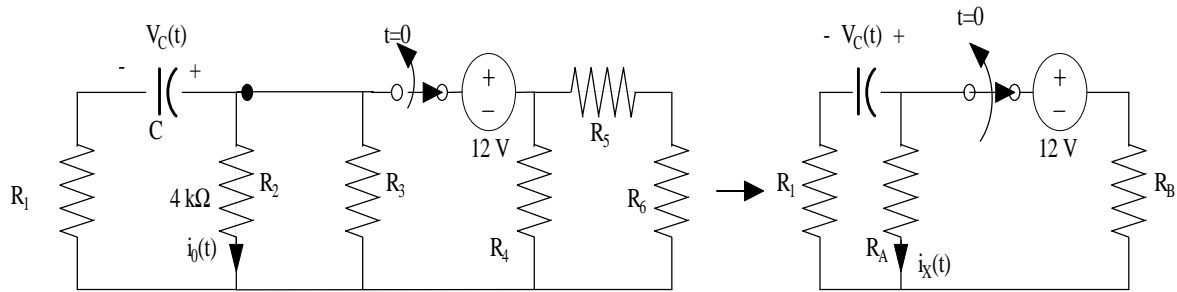


### Problem 6.21

Use the differential equation approach to find  $i_0(t)$  for  $t > 0$  in the circuit in Fig. P.21 and plot the response including the time interval just prior opening the switch.



### Suggested Solution



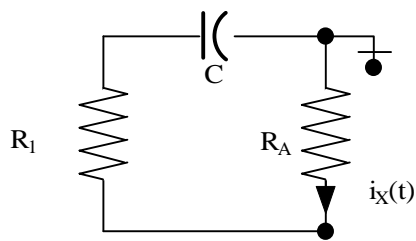
$$R_1 = 3 \text{ k}\Omega \quad R_2 = R_5 = 4 \text{ k}\Omega \quad R_3 = R_4 = 12 \text{ k}\Omega \quad R_6 = 8 \text{ k}\Omega \quad C = 0.05 \text{ mF} \quad R_A = 3 \text{ k}\Omega \quad R_B = 6 \text{ k}\Omega$$

For  $t < 0$ :  $V_C(t) = \frac{-12R_A}{(R_A + R_B)} = -4 \text{ V} = V_C(0^-) = V_C(0^+)$

$$i_x(0^-) = \frac{V_C(0^-)}{R_A} = \frac{-4}{3} \text{ mA} \quad i_0(0^-) = \frac{i_x(0^-)R_3}{(R_2 + R_3)} = -1 \text{ mA}$$

For  $t > 0$ : By KCL:  $\frac{C \, dV_C(t)}{dt} + \frac{V_C(t)}{R_1 + R_A} = 0 \Rightarrow \frac{dV_C}{dt} + \frac{10}{3} = 0$

For  $t > 0$



If  $V_C(t) = K_1 + K_2 e^{-\frac{t}{\tau}}$ , then  $\tau = 0.3 \text{ S}$  and  $K_1 = 0$

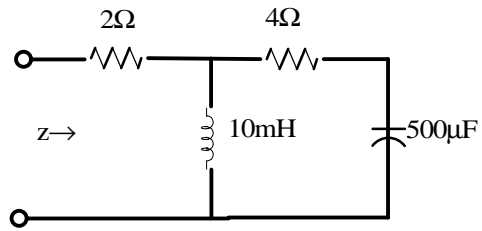
$$V_C(0^+) = K_2 = -4 \text{ V} \quad \text{so, } V_C(t) = -4e^{-\frac{10t}{3}} \text{ V}$$

But  $i_x(t) = \frac{-V_C(t)}{R_1 + R_A}$  and  $i_0(t) = \frac{i_x(t)R_3}{R_2 + R_3} \Rightarrow$

$i_0(t) = 0.5e^{-\frac{10t}{3}} \text{ mA}, \quad t > 0$ $= 1 \text{ mA}, \quad t < 0$
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### Problem 7.13

Find  $\mathbf{Z}(j\omega)$  at a frequency of 60 Hz for the network shown.



### Suggested Solution

$$Z_L = j\omega L = j(377)(10 \times 10^{-3}) = j3.77$$

$$Z_c = \frac{1}{j\omega C} = \frac{10^6}{j377(5)} = -j5.3$$

$$Z = 2 + \frac{j3.77(4 - j5.3)}{j3.77 + 4 - j5.3} = 2 + \frac{j15.08 + 20}{4 - j1.535} = 5.1 + j4.96\Omega$$