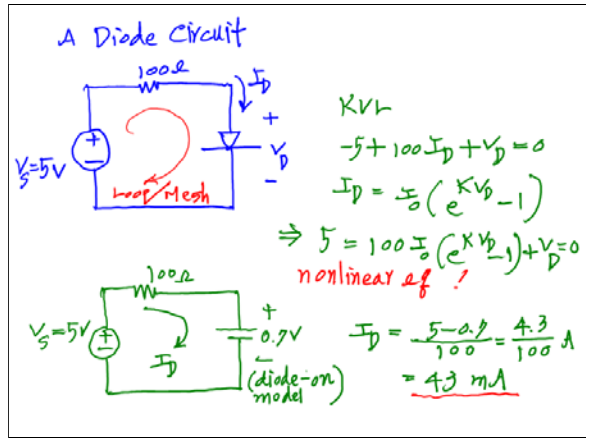
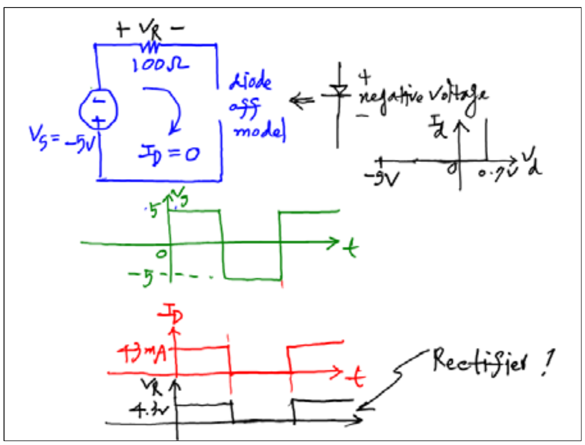
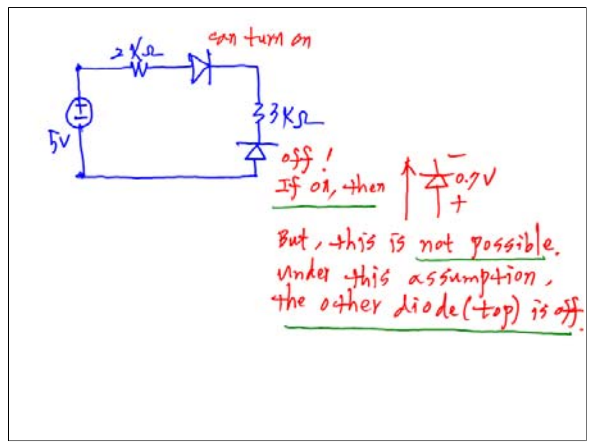
EE101 Lect 6 Jan 24, 2019

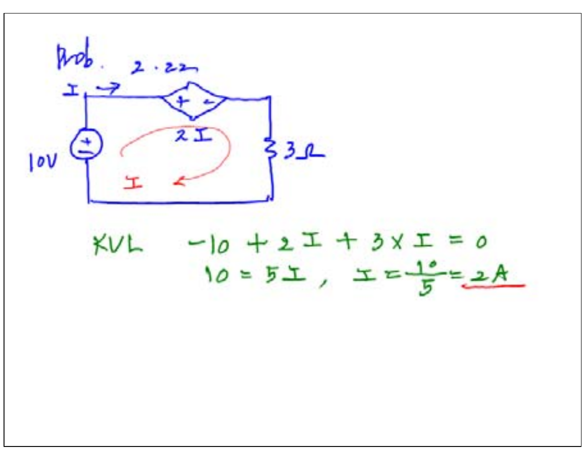
HW #3 (for Quiz 3 on Jan 29)

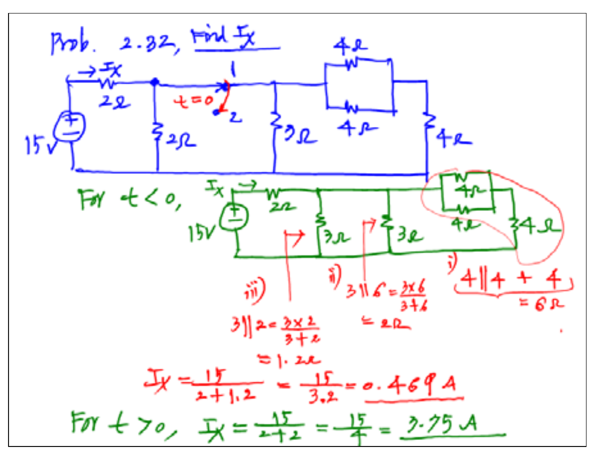
1. Prob. 3.3
2. Prob. 3.7
3. Prob. 3.11
4. Prob. 3.20
5. Prob. 3.26
6. Prob. 3.32
7. Prob. 3.48
8. Prob. 3.58



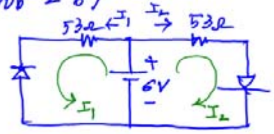








Prob 2.67

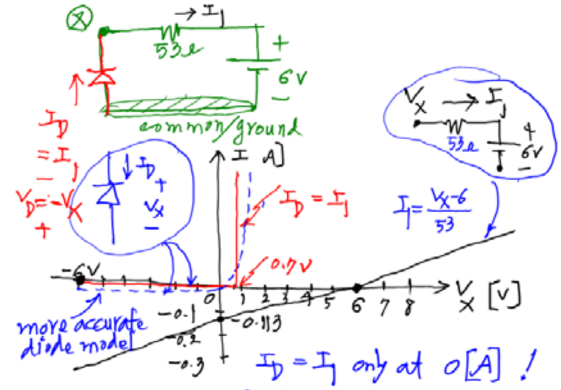


Right side mesh : KVL $-6 + 53I + 0.7 = 0$

$I = \frac{6-0.7}{53} = 0.1A$

Left side mesh : KVL ? But diode is off !

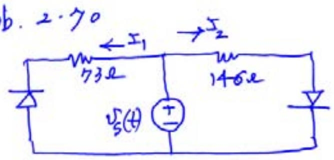
$I_1 = 0$

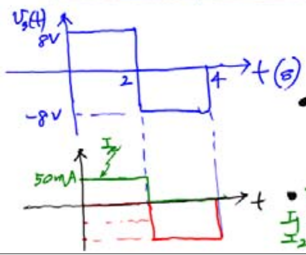


$I_D = I_1$ only at 0[A] !

⇒ open circuit with 0 current !

Prob. 2.70

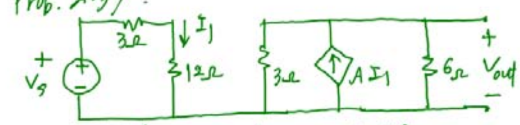




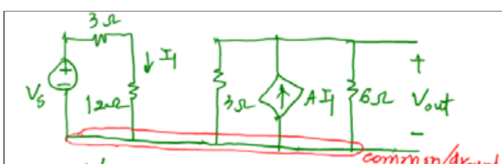
- For $0 < t < 2$
  $I_2 = \frac{8-0.7}{146} = \frac{7.3}{146} = 50[mA]$
  $I_1 = 0$
- For $2 < t < 4$
  $I_1 = -(8-0.7)/73 = -100[mA]$
  $I_2 = 0$

Continued on Nodal Analysis,
Loop/Mesh Analysis (Chap 3 pp. 115-143)

Prob. 2.37.



If $V_o/V_s = 9$, what is "A"?



$V_{out} = 6\Omega \times I_{6\Omega} = 6\Omega \times AI_1 \left(\frac{\frac{1}{6}}{\frac{1}{3}+\frac{1}{6}} \right)$

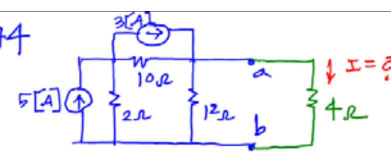
$= 6 \times AI_1 \left(\frac{1}{2+1} \right) = 3AI_1$

$I_1 = \frac{V_s}{3+12} = \frac{V_s}{15}$

$\Rightarrow V_{out} = 2A \frac{V_s}{15}$

$\frac{V_{out}}{V_s} = 9 = \frac{2A}{15}, \quad A = \frac{9 \times 15}{2} = 67.5$

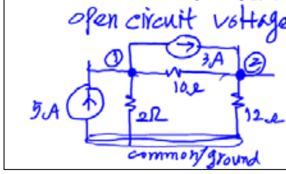
Prob. 2.44



there can be a few different approaches to finding I.

(Method 1) Thevenin's equiv. ckt for the left side of terminals a + b.

open circuit voltage V_{oc} = ?



Nodal Analysis ($V_{(2)} = V_{oc}$)

KCL at (1): $5 = 3 + \frac{V_1}{2} + \frac{V_1 - V_2}{10}$ (1)

KCL at (2): $3 + \frac{V_1 - V_2}{10} = \frac{V_2}{12}$ (2)

$$5 = 3 + \frac{v_1}{2} + \frac{v_1 - v_2}{10} \qquad (1)$$

$$\times 10 \Rightarrow 50 = 30 + 5V_1 + V_1 - V_2 \Rightarrow 6V_1 - V_2 = 20 \qquad (1)'$$

$$3 + \frac{V_1 - V_2}{10} = \frac{V_2}{12} \qquad (2)$$

$$\times 60 \Rightarrow 180 + 6V_1 - 6V_2 = 5V_2 \Rightarrow -6V_1 + 11V_2 = 180 \qquad (2)'$$

$$(1)' + (2)' \Rightarrow 10V_2 = 20$$

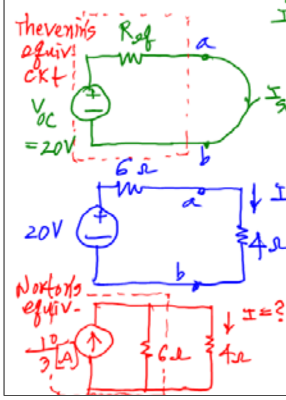
$$\boxed{V_2 = 20\,V} = V_{out}$$

Next, let us find I_{SC}:

$$KVL: 2(I_{SC} - 5) + 10(I_{SC} - 3) = 0$$

$$12 I_{SC} = 40 \Rightarrow I_{SC} = 10/3\,[A]$$

Thus far, we found $V_{OC} = 20\,[V]$, $I_{SC} = 10/3\,[A]$

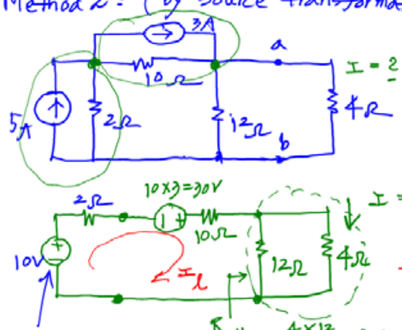


$$R_{eq} = \frac{V_{OC}}{I_{SC}} = \frac{20[V]}{10/3\,[A]} = 6\,[\Omega]$$

$$I = \frac{20}{6+4} = 2\,[A] \quad \text{ans}$$

$$I = \frac{10}{3} \cdot \frac{\frac{1}{4}}{\frac{1}{6} + \frac{1}{4}} = \frac{10}{3} \cdot \frac{3}{2+3} = 2\,[A] \checkmark$$

Method 2: (By source transformation)



KVL

$$-10 + 2I_l - 30 + 10I_l + 3I_l = 0$$

$$I_l = 40/15 = 8/3$$

$$4 \| 12 = \frac{4 \times 12}{4 + 12} = 3\,\Omega$$

$5A \times 2\Omega = 10[V]$

By current division $I = I_l \cdot \frac{1/4}{1/4 + 1/12} = \frac{8}{3} \cdot \frac{3}{3+1} = 2A$ ans

Prob. 2.46

Determine I

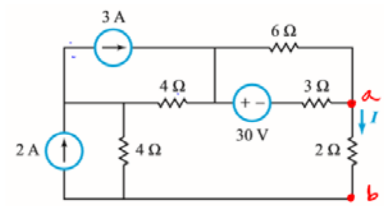


Figure P2.46: Circuit for Problem 2.46.

Let's solve this prob. by first finding the Norton's equivalent circuit for a-b port (terminals)

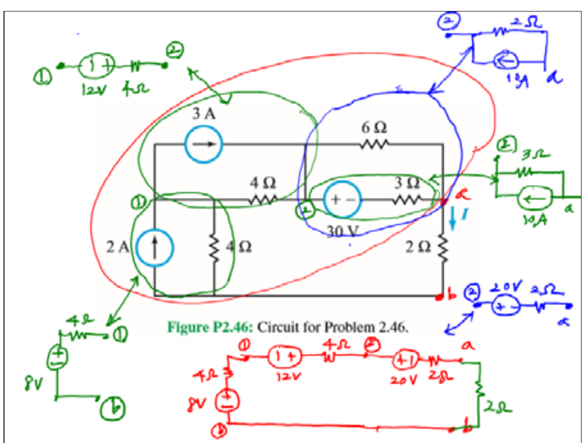
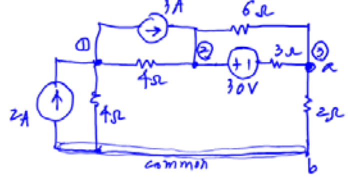


Figure P2.46: Circuit for Problem 2.46.

Nodal Analysis



KCL at ① $\quad 2 = 3 + \frac{V_1}{4} + \frac{V_1 - V_2}{4} \qquad (1)$

KCL at ② $\quad 3 + \frac{V_1 - V_2}{4} = \frac{V_2 - V_3}{6} + \frac{V_2 - 30 - V_3}{3} \qquad (2)$

KCL at ③ $\quad \frac{V_2 - V_3}{6} + \frac{V_2 - 30 - V_3}{3} = \frac{V_3}{2} \qquad (3)$

$(1) \rightarrow \quad 2V_1 - V_2 = -4 \quad (1)'$

$(2) \rightarrow \quad -3V_1 + 9V_2 - 6V_3 = 156 \quad (2)'$

$(3) \rightarrow \quad V_2 - 2V_3 = 20 \quad (3)'$

$3 \times (1)' + 2 \times (2)' \rightarrow$

$$\begin{array}{r} 6V_1 - 3V_2 \qquad\qquad = -12 \\ -6V_1 + 18V_2 - 12V_3 = 312 \\ \hline 15V_2 - 12V_3 = 300 \quad (4) \end{array}$$

$(4) - 15 \times (3)' \rightarrow$

$$\begin{array}{r} 15V_2 - 12V_3 = 300 \\ -(15V_2 - 30V_3 = 300) \\ \hline 18V_3 = 0 \end{array} \quad \boxed{V_3 = 0\ V}$$

From $(3)'$ $\boxed{V_2 = 20\ V}$

From $(1)'$ $2V_1 - 20 = -4 \Rightarrow \boxed{V_1 = 8\ V}$