

06/28/09

Lecture 4 - Techniques of Circuit Analysis

(1)

1) Administration → My lecture notes ~~are~~ online will be

→ Tuesday morning lab space (current: 36) we want only 28 people.

New lab: 11:2-5 pm

Conclusion: Open up a new lab section on

Monday 2-5 pm. in 140 AB

Starts next week!

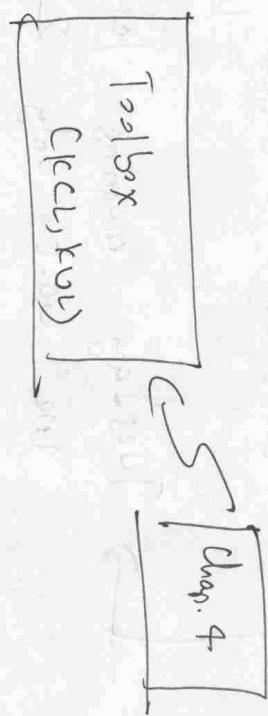
There is discussion this week.

make use of nine & TAS OH

MF: 288 _{w:} (2-3 pm)
140 AB room

(2)

Recap:
Week 1: Chapters 1-3: Basic circuit analysis.



Chapter 4: Techniques of Circuit Analysis

Section 4.1: Terminology ← just read it.

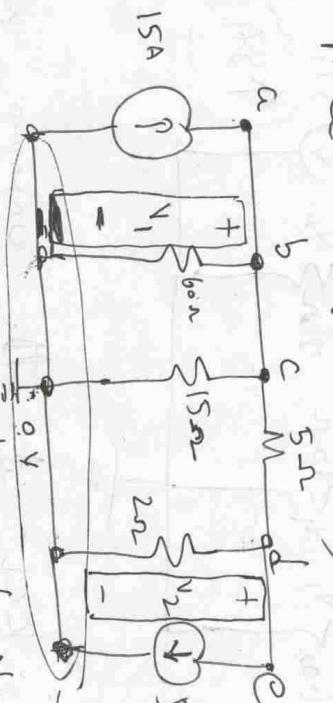
- (1) Understand the difference between a mesh & a loop

- (2) Difference between planar & non-planar circuit

D 4.5)

For the circuit below, find the unknown (5) node voltages using nodal-analysis (aka

node voltage method)

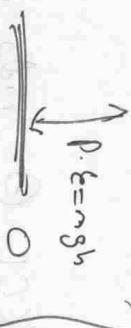


~~Step~~

No nodal analysis involves 4-steps:

Step 1: Pick a reference node. (i.e., a ground)

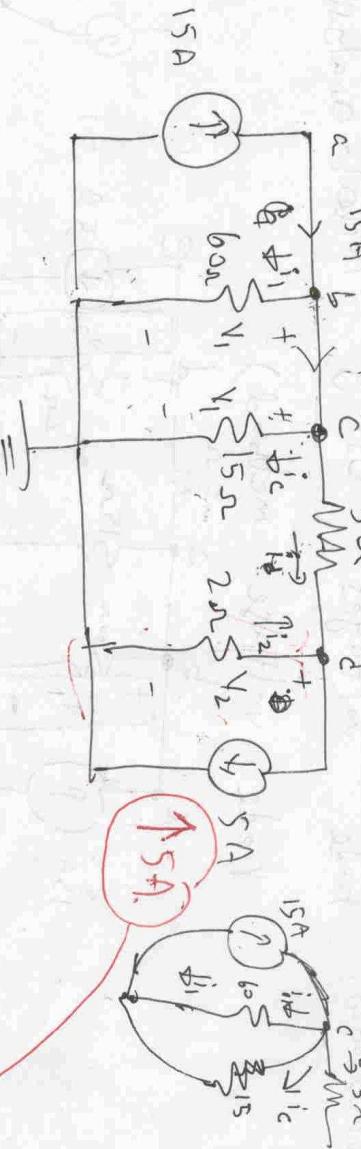
Because: voltages are measured relative to a reference. [In Mech E:



Conventions: Bottom node in the circuit is picked as Gnd (ground) symbol:

③

Step 2: You label the unknown node voltages.



Step 3: You write KCL at the "unknown node".

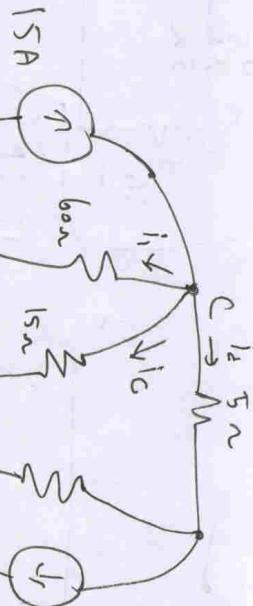
$$\text{KCL @ node } c: \quad \sum i_{\text{entering}} = \sum i_{\text{leaving}}$$

$$\Rightarrow \boxed{15 = i_1 + i_c + i_d}$$

$$\text{KCL @ node } d: \quad \sum i_{\text{entering}} = \sum i_{\text{leaving}}$$

$$\Rightarrow \boxed{i_d + i_2 = 5 \text{ A} \rightarrow i_d + i_2 + 5A = 0}$$

④



N.T.C.

(5)

Step 4: Rewrite unknown currents in terms of node voltages

$$V_1 \xrightarrow{\text{Conventions}} V = iR$$

$$V_2 \xrightarrow{\text{Conventions}} V = -iR$$

Very important

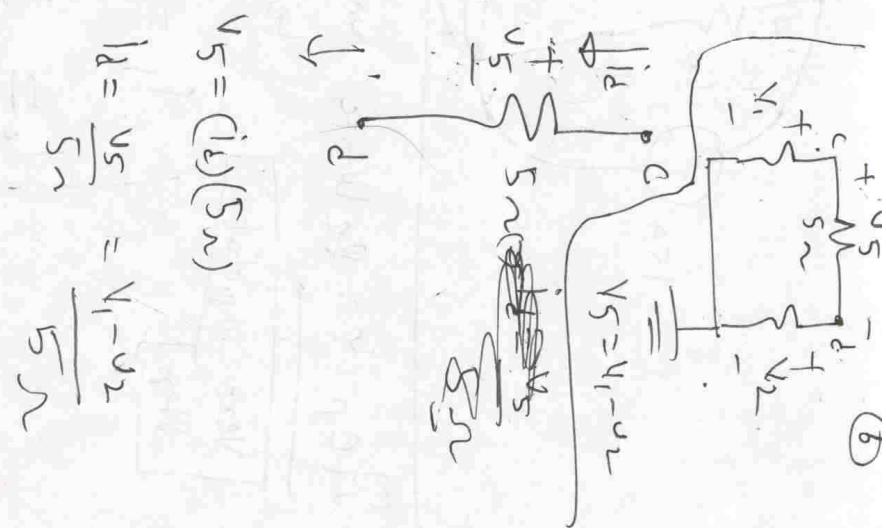
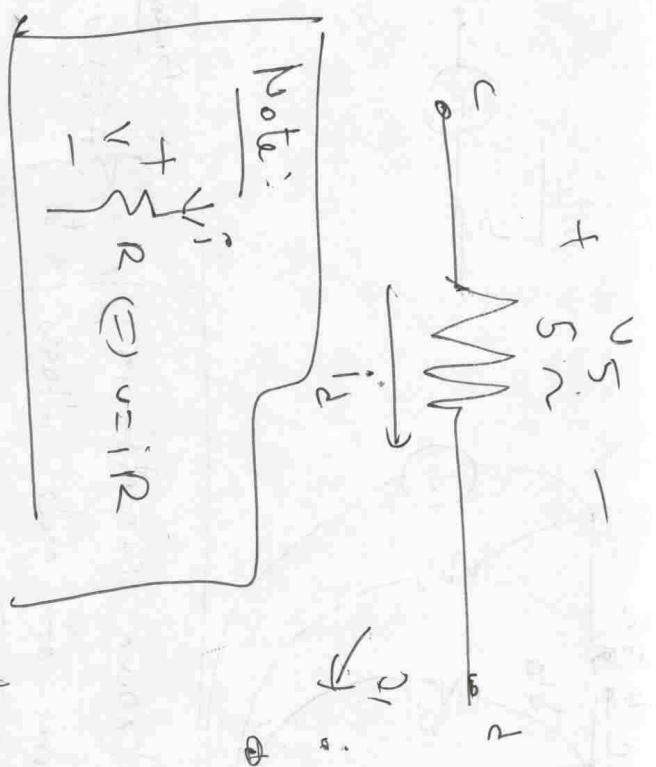
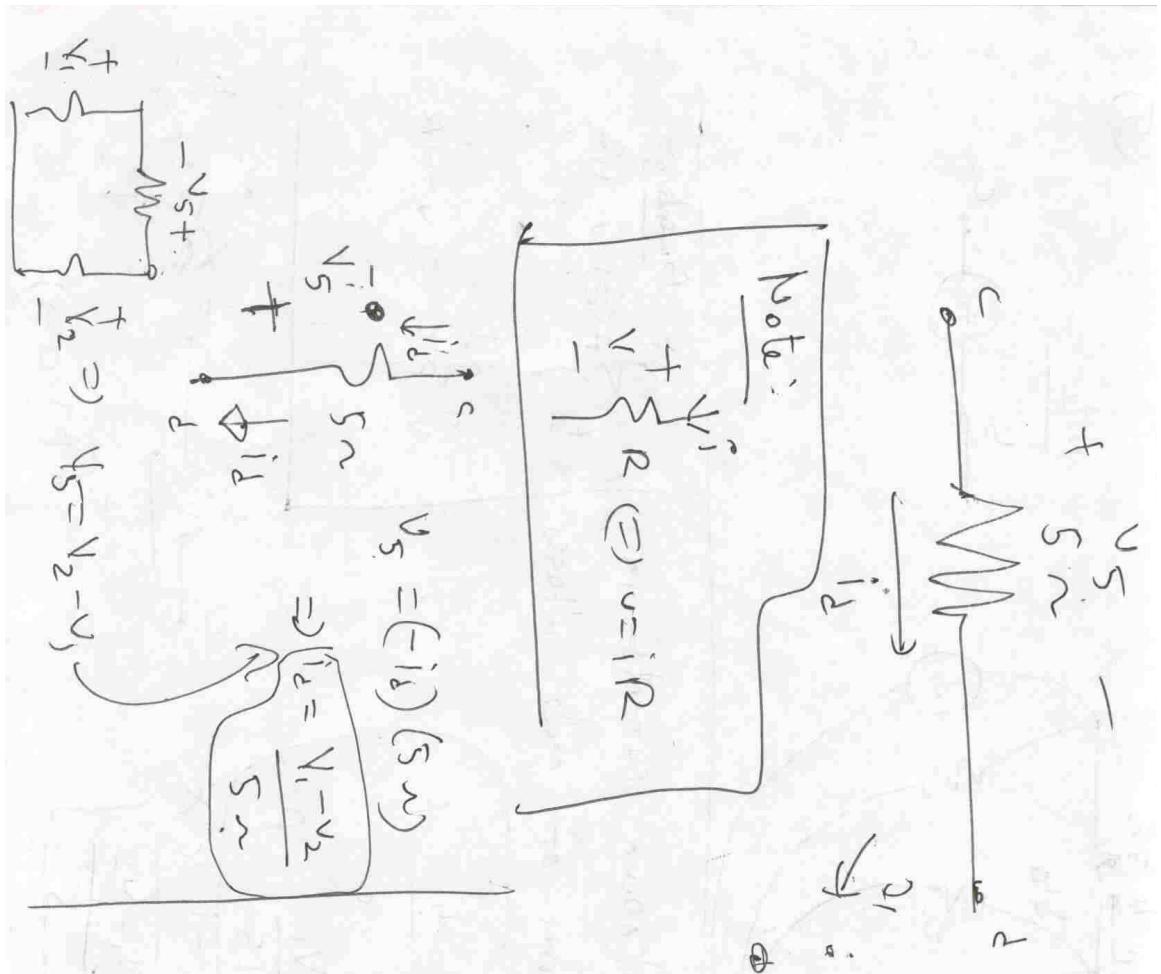
Step 4

$$i_1 = \frac{V_1}{6} \text{ A}$$

$$i_c = \frac{V_1}{15} \text{ A}$$

$$i_d = 15 - i_1 - i_c$$

$$i_2 = \frac{V_1 - V_2}{5}$$



$$i_2 = -\frac{v_2}{2}$$

$$v_2$$

$$i_2 = -\frac{v_2}{2}$$

$$i_2 \uparrow$$

⊗

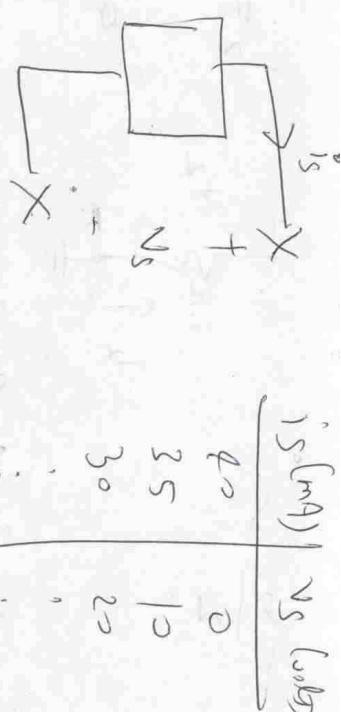
$$\begin{aligned} 15 &= i_1 + i_2 + i_3 \\ 5 &= i_2 + i_2 \\ &\Rightarrow \frac{v_1}{60} + \frac{v_1}{15} + \frac{v_1 - v_2}{5} = 15 \end{aligned}$$

$$\Rightarrow \left(\frac{1}{60} + \frac{1}{15} + \frac{1}{5} \right) v_1 + \left(-\frac{1}{5} \right) v_2 = 15$$

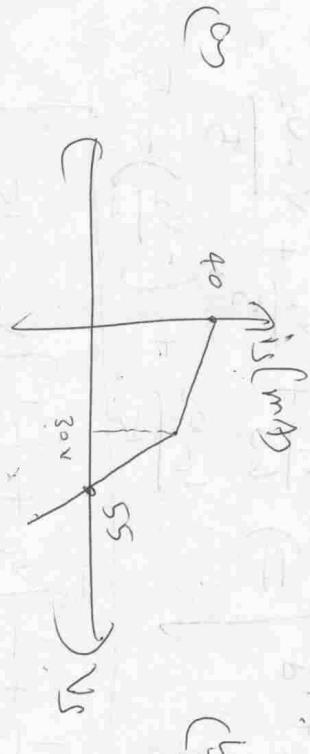
$$\left(\frac{1}{60} + \frac{1}{15} + \frac{1}{5} \right) v_1 + \left(-\frac{1}{5} \right) v_2 = 15$$

⊗

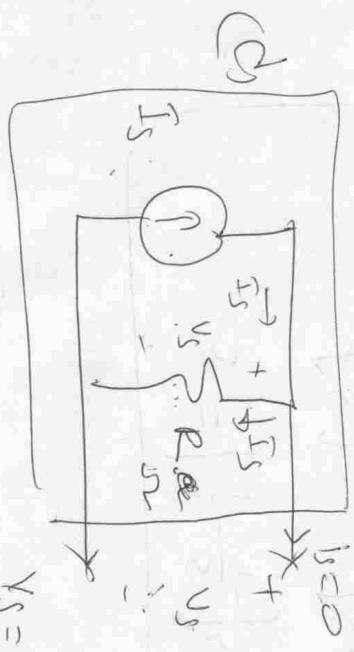
(2.17)



(c)

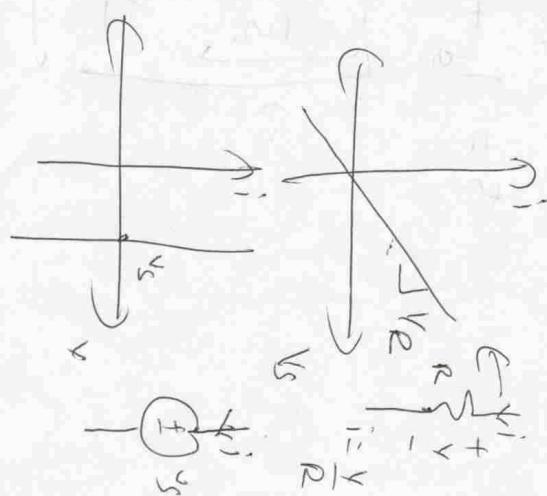


(d)

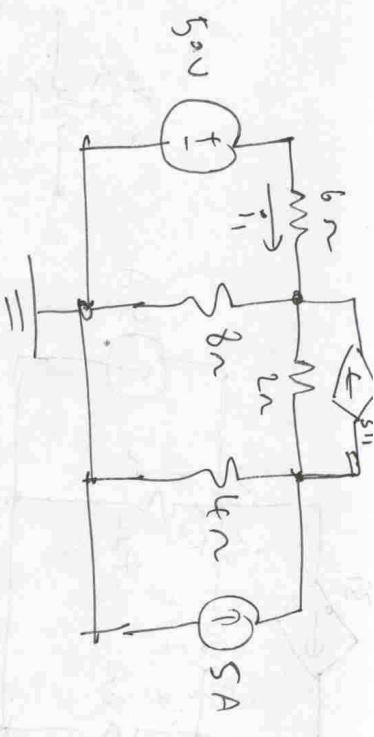


$$V_S = I_S R$$

(8)



D(4.7)



Newton
VS

$$\text{Lienarity} = \frac{d}{dx}$$

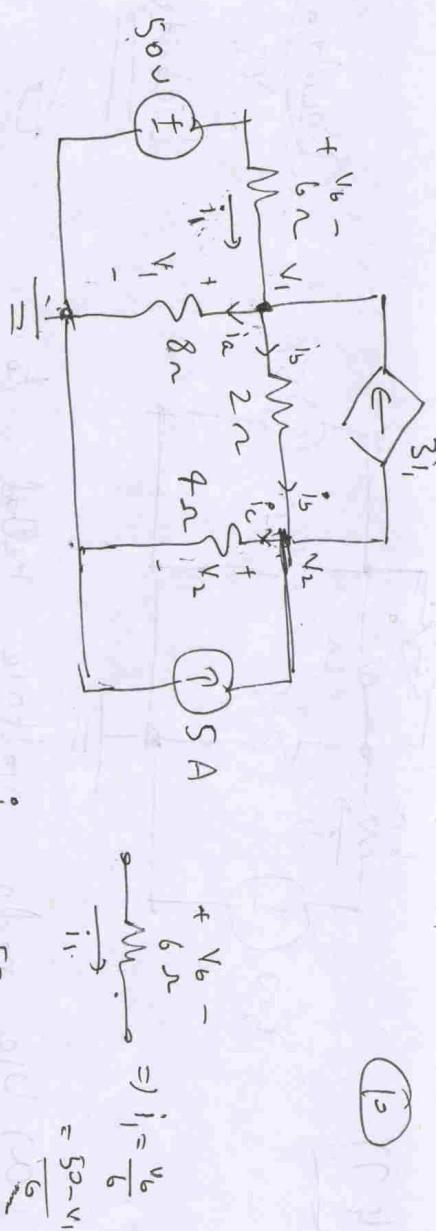
(4)

(a) Use node voltage method to

find the power associated with each source

in the circuit shown.

(4.7.2)



KCL @ V₁: $i_1 + 3i_1 = i_a + i_b$

$$\Rightarrow \left[\frac{50 - V_1}{6} + 3\left(\frac{50 - V_1}{6}\right) = \frac{V_1}{8} + \frac{V_1 - V_2}{2} \right] \quad i_a = \frac{50 - V_1}{6}$$

$$i_1 = -\frac{50}{6} \times$$

$$i_1 = \frac{50 - V_1}{6} \quad \Rightarrow \quad i_1 = \frac{V_6 - V_1}{6}$$

KCL @ V₂: $i_1 + i_b = i_c + 3i_1$

$$95\% \text{ of}$$

$$\left[5 + \frac{V_1 - V_2}{2} = \frac{V_2}{4} + 3\left(\frac{50 - V_1}{6}\right) \right] \quad 98\% \text{ of}$$

points