Hilroy

80 Pages
27.6 cm x 21.2 cm

Ruled 7 mm • Ligné 7 mm

EXERCISE BOOK
CAHIER D'EXERCICES

NAME/NOM _____

SUBJECT/SUJET ELEC 201

ASSEMBLED IN CANADA WITH IMPORTED MATERIALS
ASSEMBLÉ AU CANADA AVEC DES MATIÈRES IMPORTÉES

12107

Overview

9/5/18

Reference Book

- "Fundamentals of Electric Circuits" - McGraw-Hill 6th ed.
  Alexander and Sadiku
- DeCarlo and Lin "Linear Circuit analysis" Oxford 2nd ed.

office hours

Virtual google meet

http://tinyurl.com/11-office-hour

Kaiser 3025

google docs poll
give
CWL ID not password
and email

LEC 1

9/7/18

ECT is a language

- Charge
- Current
- Voltage

Current (Flow of charge at a point)

3C/s ←⊖

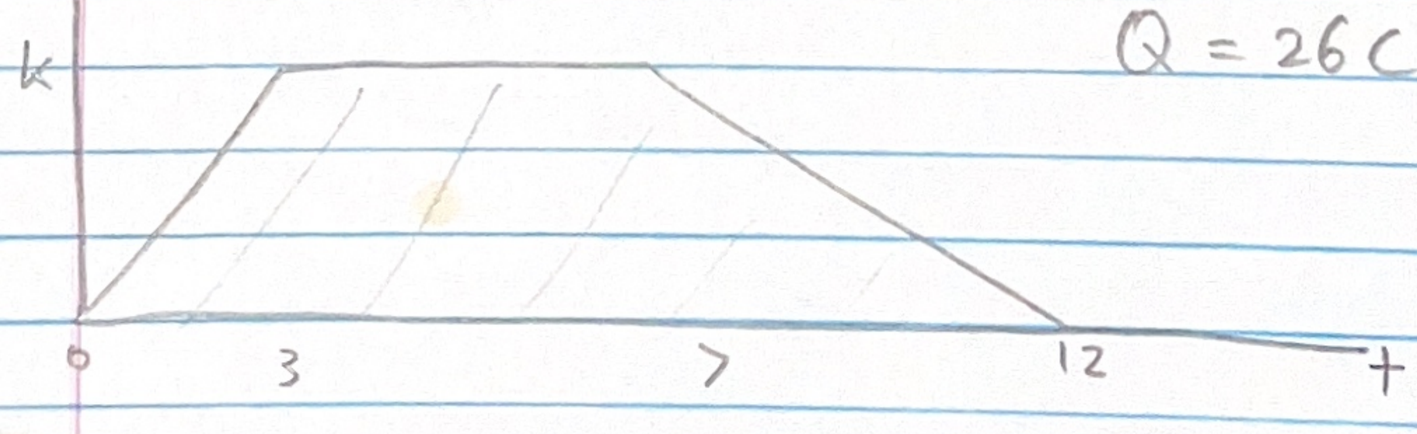
7C/s →⊕

= ⊕ → 10C/s

or

10A

$$i = \frac{dq}{dt}$$



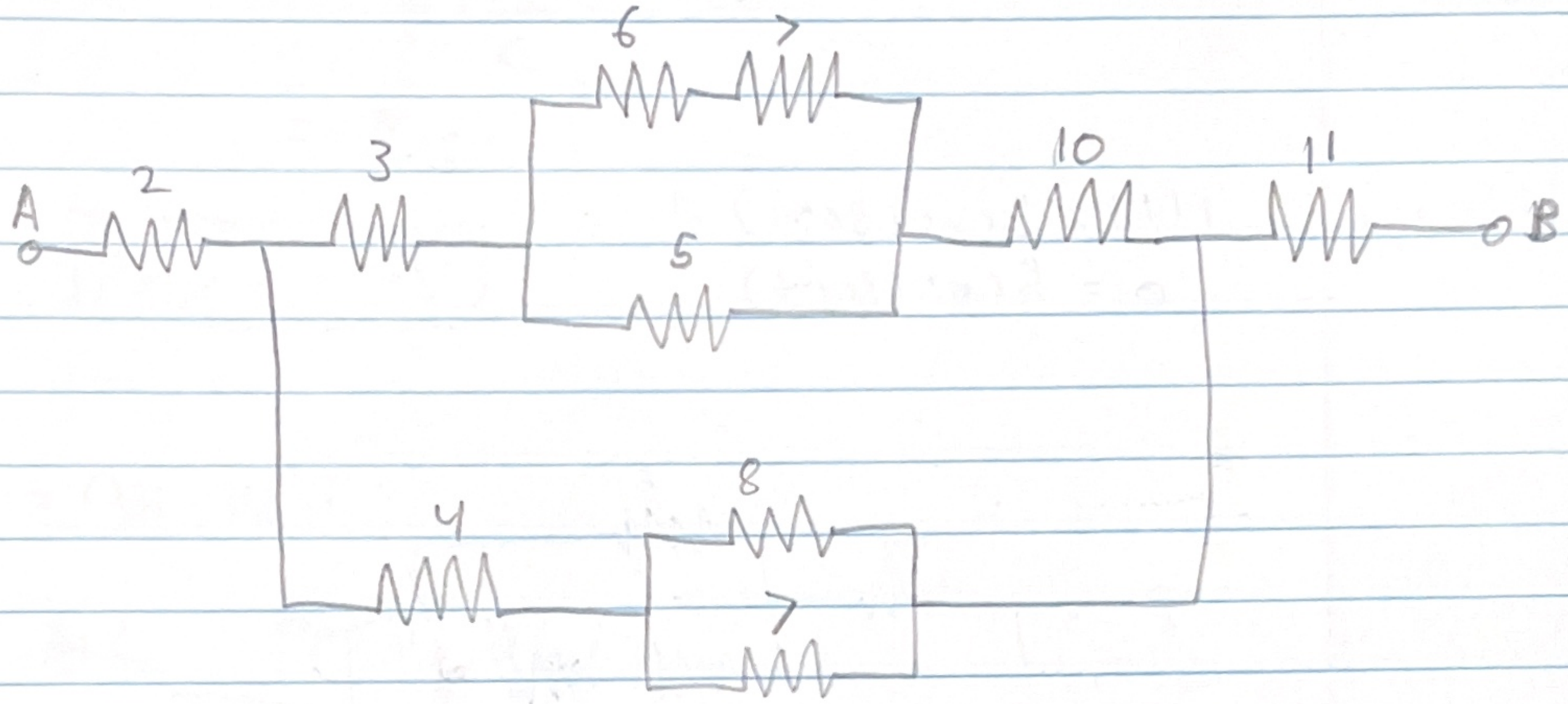
$Q = 26C$

$$\frac{3k}{2} + 4k + \frac{5k}{2} = 26$$

$$k\left(\frac{3}{2} + 4 + \frac{5}{2}\right) = 26$$

$$\therefore k = 3.25$$

$i(t) = 5\cos(300t)$ A



Ref:= 2+RR(4+RR(8,9), 3+RR((6+>,5)+10)+11

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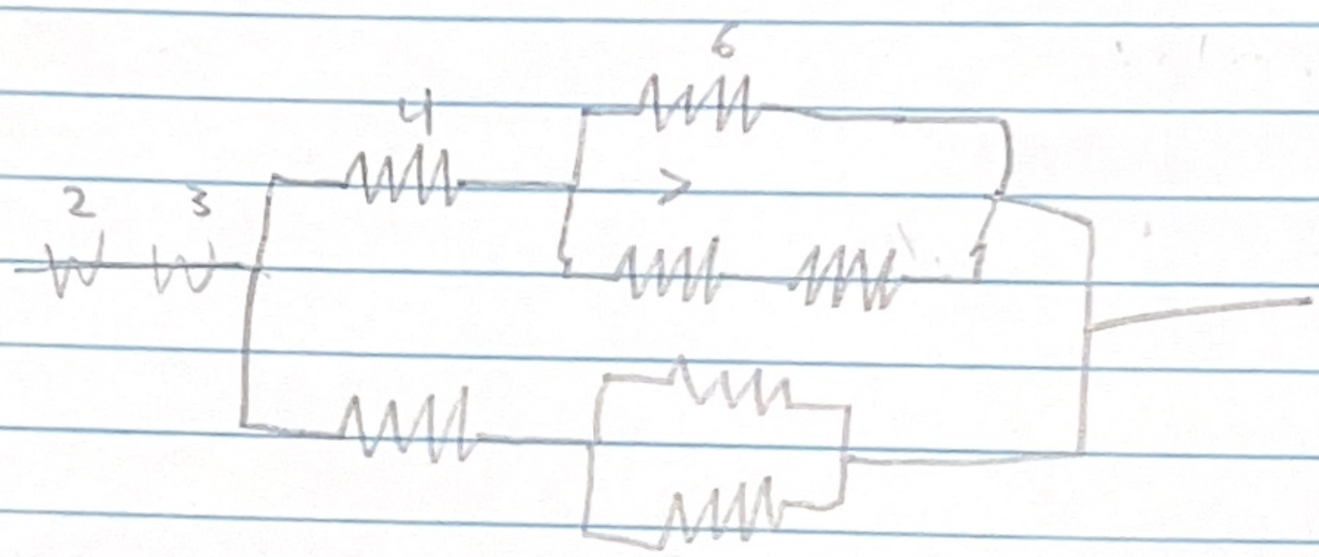
Example $i(t) = 5\cos(300t)$ A

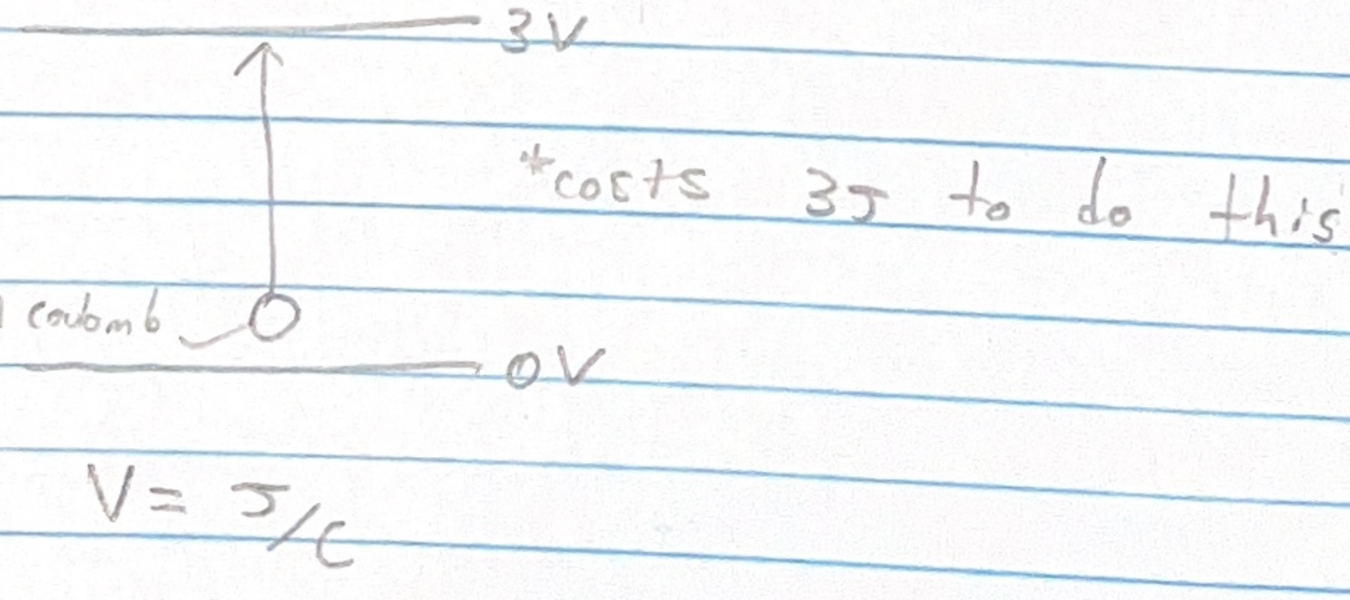
$\omega = 5\cos(300t)$



8.2

Voltage

- Difference of electric potential



$$\text{Power} = \frac{C}{s} \cdot \frac{J}{C}$$

$$= J/s$$

Power = iV

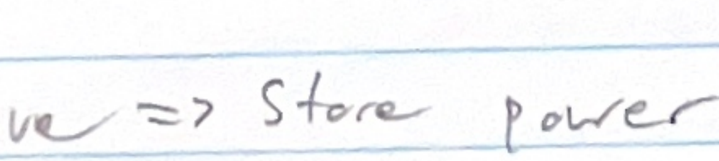
$P = (V_o - V_d)i$

CALC: $PP(V_o, V_d, i)$

Energy

$W = \int p\,dt$

Directions/Polarities/- sign



Components => linear one pair of terminals

Elements

Active => can deliver power ie: Batteries. Called sources

Passive => Absorb power ie: resistors

Reactive => Store power and deliver back to the circuit ie: inductors, capacitors

Resistance => opposition to currents i

Inductance => opposition to changes in currents $\frac{di}{dt}$

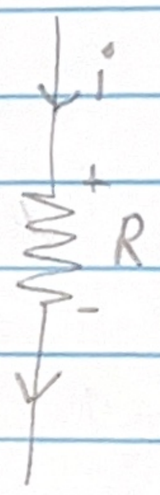
Capacitance => opposition to changes in voltages $\frac{dv}{dt}$

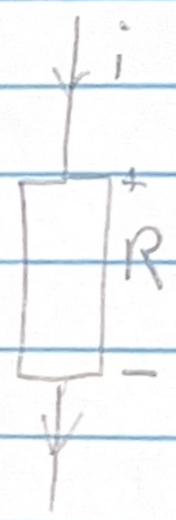
Ohm's Law

$$V = IR$$

$$I = \frac{V}{R}$$

$$R = \frac{V}{I}$$





European

Conductance

$$G = 1/R \quad \text{(in Siemens S)}$$

$$i = GV$$

Inductance

$$V = L\frac{di}{dt} \; ; \; \frac{di}{dt} = \frac{V}{L} \; ; \; i = \frac{1}{L}\int v\,dt$$

L in Henrys (H)

Capacitance

C in Farads (F)

$$i = C\frac{dv}{dt} \qquad V = \frac{q}{C}$$

$$v = \frac{1}{C}\int i\,dt \qquad q = CV$$

Resistors 2 Parameters

① Resistance
② Power Threshold

Inductors 2 Parameters

① Inductance
② Current threshold

Capacitors 2 Parameters

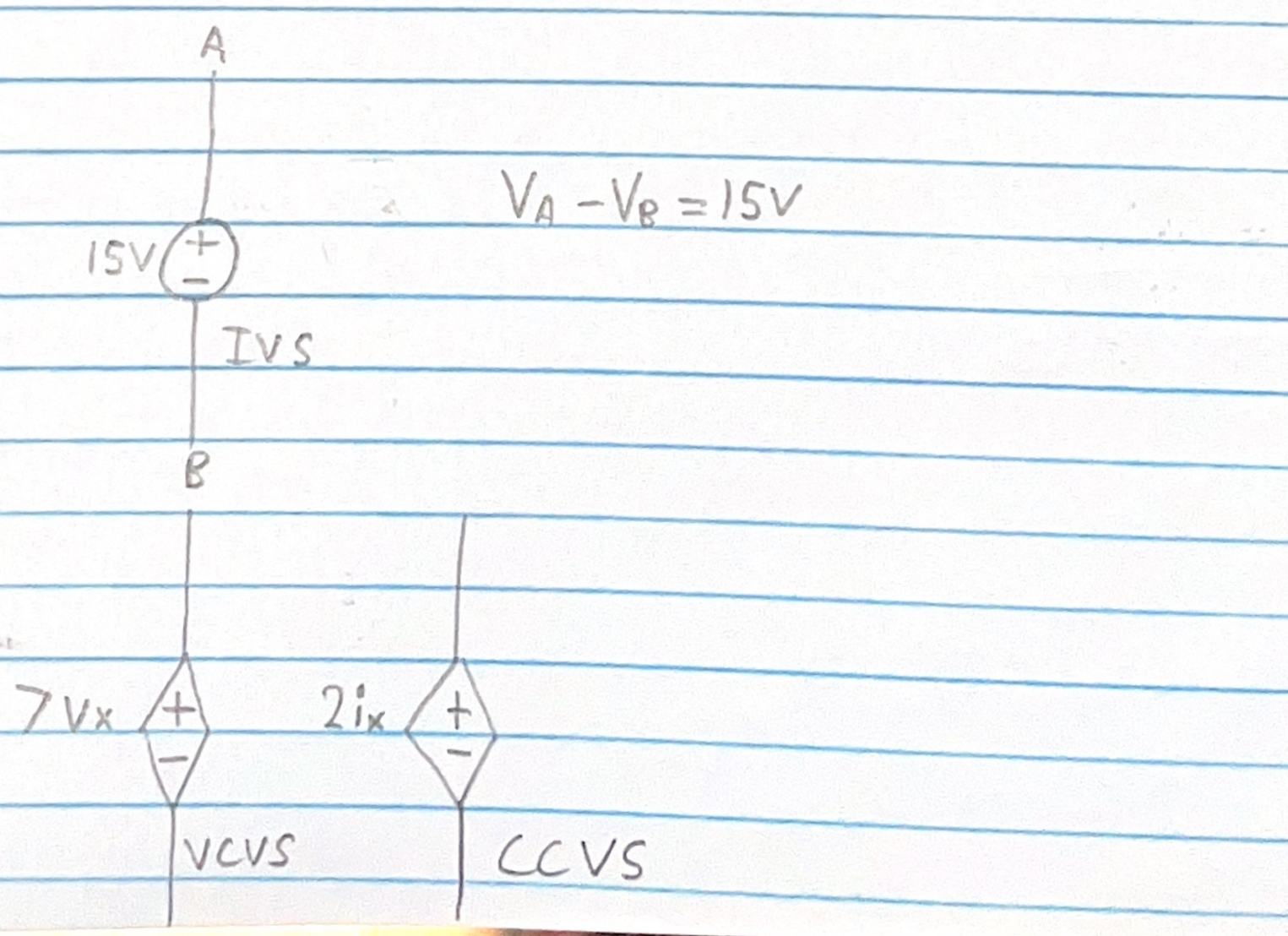
① Capacitance
② Voltage threshold

Active Sources

① Independent — Values don't depend on current/voltage

② Dependent/Controlled — Values depend on current/Voltage in the circuit

- Sources
  - independent
    - voltage
    - current
  - dependent
    - voltage
      - VCVS
      - CCVS
    - current
      - VCCS
      - CCCS



$V_A - V_B = 15V$

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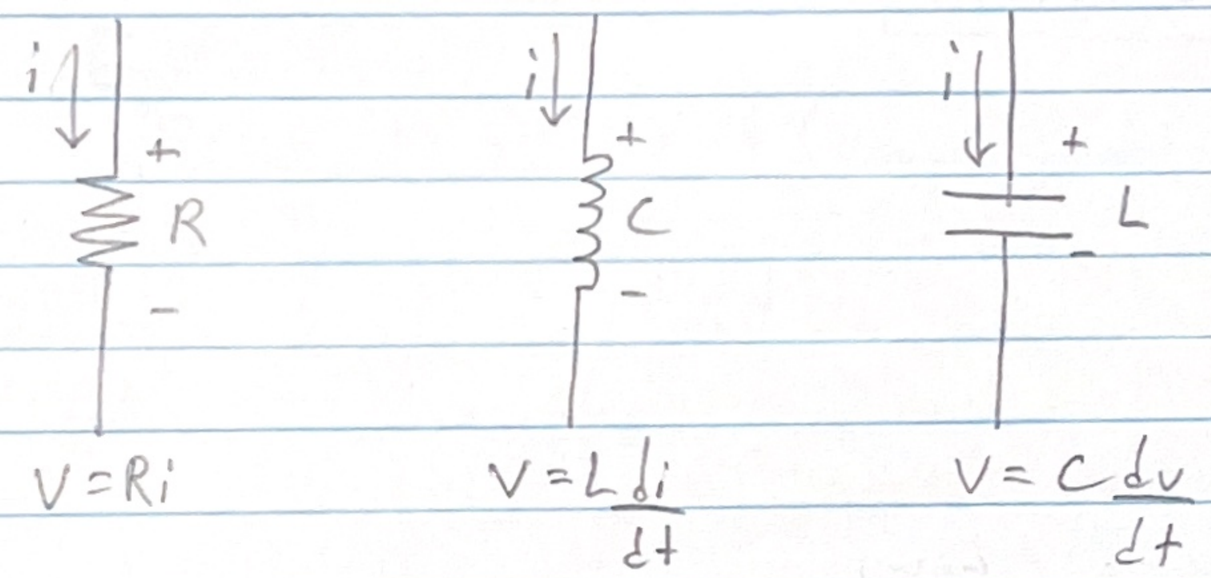
q C

i C/s

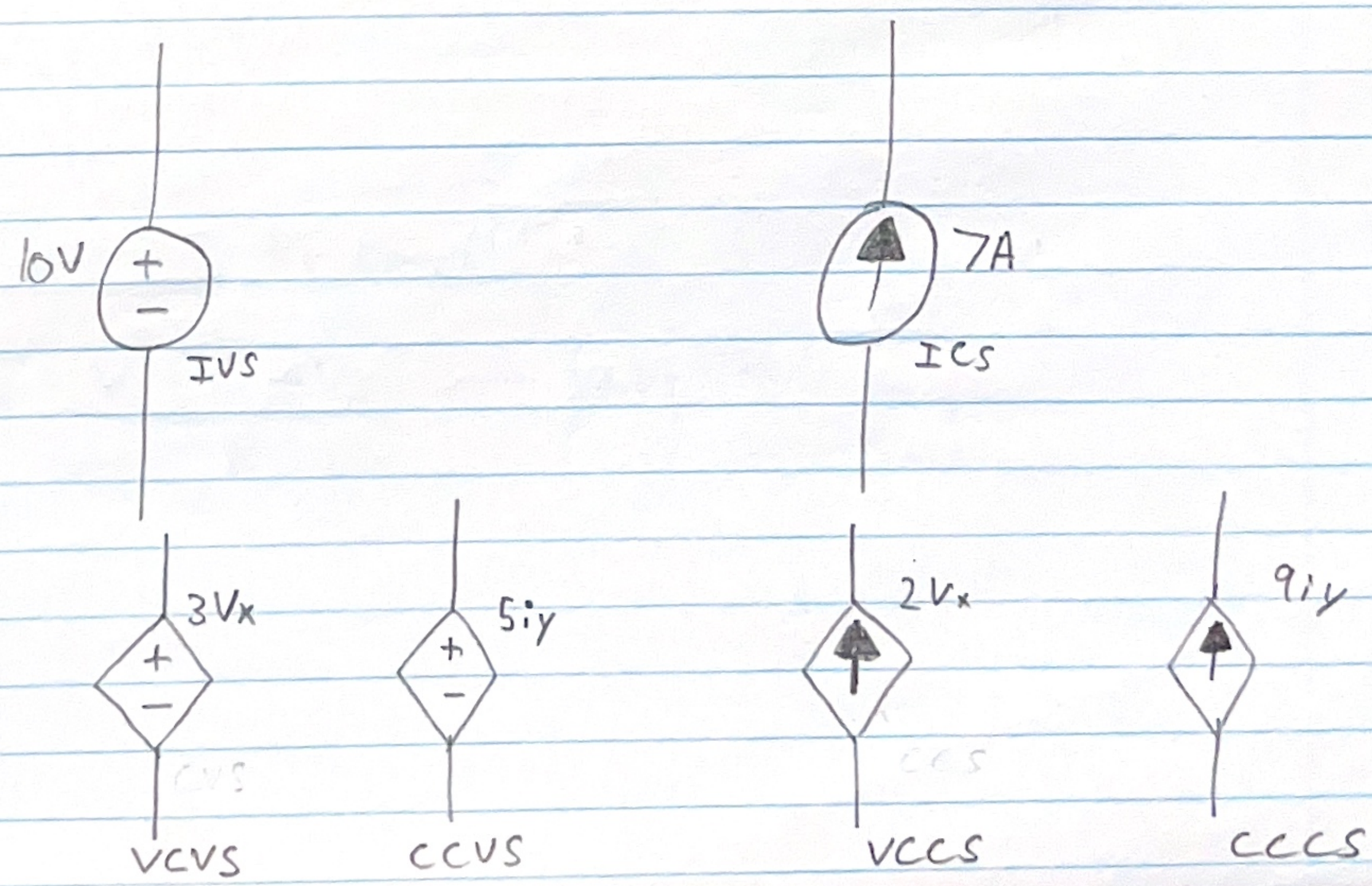
- Current flowing downhill is absorbing ie: resistor
- uphill is delivering power

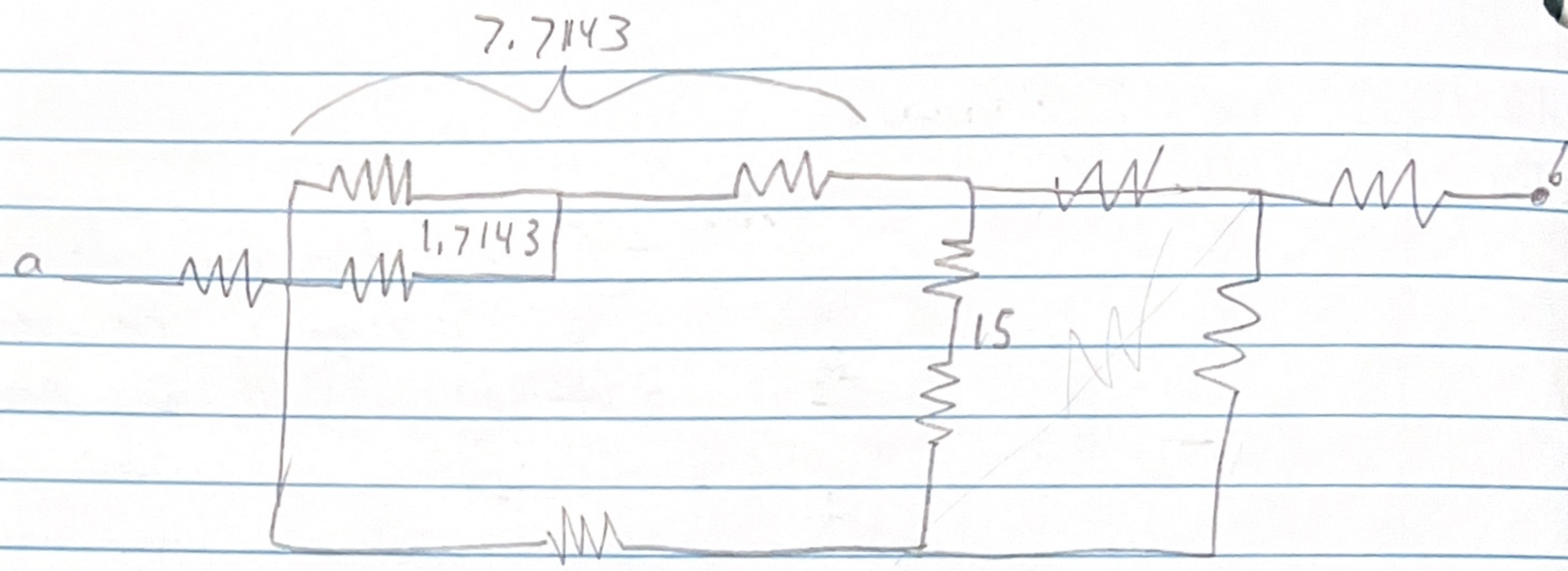
V J/C

P W = iV



Sources (Ideal) //round



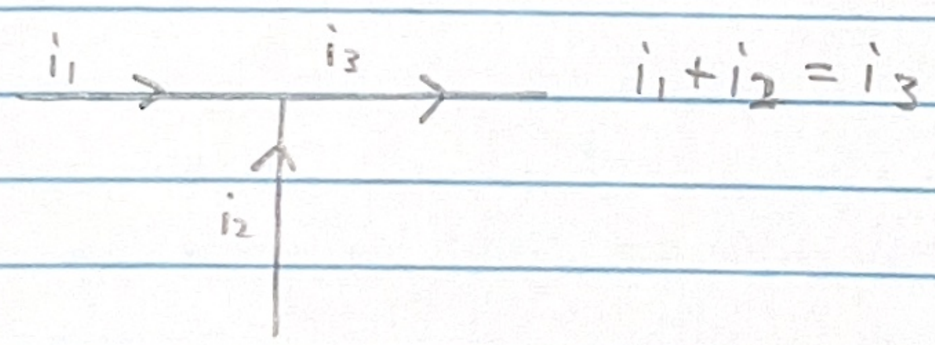


Kirchoff's Laws

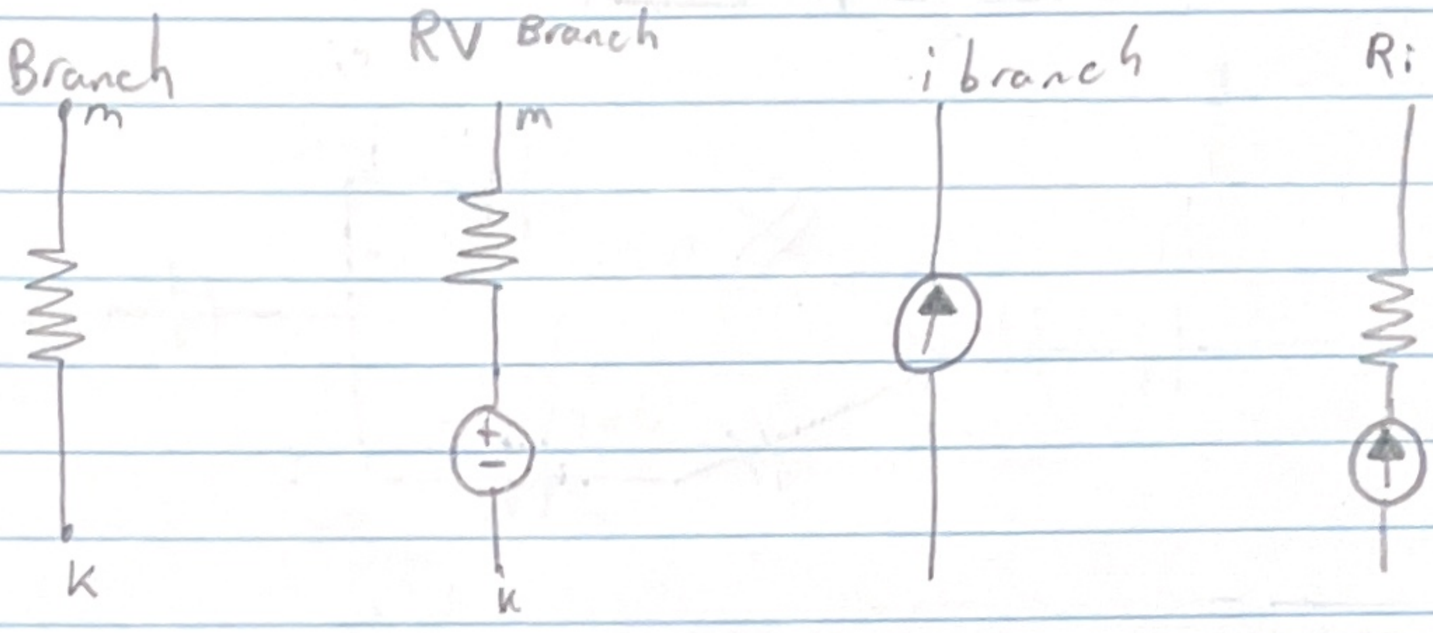
KVL (Voltage Law)

$$\sum_{loop} V = 0$$

KCL (Current Law)



Types of Branches



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Current in R Branch

$$I = \frac{V_o - V_d}{R}$$

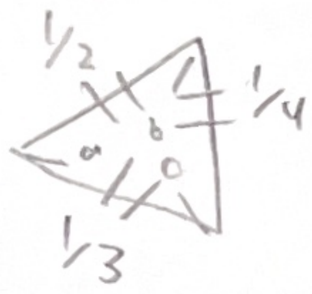
Current in RV Branch

$$I = \frac{V_o - V_d \pm V_s}{R} \quad \begin{cases} +V_s : \text{Helping} \\ -V_s : \text{Opposing} \end{cases}$$

$\sqrt{1}$

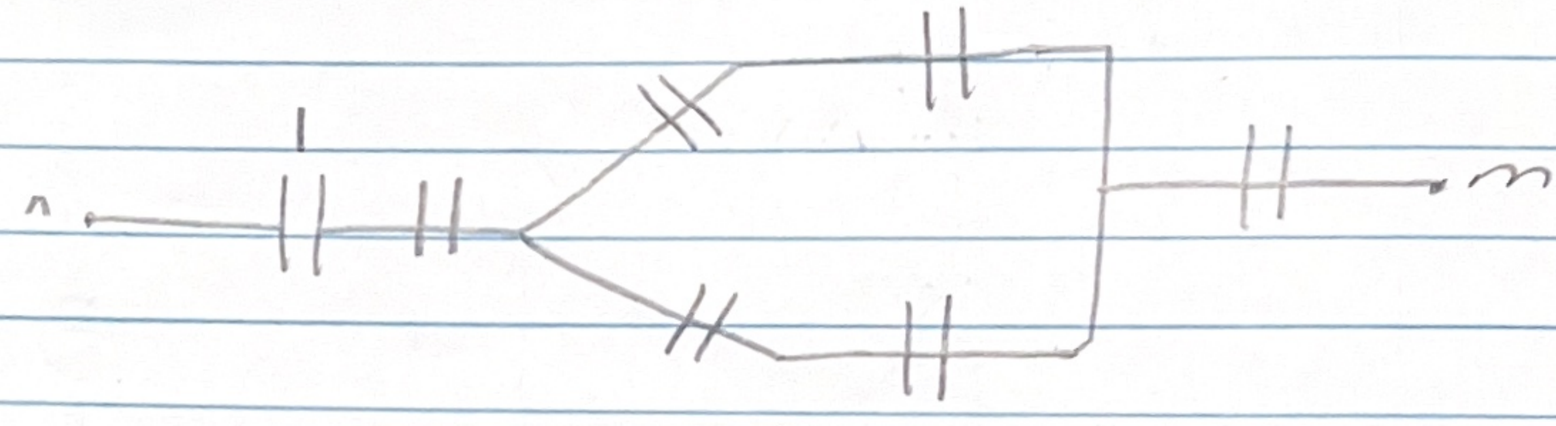
↑

must be lowercase



$$a = \frac{(\frac{1}{2})(\frac{1}{3})}{\frac{1}{2}+\frac{1}{3}+\frac{1}{4}} = 0.1538 \qquad c = \frac{(\frac{1}{3})(\frac{1}{4})}{\frac{1}{2}+\frac{1}{3}+\frac{1}{4}} = 0.1154$$

$$b = \frac{(\frac{1}{3})(\frac{1}{4})}{\frac{1}{3}+\frac{1}{2}+\frac{1}{4}} = 7.6923 \times 10^{-2}$$



Top Hat

$V_1 = -1.\overline{11}$ $\quad i_x = 6.698412$

$V_2 = 29.381$ $\quad V_y = 3.\overline{88}$

$V_3 = 3.\overline{88}$ $\quad i_e = -0.3015873$

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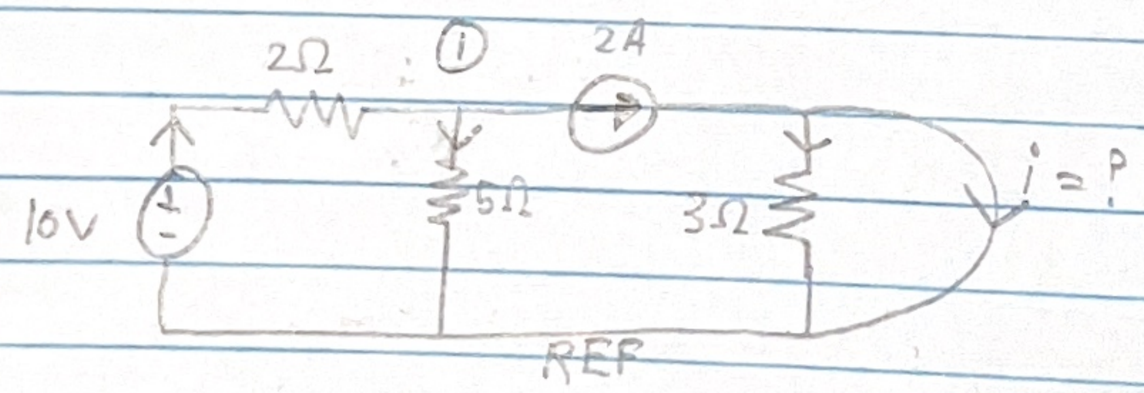


$$V_1: \frac{V_{REF}-V_1+10}{2} = \frac{V_1-V_{REF}}{5}+2$$

$$\frac{-V_1+10}{2} = \frac{V_1}{5}+2$$

$$\frac{-V_1}{2}+5 = \frac{V_1}{5}+2$$

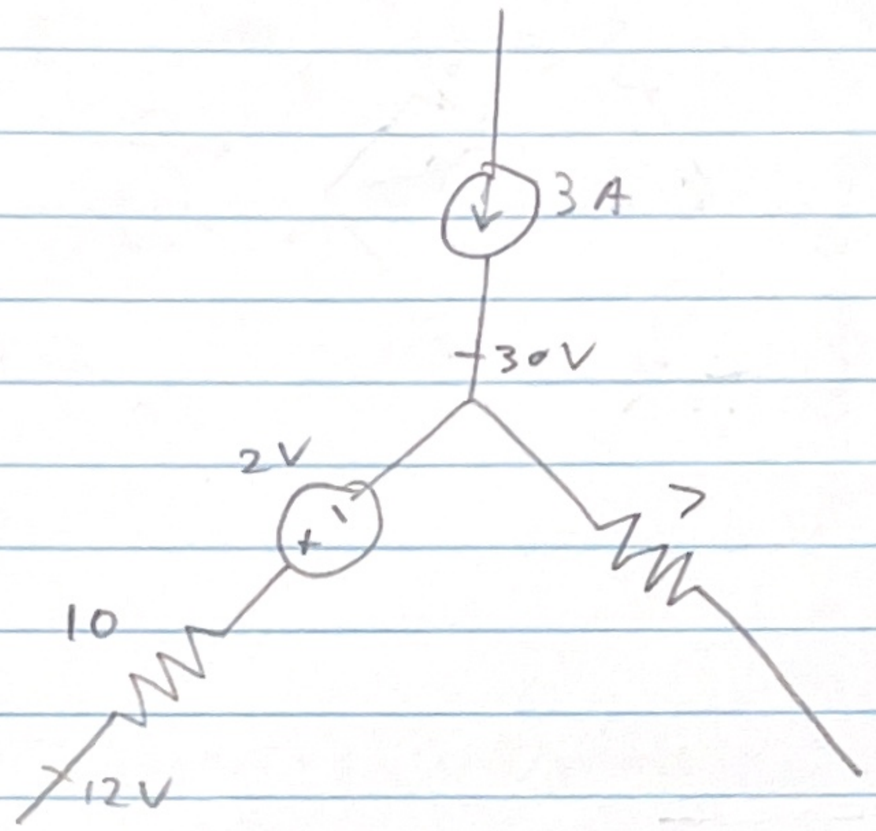
$$\frac{V_1}{5}+\frac{V_1}{2} = 3$$

$$\frac{2V_1}{10}+\frac{5V_1}{10} = 3$$

$$\frac{7V_1}{10} = 3$$

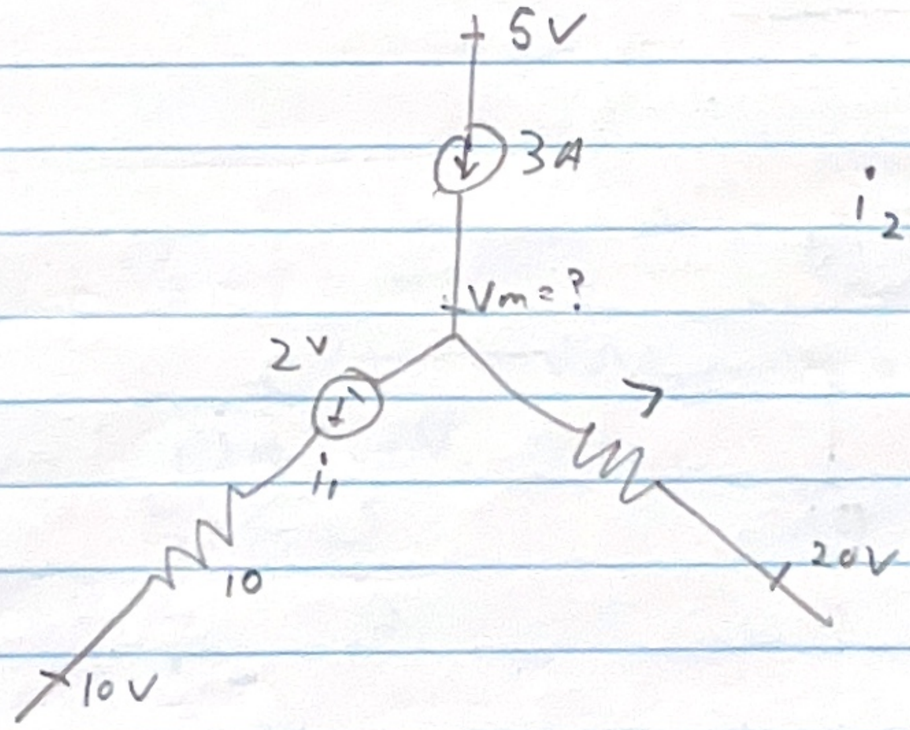
$$V_1 = \frac{10}{7}(3)$$

$$V_1 = \frac{30}{7}\,V$$



$$i = \frac{V}{R} = \frac{32-12}{10} =$$

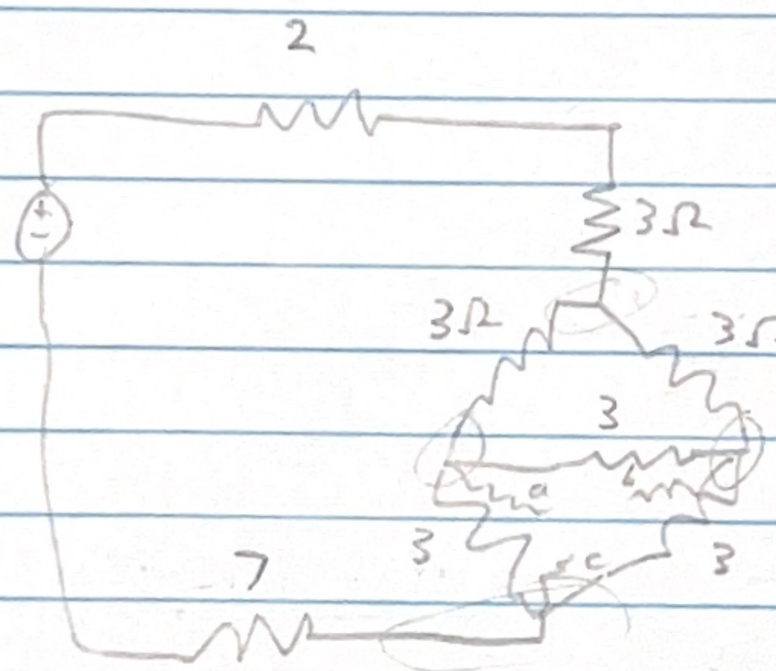
$$\frac{(Vm+2)-10}{10} = i_1$$



$$i_2 = \frac{Vm-20}{7}$$

$$\frac{Vm-20}{7} + \frac{Vm-8}{10} = 3$$

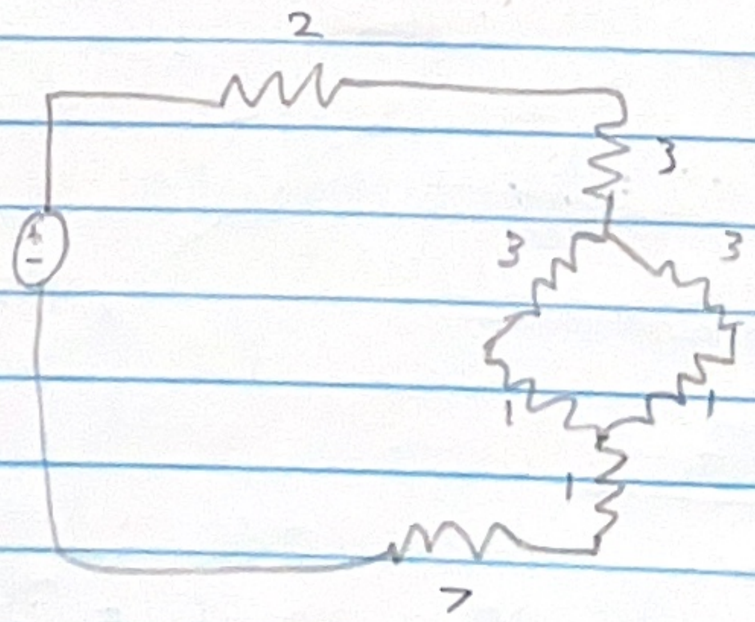
$$\frac{Vm}{7} - \frac{20}{7} + \frac{Vm}{10} - \frac{8}{10} = 3$$

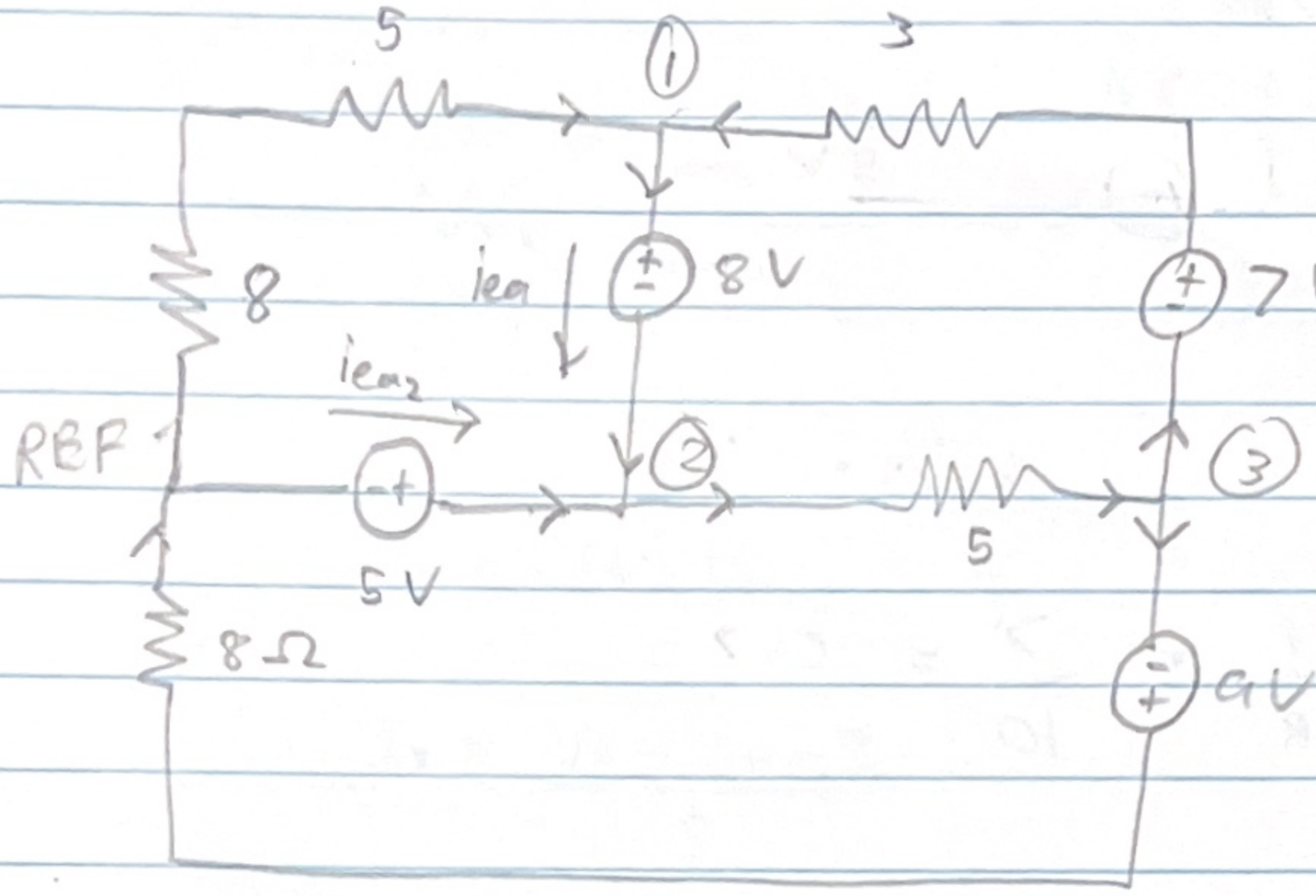


$$b=c=a=\frac{(9)(9)}{27}$$

$$a,b,c=\frac{(3)(3)}{9}$$

$$=1$$





$$V_1: \frac{V_{Ref} - V_1}{13} + \frac{V_3 - V_1 + 7}{3} = i_{ea}$$

$$V_2: i_{ea_2} + i_{ea} = \frac{V_2 - V_3}{5}$$

$$V_3: \frac{V_2 - V_3}{5} = \frac{V_3 - V_1 + 7}{3} + \frac{V_3 - 0 + 9}{8}$$

$i_{ea}: V_2 + 8 = V_1$ Known

$V_2 = 5V$

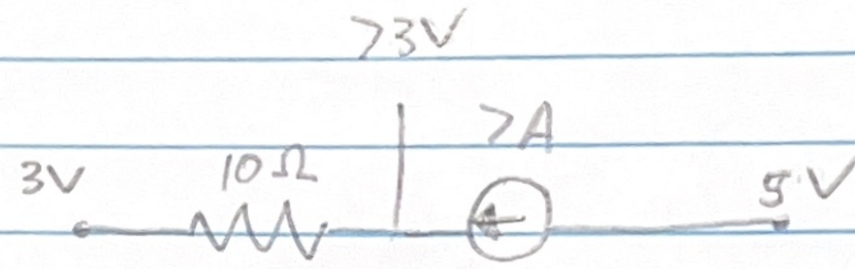
$i_{ea_2}: 0 + 5 = V_2$

$A = V_1$

$B = V_3$

$C = i_{ea}$

$D = i_{ea_2}$



$P_S = ?$

$$V = \frac{i}{R} = \frac{?}{10} = 0.?$$

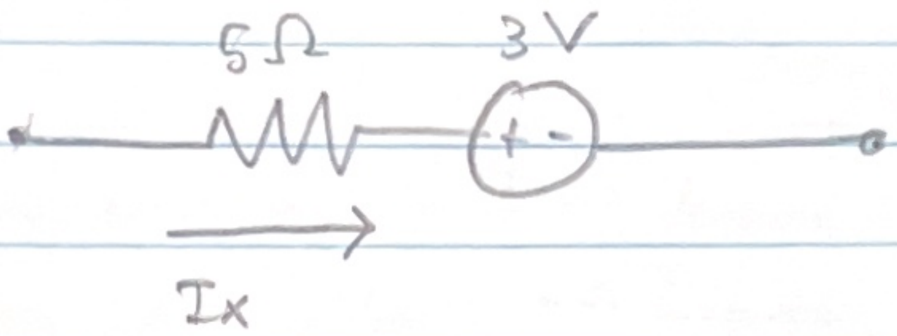
~~$V = 5 - 3.7 = 1.3$~~

$P = iV$
$= (7)(1.3)$
$= 9.1\,W$

$V = IR = 70V$

$V = 5 - 73 = -68$

$P = iV = -68.?$



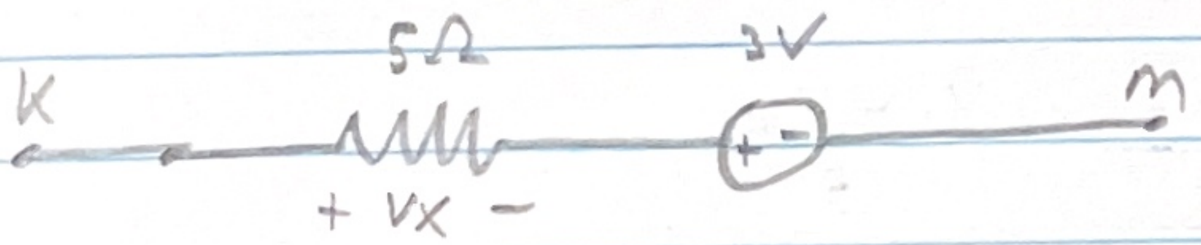
$$I_x = f(V_k, V_m)$$

$$I_x = \frac{V_k - V_m - 3}{5}$$

$$I_x = \frac{V_k}{5} - \frac{V_m}{5} - \frac{3}{5}$$

$$a = \frac{1}{5} \qquad b = \frac{-1}{5} \qquad c = \frac{-3}{5}$$

$$p = 0.024$$



$V_m + 3 + V_x = V_k$ $\qquad a = -1$

$\qquad\qquad b = 1$

$V_m + 3 + V_x - V_k = 0$ $\qquad c = 3$

Modified Nodal Analysis

Unknowns

1. Voltages of true nodes (KCL)
2. Controlling Variables (CTL)
3. Evil currents (EVL)

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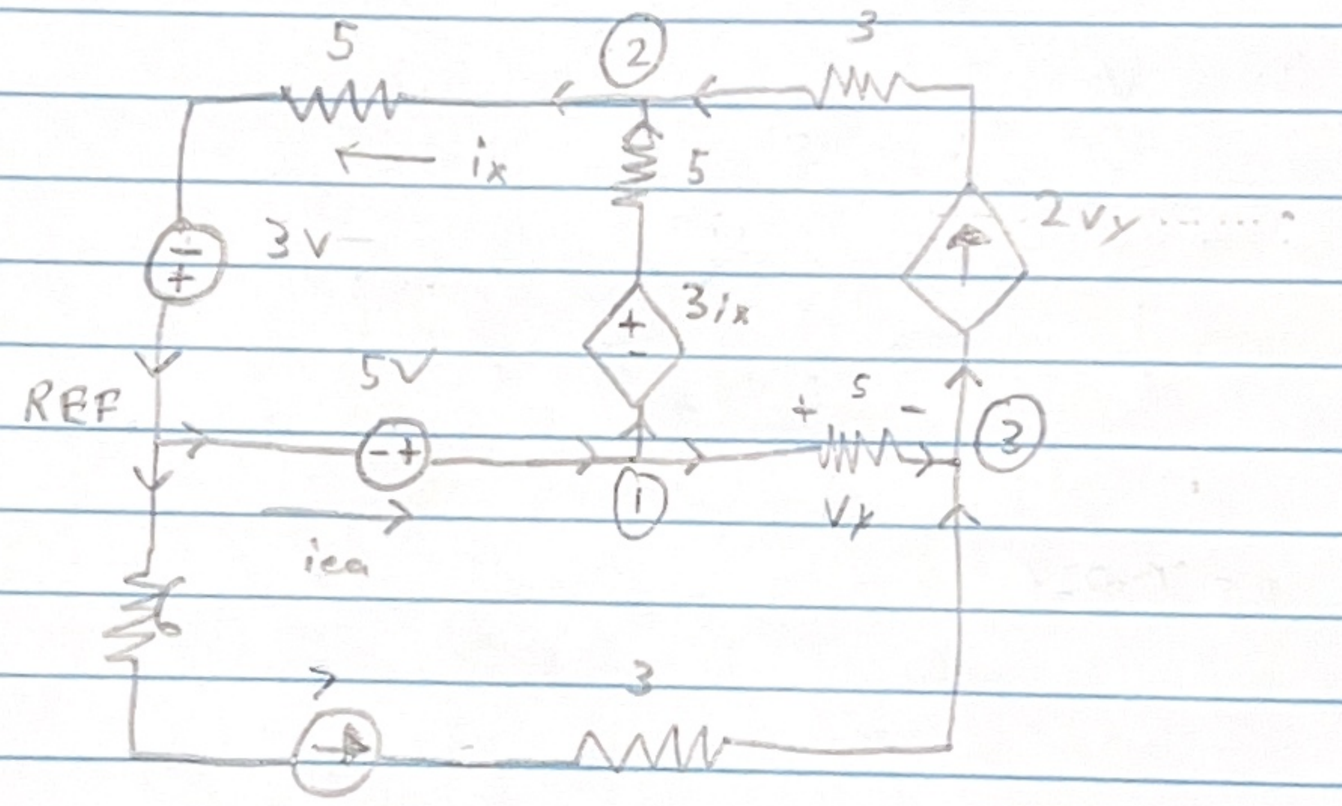


V_1 : $i_{EA} = \frac{V_1 - V_2}{5} + \frac{V_1 - V_2}{5}$

V_2 : $\frac{V_1 - V_2}{5} + 2V_y = i_x$

V_3 : $\frac{V_1 - V_3}{5} + 7 = 2V_y$

CTL$_1$: $V_1 - V_y = V_3$

CTL$_2$: $i_x = \frac{V_2 - V_{ref} + 3}{5}$

$V_1 = 5$

A $V_2 = 14$

B $V_3 = 2.4$

C $i_x = 3.4$

D $V_y = 2.6$

F $i_{EA} = -3.6$ ~~0.335~~ A

V
IR $I = \frac{V}{R}$

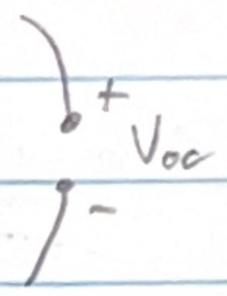
Thenevin and Norton Equivilants

Thenevin equivilant → Vsource

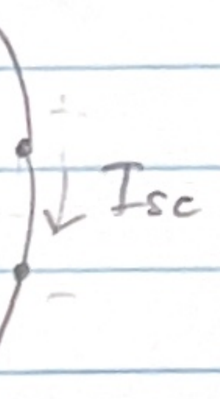
Norton equivilant → Isource

4 new Ideal Elements

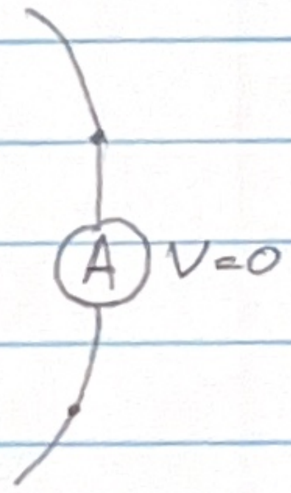
① open circuit eqn: $i = 0$



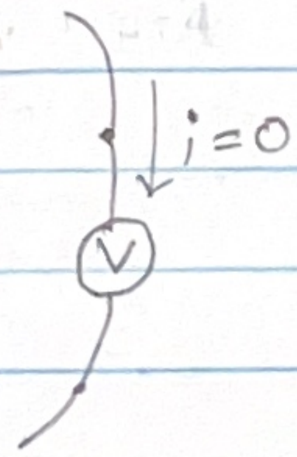
② Short circuit eqn: $V = 0$



③ Ideal Ammeter → shows current through it
(special short circuit)

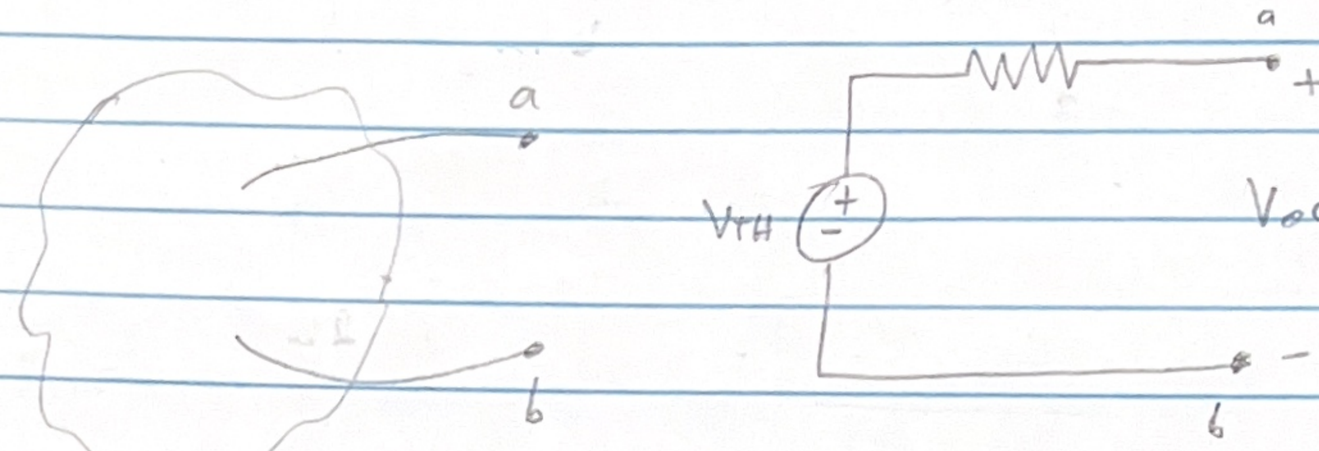


④ Ideal Voltmeter → shows voltage
(special open circuit)



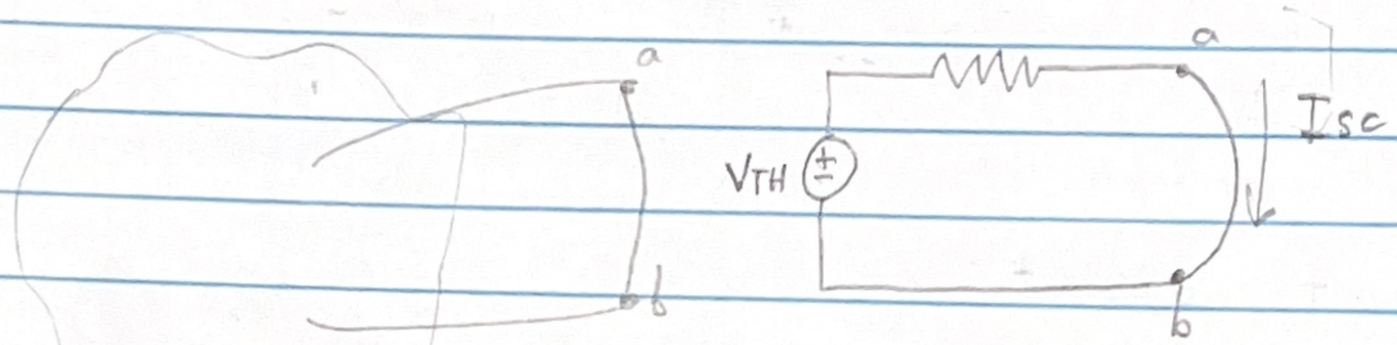
Classic method

OPEN TEST



$V_{oc} = V_{TH}$

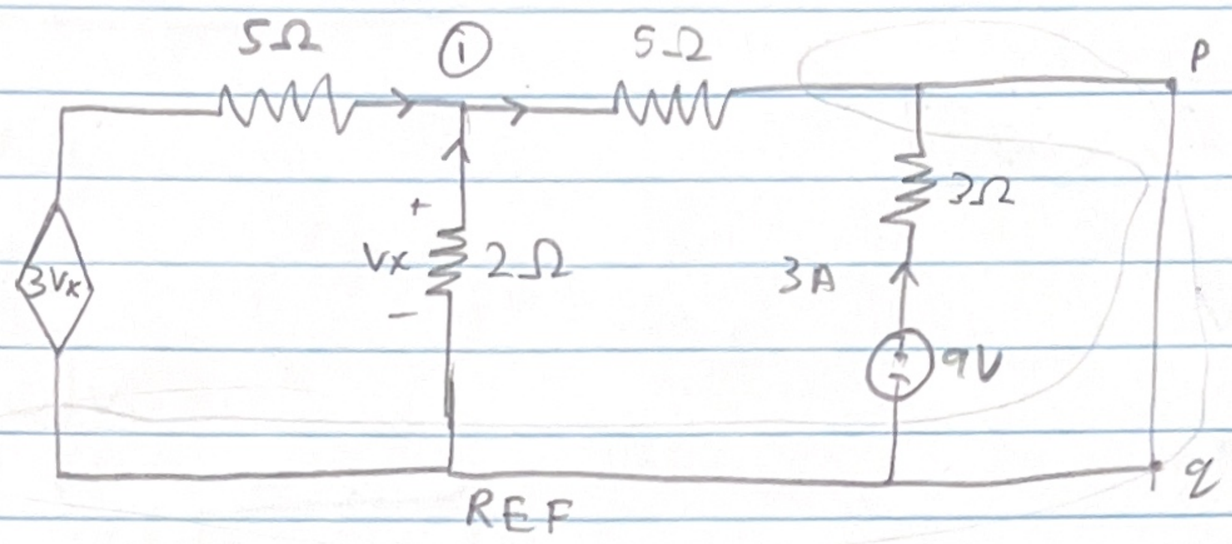
SHORT TEST



$$I_{sc} = \frac{V_{TH}}{R_{TH}}$$

$V_{TH} = V_{oc}$

$$R_{TH} = \frac{V_{TH}}{I_{sc}}$$



$$V_1: \frac{0 - V_1 + 3V_x}{5} + \frac{0 - V_1}{2} = \frac{V_1 - 0 - 9}{8}$$

CTL: $0 + V_x = V_1$

$V_x = 5$

$V_1 = 5$

$$\left(\frac{V_1 - V_0 - 9}{8}\right)(5) = -5/2$$

I * R

V / I R

$I = \frac{V}{R}$

$\frac{0 - 5 + 5 + 9}{3} = 3A$

$\frac{V_1 - 0}{5} = 1A$

Maximum power transfer Criterion

10/04/18

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Power formulas

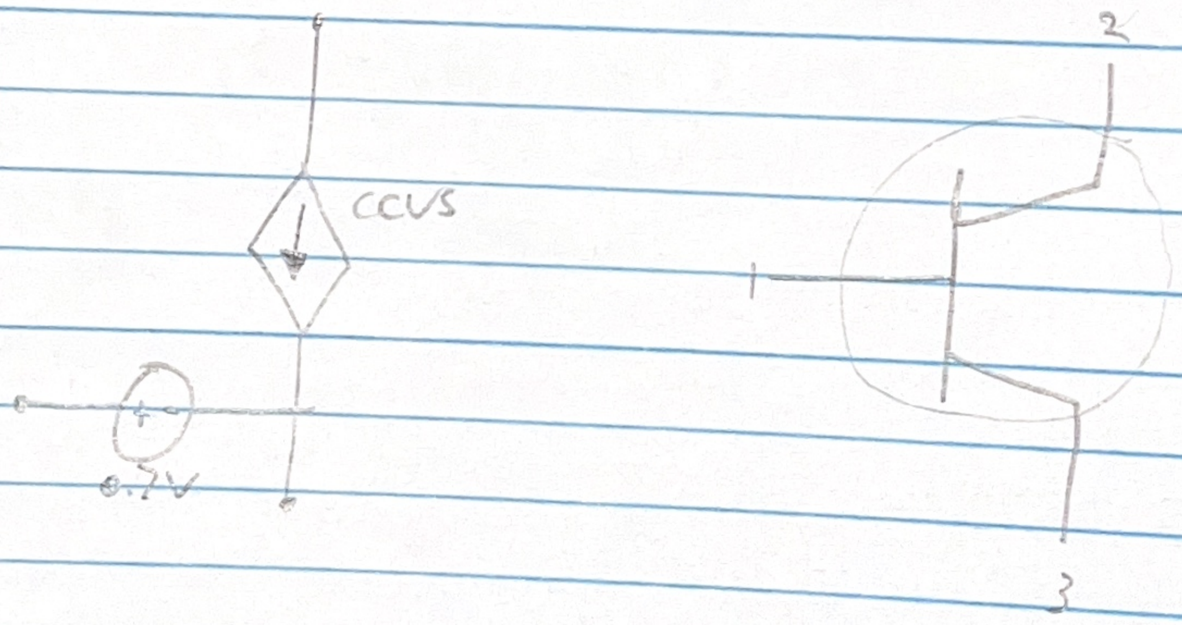
$P = IV$

$p = I^2 R$

$p = \frac{V^2}{R}$

For max power $R_x = R_{TH}$

Transistor



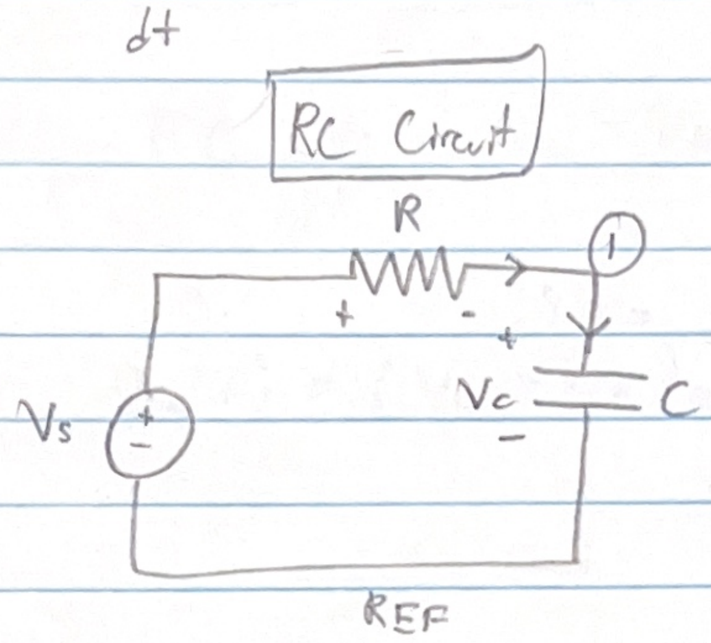
DE order = # of reactive elements

First order Circuits

$$V = L\frac{di}{dt}$$

$$i = C\frac{dv}{dt}$$

RC Circuit



$V_c = V_1 \qquad i_c = C\frac{dV_1}{dt}$

KVL: $V_S - R\,i - V_c = 0$

$$KCL_1: \frac{0 + V_S - V_1}{R} = C\frac{dV_1}{dt}$$

$$V_S - V_1 = RC\frac{dV_1}{dt}$$

$$V_S = V_1 + RC\frac{dV_1}{dt}$$ Constant coefficient 1st O; 1o DE

Exponential functions

$$i(t) = Ae^{-t/\tau}$$

$$i(t) = (I_o - I_f)e^{-t/\tau} + I_f$$