Issues: (1) Re-evaluate point breakdown (?)
(2) Tuesday, July 4th: LAB makeup (?)

Wednesday (06/28)

Overview of EE (90%)

- Linear
  - Systems theory
  - Non-linear

Mathematics

Circuit

Implementation

Chapter 2: Circuit Variables

(1.1) Overview of EE

Your circuit works because they are "lumped-parameter system"
\[(1.2) \rightarrow \text{SI units:}\]

\[
[V] = \text{volt} \equiv \frac{\text{d}q}{\text{d}t} = v
\]

\[
[I] = \text{ampere} \equiv \frac{\text{d}q}{\text{d}t} = i
\]

\[
P = \frac{\text{d}w}{\text{d}t} = \frac{\text{d}w}{\text{d}q} \cdot \frac{\text{d}q}{\text{d}t} = V \cdot I
\]

\[
[V] \, [I] = \text{watt (W)}
\]

\[
\text{Diagram:}
\]

\[
\text{Known:}
\]

\[
1 \text{ pico} = 10^{-12}
\]

\[
1 \text{ nano} = 10^{-9}
\]

\[
(1.3) \rightarrow \text{Circuit analysis}
\]

\[
\text{Find unknown quantities [V, I, P] in circuit}
\]
Step 1 in Circuit analysis: Get your circuit diagram. 99% of the time we will give it to you.

Step 2: Carry out the analysis 😊
You do this 😞 lose point!

Section 1.5.16: Ideal basic circuit element:

"Death Dealer"

Passive Sign Convention: A mathematical Convention to distinguish absorbing power from releasing power.
\[ i = \frac{6 \text{ V}}{2 \Omega} = 3 \text{ A} \] (Ohm's law)

\[ P_{\text{battery}} = V_i \]
\[ P_{\text{resistor}} = V_i \]
\[ = (6 \text{ V})(3 \text{ A}) = -18 \text{ W} \] (\(\infty\))
\[ = (6 \text{ V})(3 \text{ A}) = +18 \text{ W} \] (\(\infty\))

\[ P_{\text{battery}} = 18 \text{ W} \text{ delivered} \]
\[ P_{\text{resistor}} = 18 \text{ W} \text{ absorbed} \]
Example:
\[ P_1 = V \cdot I \]
\[ = (5 \, \text{V}) \cdot (-3 \, \text{A}) \]
\[ P_1 = -15 \, \text{W} \]

Example:
\[ P_1 = -V \cdot I \]
\[ = -(5 \, \text{V})(3 \, \text{A}) \]
\[ P_1 = -15 \, \text{W} \]

**Trick question:** Plot i-v graph for 9V battery.

\[ 9 \, \text{V} \]
Case (ii) \( i > 0 \)
\[ r = -vi = -9i \leq 0 \ (i > 0) \]

Case (iii) \( i < 0 \)
\[ r = -vi = -9i \geq 0 \ (i < 0) \]

Comment:

Recall:

\[ i = 3 \text{ A.} \]

Q1: Is \( i \) unique? A: Yes!

Q2: Can you give me a circuit that has no solution?
Example:

\[ V = 9 \text{ V} \]

KVL gives: \[ 9 \text{ V} = 0 \text{ V} \]

Q: Can you give me a circuit that has only one solution? Difficult.

Think about it.

[Yes, there is at least 1 circuit 😊]

On Wednesday: Chapter 2: Circuit Elements.

Note: Today was just a brief intro. If you are bored (or don't understand, it's OK. Hopefully HW 1 gets you going.)