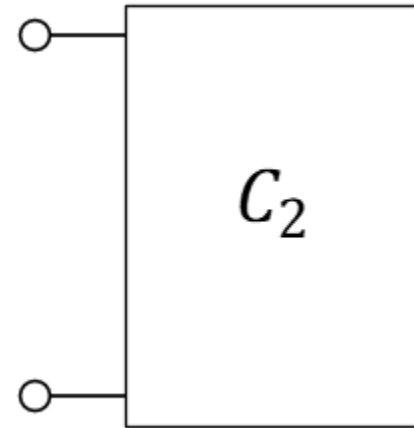
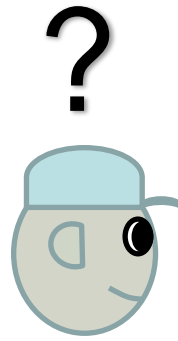




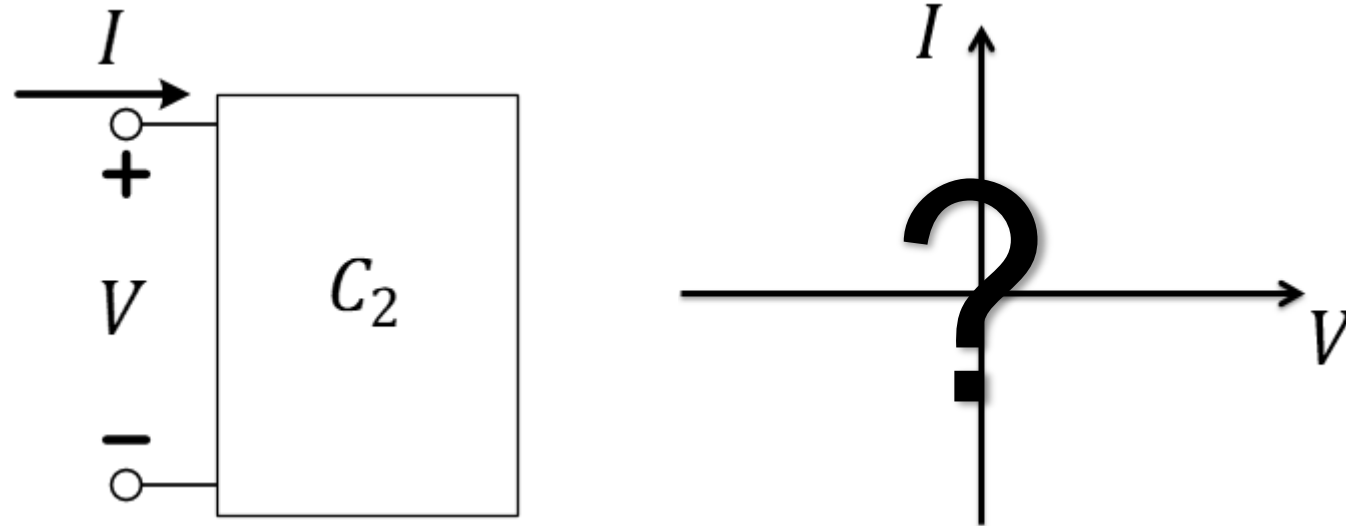
Lecture 11: IV Characteristics

- Measuring I-V Characteristics of Circuits
- Calculating I-V Characteristics of Linear Circuits
- Operating (I,V) point when Sub-circuits are Connected
- Power and the I-V Characteristics

What's in the Box?

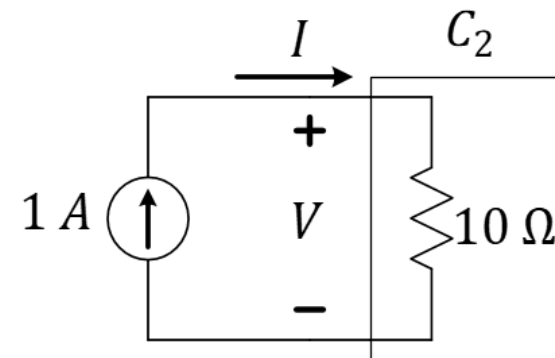
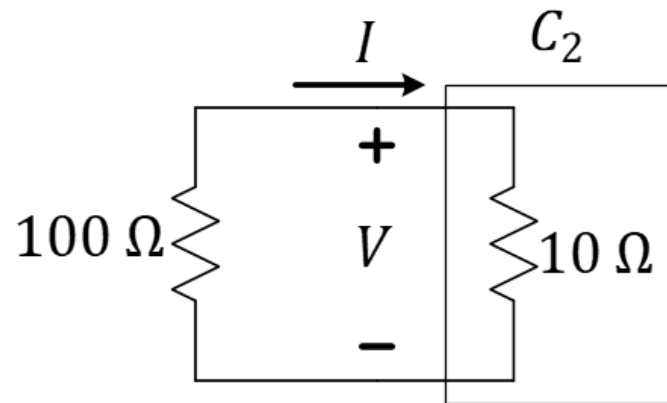
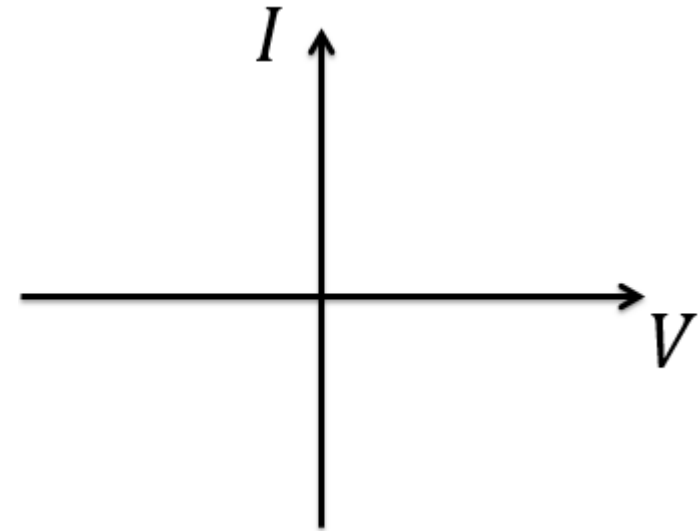
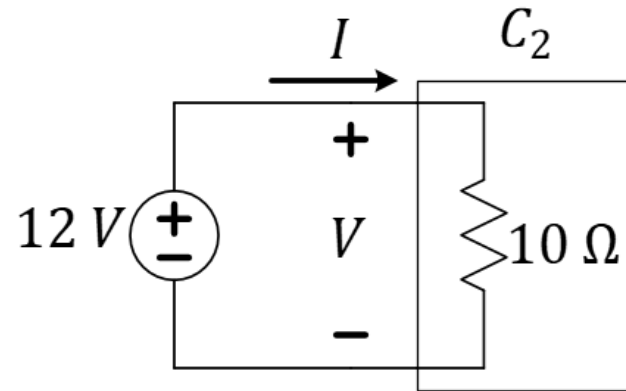
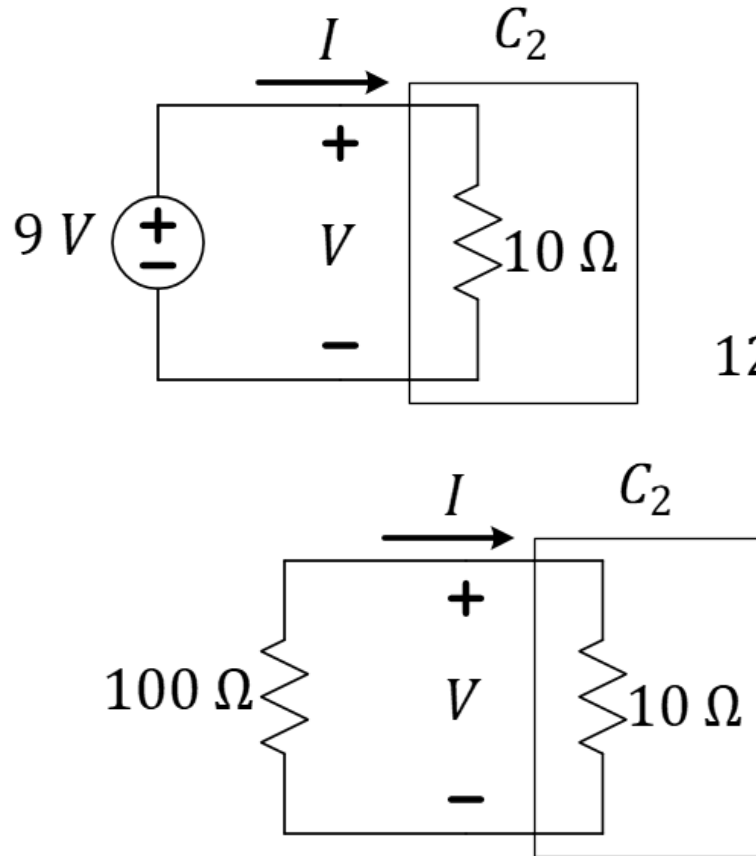


Can We Discover the IV Behavior?

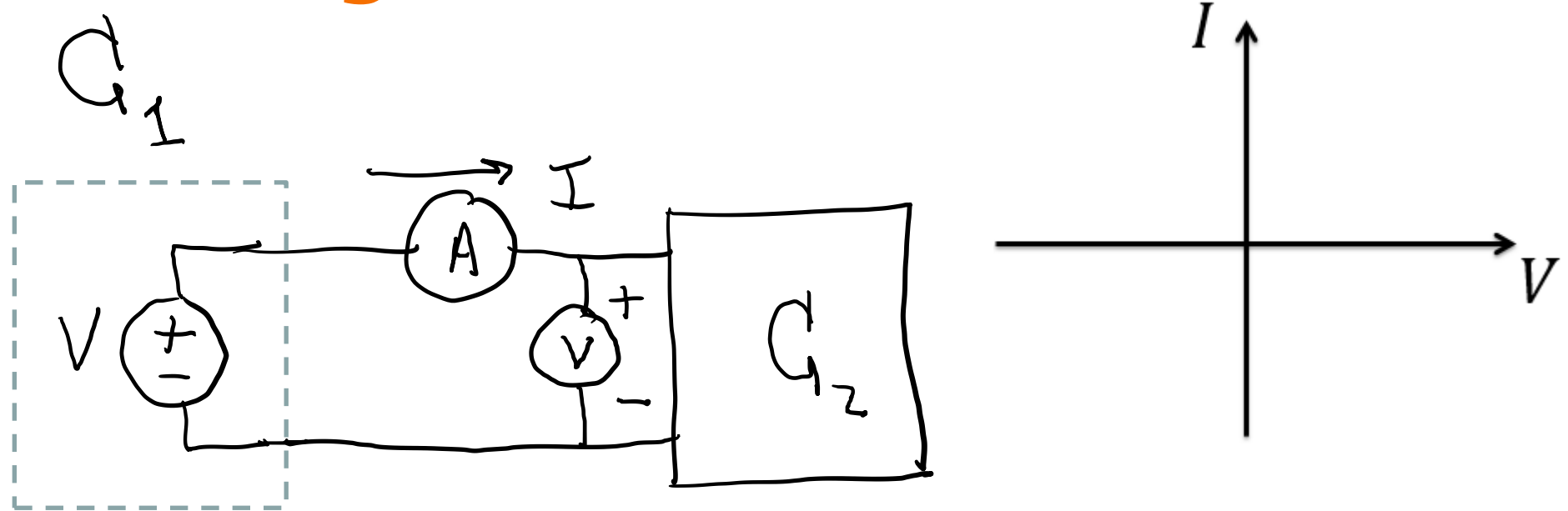


Example: C2 is a $10\ \Omega$ Resistor

Attach a bunch of things and take current-voltage data points!



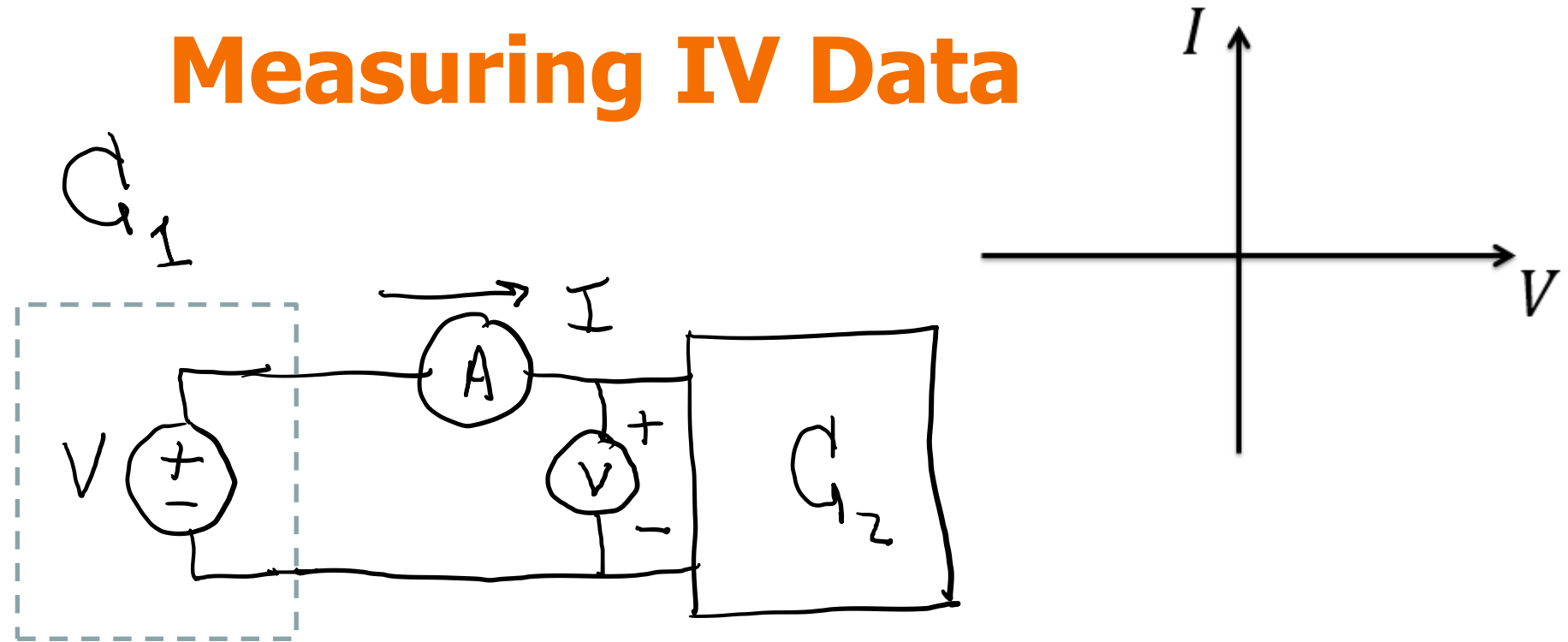
Measuring IV Data in the Lab



Q: What is the voltage drop across an ideal current-meter (ammeter)?

- A. 0 V
- B. 1 V
- C. Depends on the ammeter's internal resistance

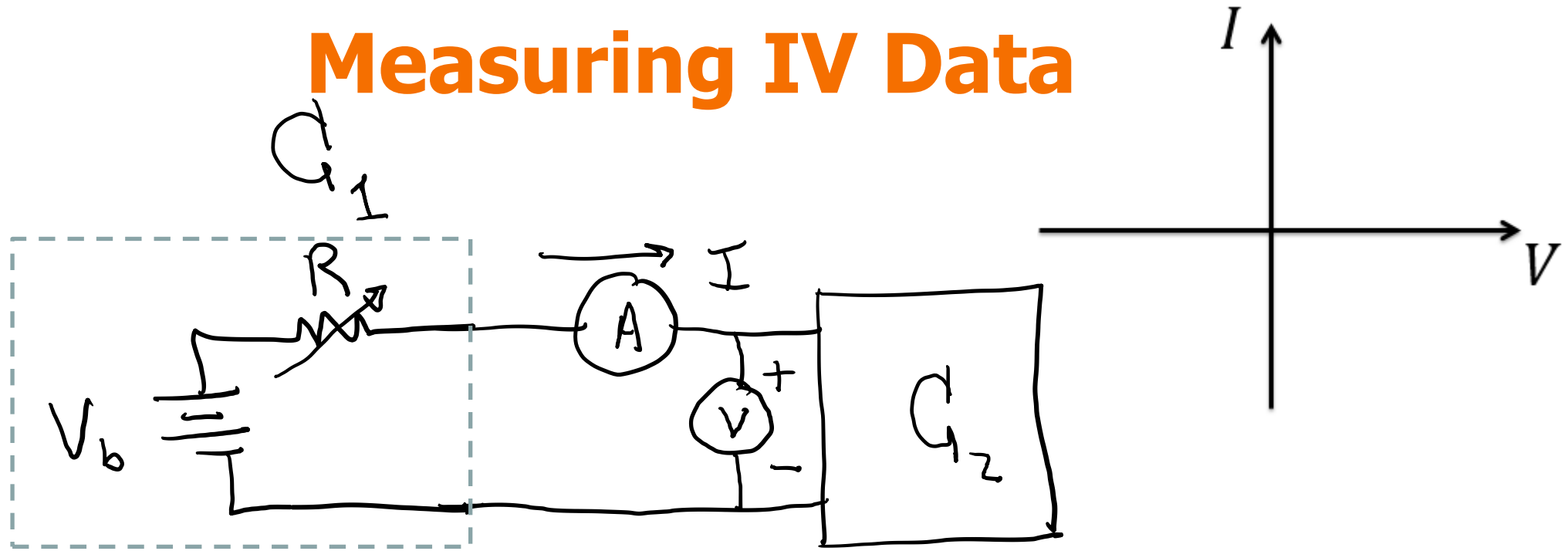
Measuring IV Data



Q: When would this technique be a bad idea?

- A. When C_2 is another voltage source
- B. When C_2 is a current source
- C. When C_2 is a resistor

Measuring IV Data



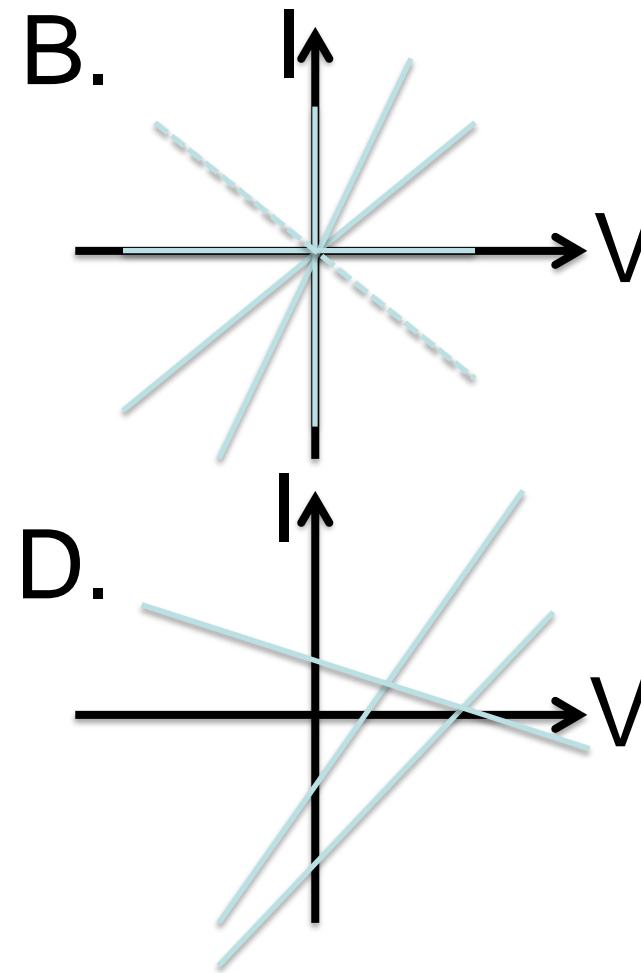
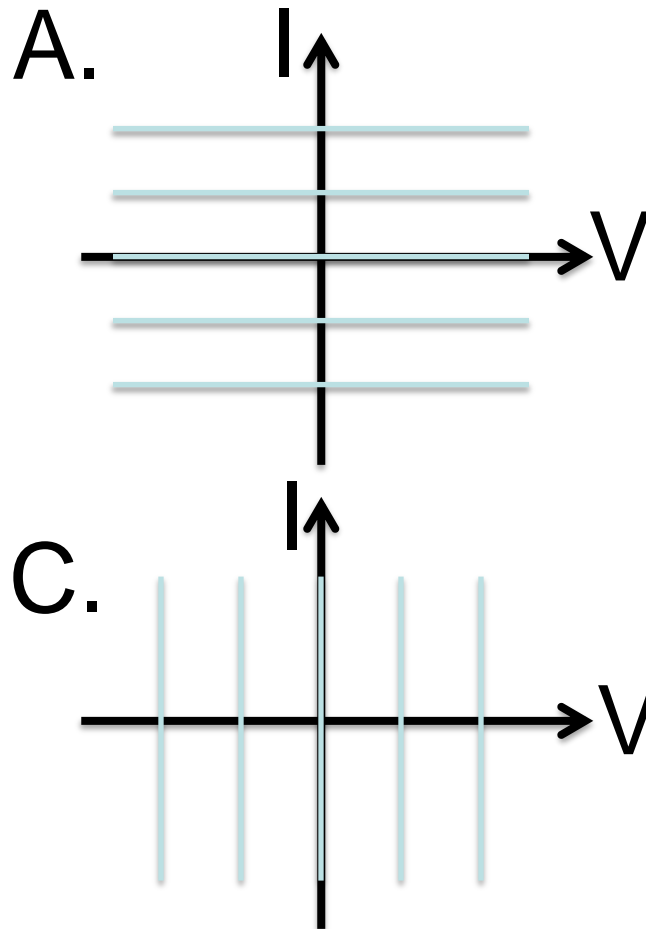
Q: Should this work to fix V_b and allow $0 < R < \infty \Omega$?

A. ☒ Yes

B. ☐ No

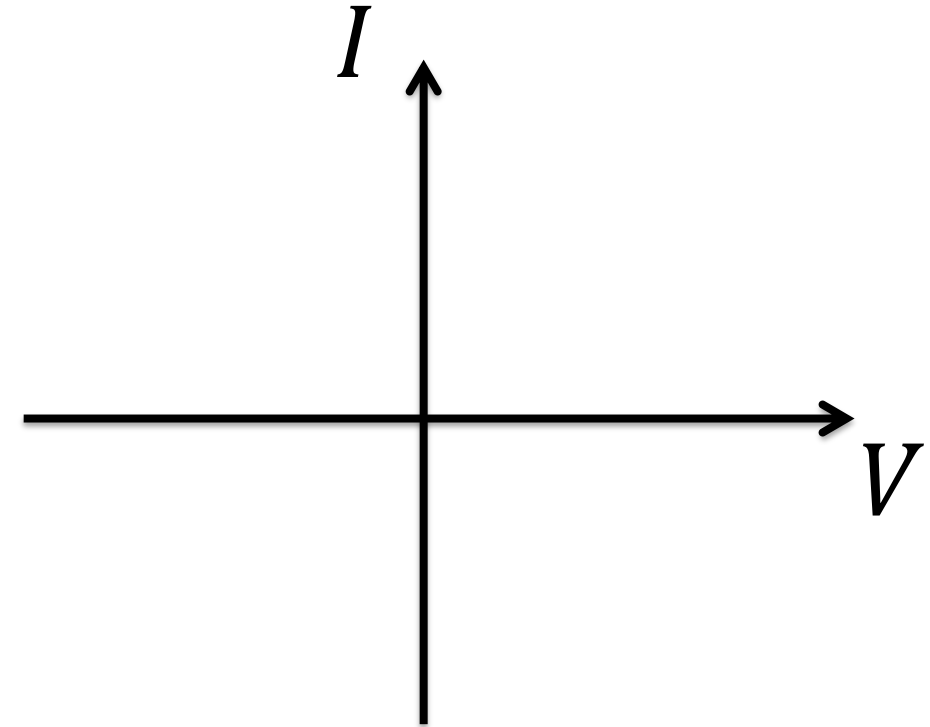
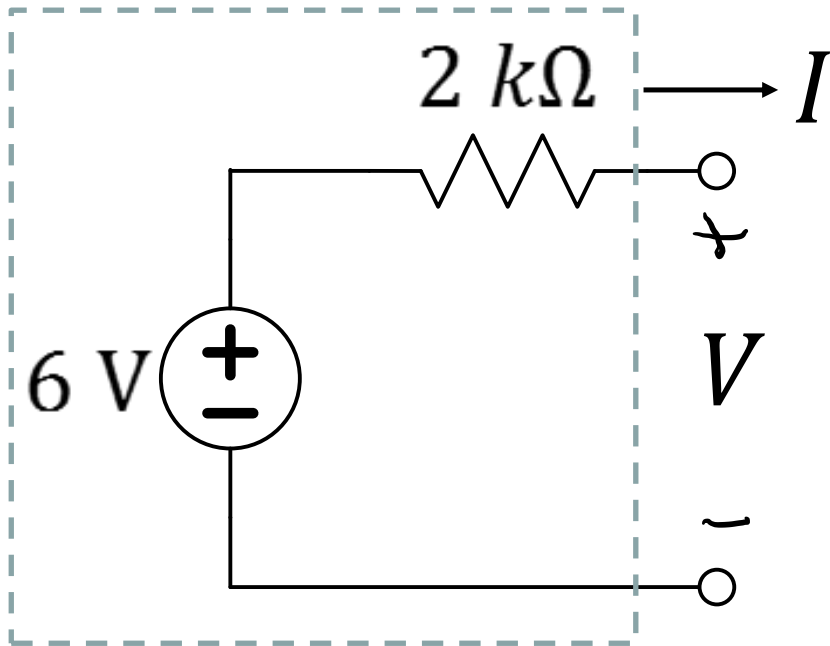
Linear I-V curves

Q: Which set of graphs corresponds to pure resistances?



Simple Series Circuit

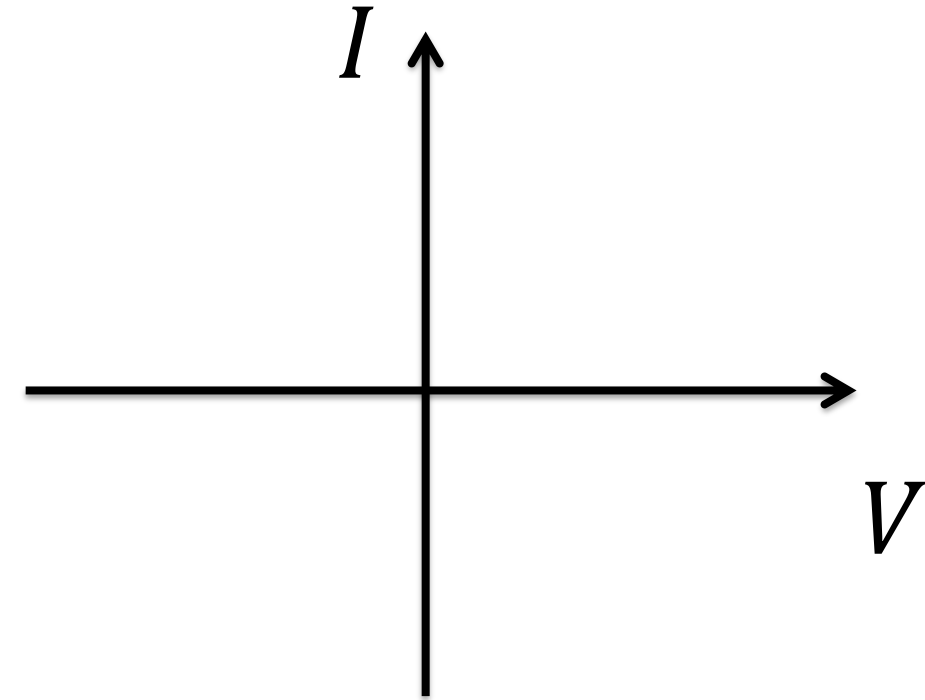
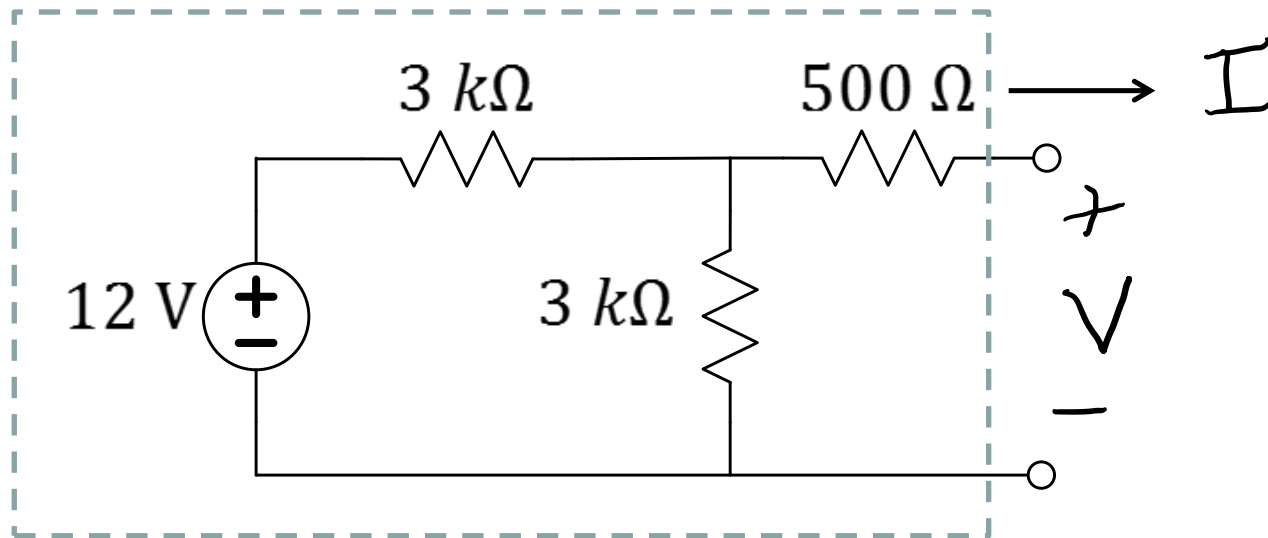
Show that the circuit has a linear IV characteristic by attaching a voltage source and analyzing it using your circuit-analysis toolbox.



Q: Find m and b such that $I = mV + b$ and then graph it.

Embedded Voltage Source

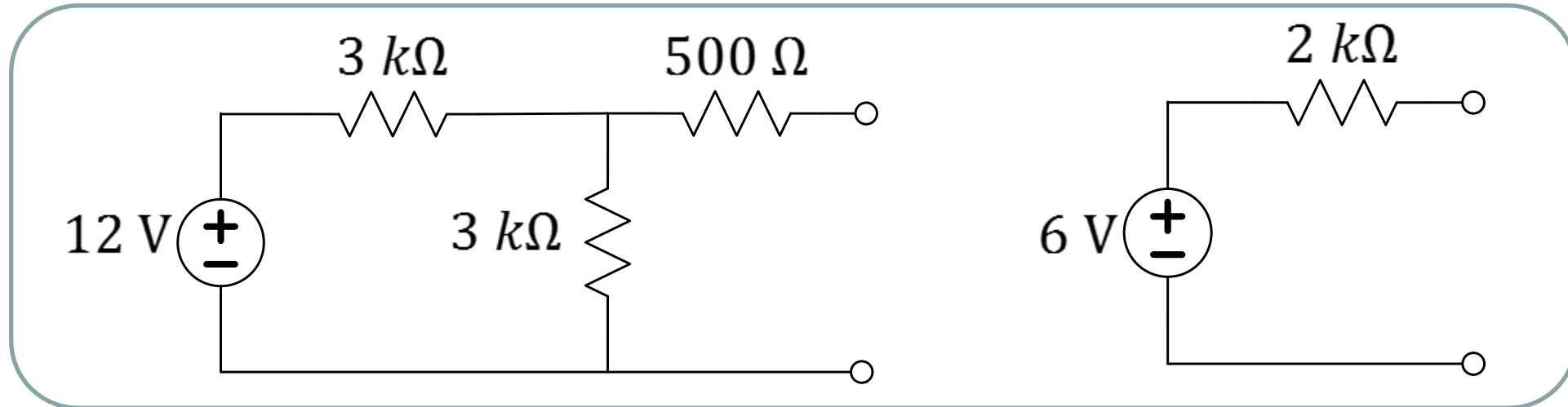
Show that this circuit also has a linear IV characteristic.



Q: Find m and b such that $I = mV + b$ and then graph it.

Embedded Voltage Source

Both these circuits have the SAME linear IV characteristic!



Q: If both circuits produce the same $I = mV + b$ plot, can the IV data be used to tell which of the two circuits is “in the box”?

- A. Yes
- B. No
- C. Other



L11 Learning Objectives

- a. Given one of the three sub-circuit descriptions (IV equation, IV line, diagram), find the other two

Note that more than one circuit diagram fits an IV description

- b. Quickly identify the IV representations of voltage and current sources, resistors, and combinations