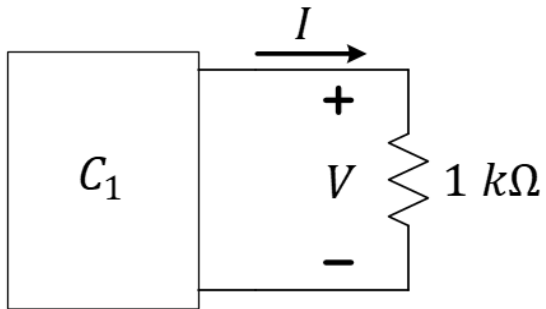# Lecture 12: IV Characteristics, Part II

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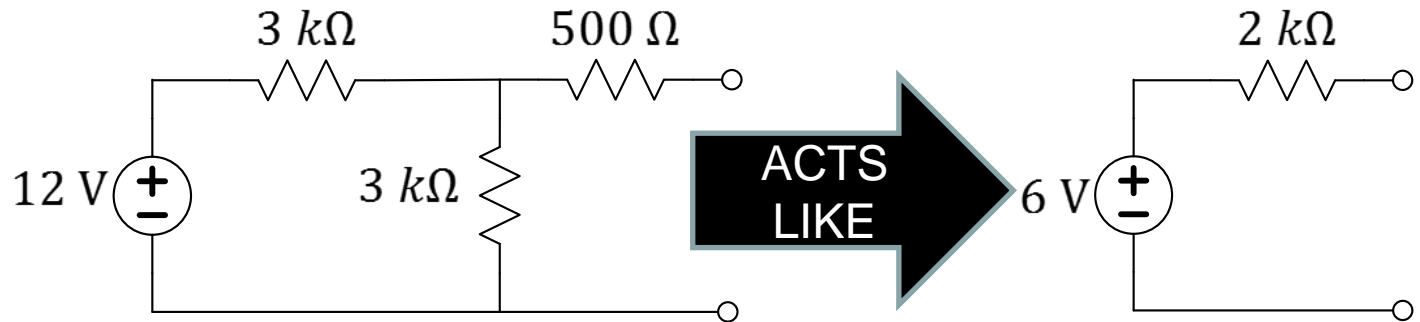- Power and the I-V Characteristics

$I = mV + b$. Why do we care?

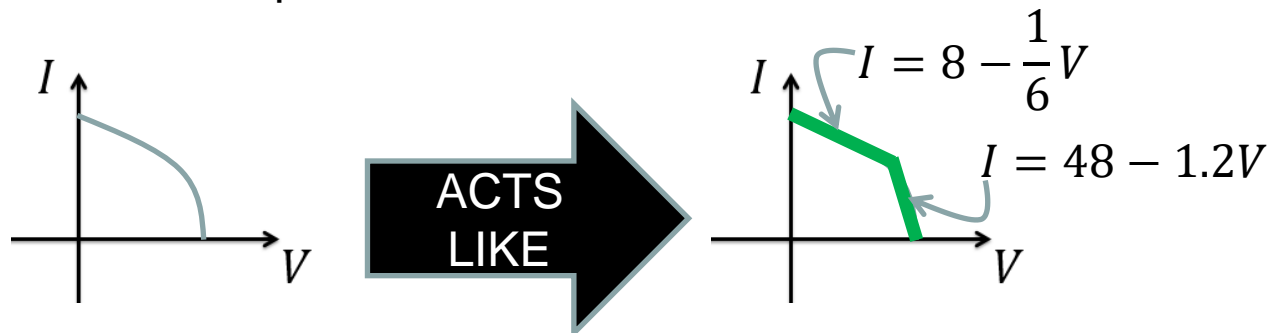Linear IV models allow prediction of operating points before two circuits are joined…

$$C_1: I = 3m - \frac{1}{2k}V; \quad C_2: I = \frac{1}{2k}V$$

$$\boxed{V_{op} = 2\,V, I_{op} = 2\,mA}$$
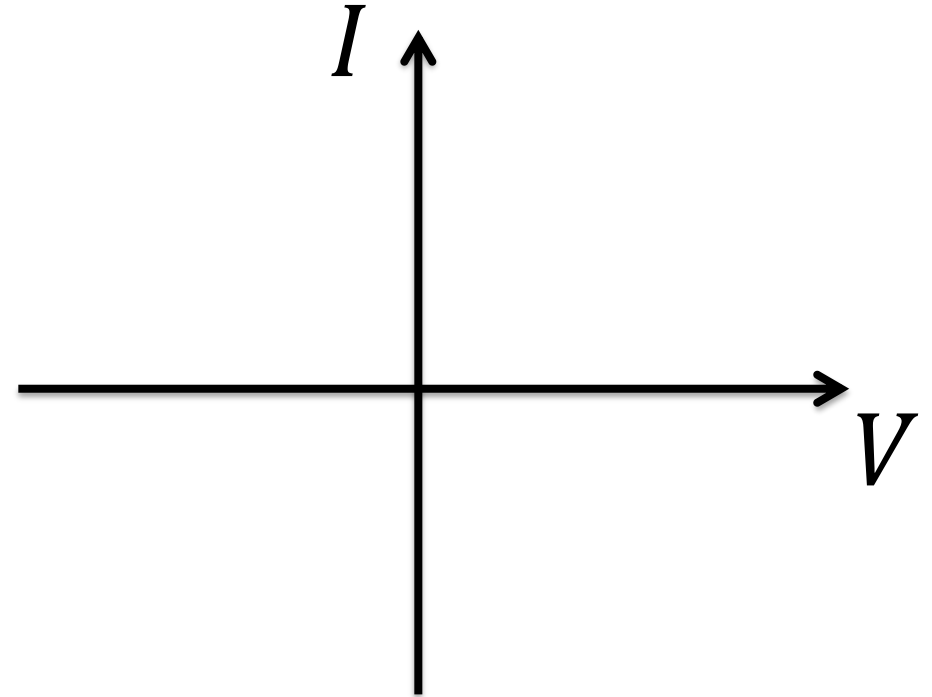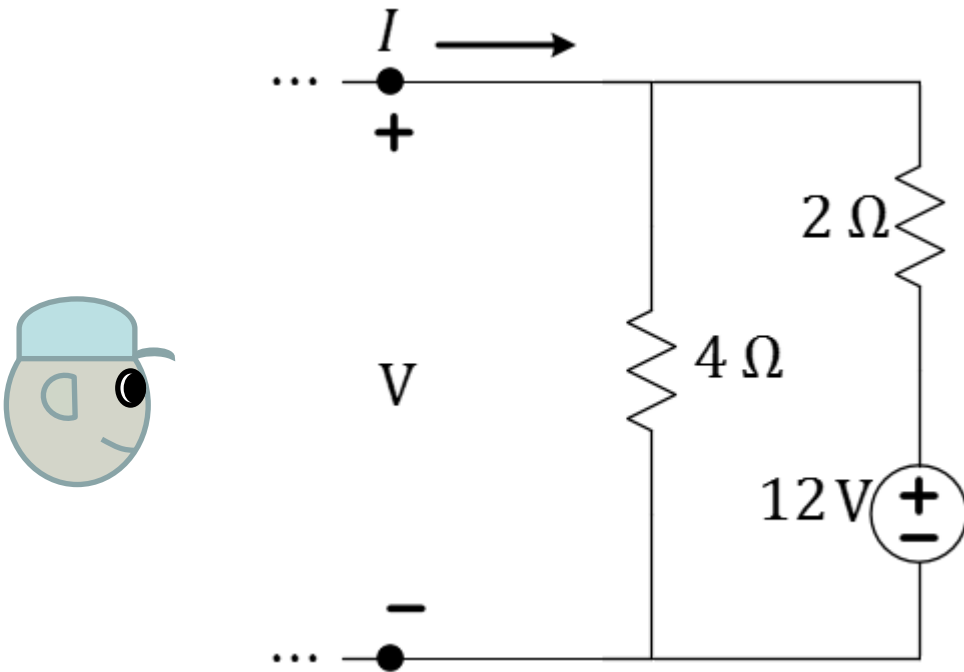
Creates simpler models based on behavior…

Creates simpler models of nonlinear devices…

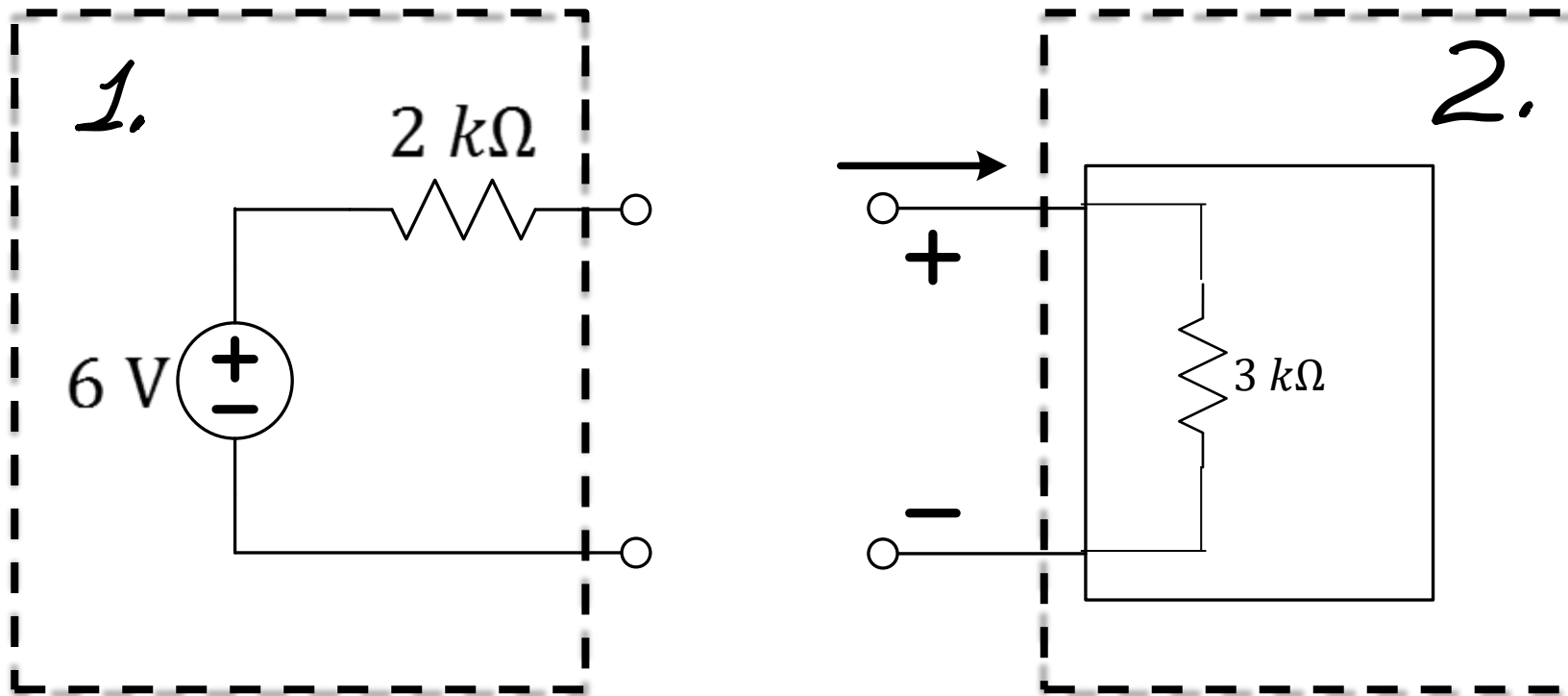$$I = 8 - \frac{1}{6}V$$

$$I = 48 - 1.2V$$

Linear I-Vs of source-resistor circuits

Any combination of current or voltage sources with resistor networks has a linear I-V (between any two nodes).
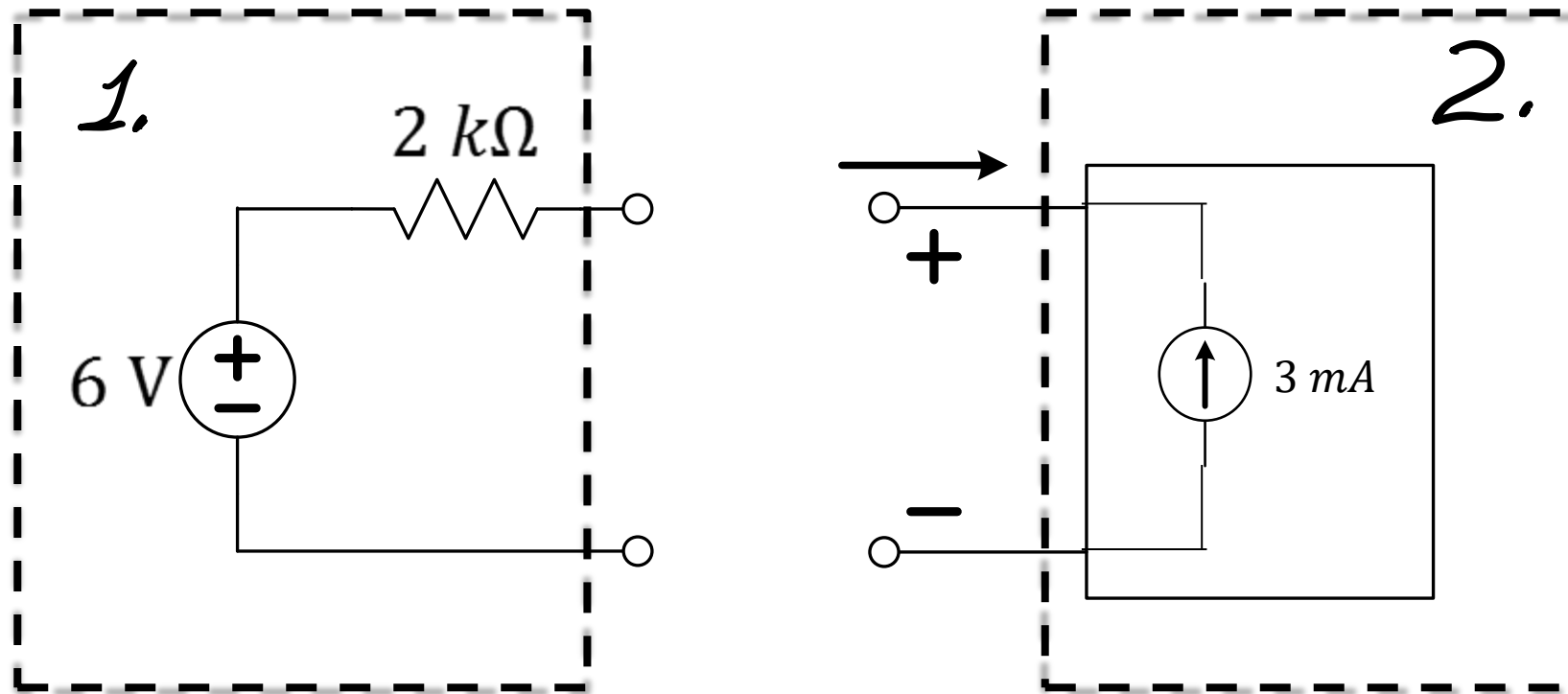

Q: What are the current values of I when V is equal to 0V, 2V, and 4V?
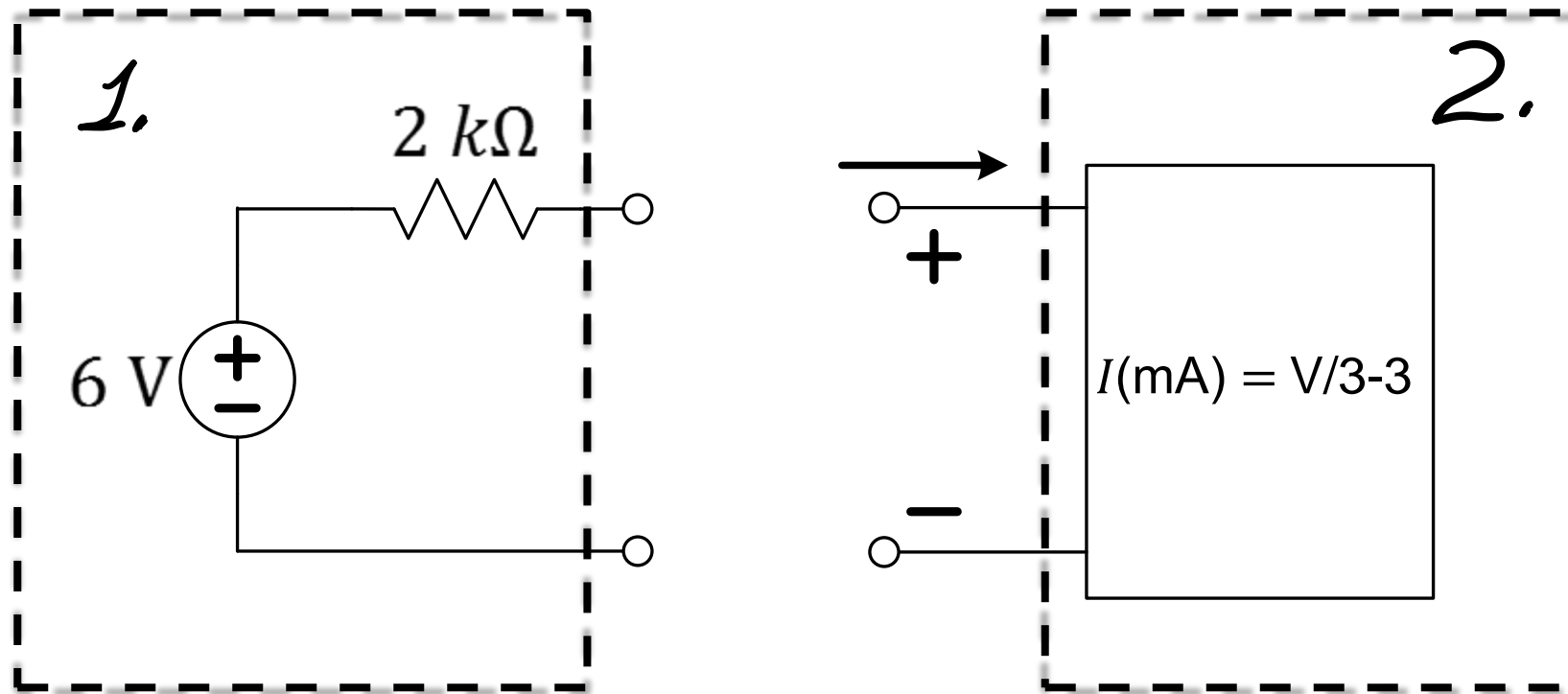
Connecting two sub-circuits

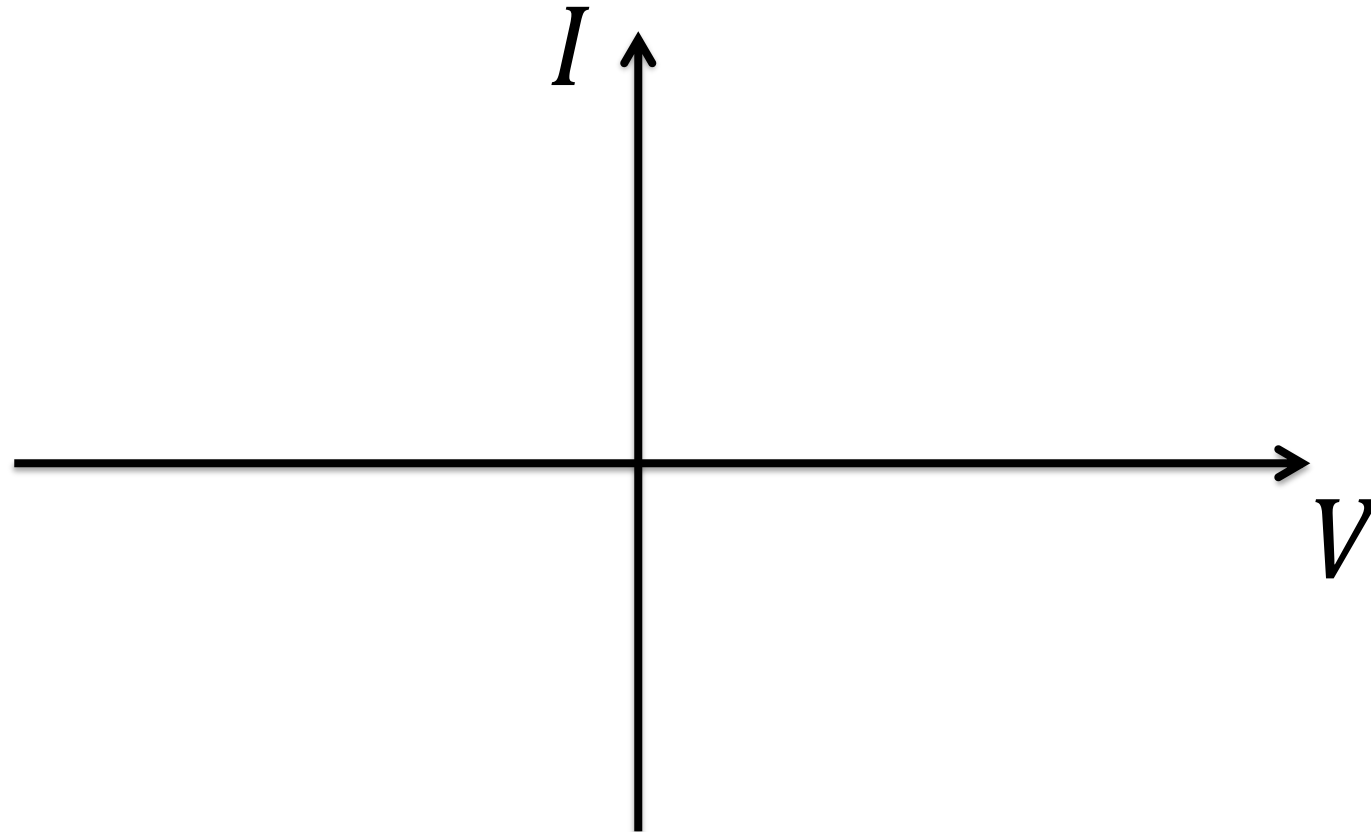Q: What are the IV characteristics of a 3 kΩ resistor?

Connecting two sub-circuits

Q: What are the IV characteristics of a 3 mA current source?

Connecting two sub-circuits

1.

$2 k\Omega$
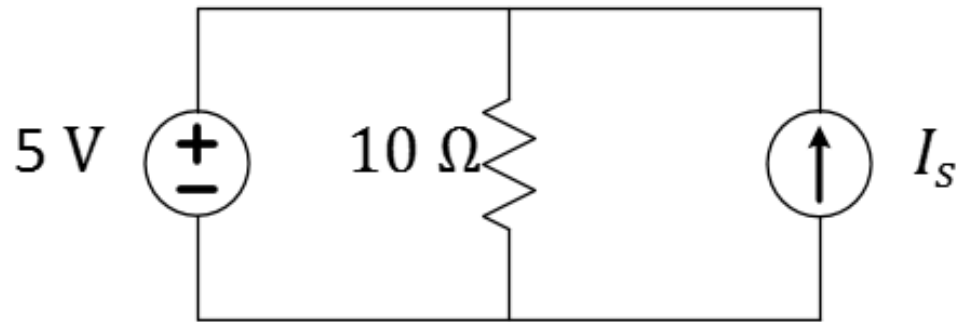
$6 V$

2.

$+$

$I(\text{mA}) = V/3\text{-}3$

$-$

Q: Given the IV characteristic equation, what will be the operating point when C_1 is joined to C_2?

Connecting two sub-circuits (cont'd)

I

V

Q: Considering the three choices for circuit #2, what is the operating point when the two sub-circuits are connected? In each case, which sub-circuit supplies the power?
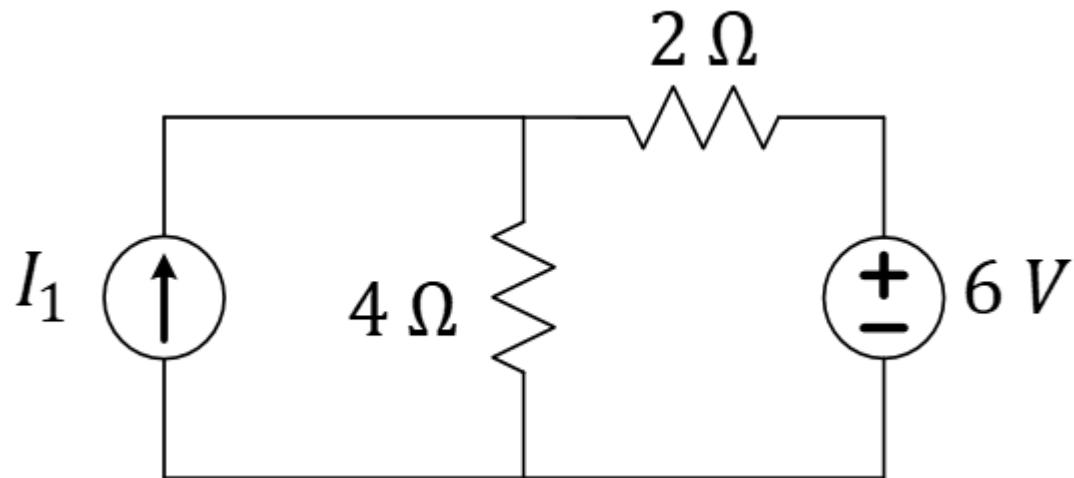
Either or Both Sources Can Supply Power

Q: For what values of I_S does the voltage source supply power?

Exercise

Q: What is the maximum value of I_1 for which the voltage source supplies power?

A. -3 A
B. -1.5 A
C. 0 A
D. 1.5 A
E. 3 A

L12 Learning Objectives

a. Find (V,I) operating points of connected sub-circuits

b. Calculate power flow between connected sub-circuits