

1. Wine Barrel Filler

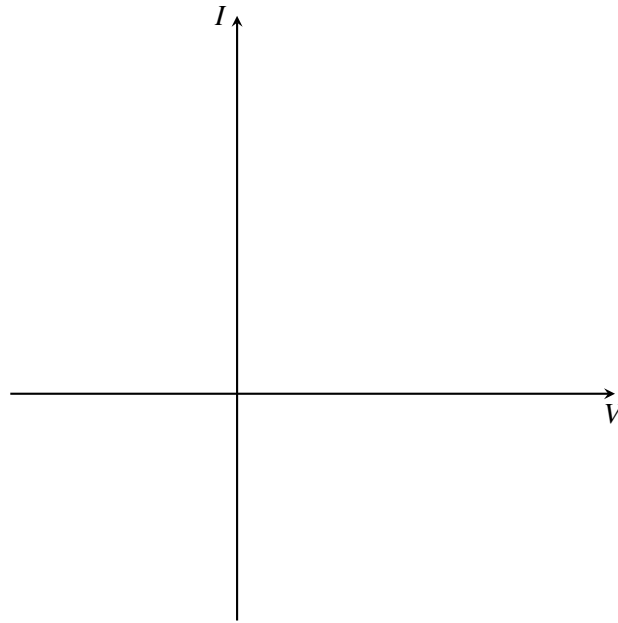
You own a wine tasting place in Berkeley! You have a very elegant dispenser set up for each kind of wine. To minimize the number of bottles you use, you dispense the wine directly from refillable rectangular barrels. To make sure that the barrels never run out, you want to design a level “detector” which will send the appropriate signal to the tank of wine to pour wine into a barrel until a certain level.

Two lateral faces of the barrel (opposite to each other) are coated inside with a perfectly conducting material and you have wires coming out of the barrel at the two faces. You are given that the resistivity of wine is ρ . Design a circuit where either the voltage across a component or the current through a circuit is indicative of the wine level in the barrel.

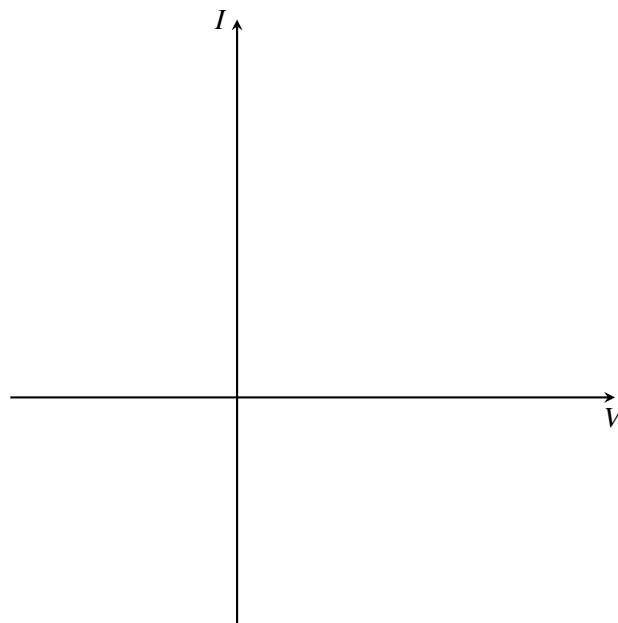
2. Voltage - Current characteristics

Sketch the voltage vs current variation for the following elements:

- (a) Ideal voltage source
- (b) Ideal current source
- (c) Resistor



How will you modify your answer for voltage and current sources if they are not ideal anymore?



3. Power and Energy

Derive power/energy dissipated in terms of voltage and current.

4. Passive Sign Convention Revisited!