

Part A: Proportions

1. A $20. \Omega$ resistor connected to a 6.0 V battery carries a current of 0.30 A . Answer each part without a calculator first, then check with $V = IR$.
 - a. The 6.0 V battery is replaced with a 12 V battery. What is the new current? Is current directly or inversely proportional to voltage?
 - b. Back on the 6.0 V battery, the resistor is replaced with a $40. \Omega$ resistor. What is the new current? Is current directly or inversely proportional to resistance?
 - a. Same resistor, double the voltage, so double the current: **$I = 0.60 \text{ A}$** . Check: $I = 12 \text{ V} / 20. \Omega = 0.60 \text{ A}$. Current is **directly proportional** to voltage.
 - b. Same voltage, double the resistance, so half the current: **$I = 0.15 \text{ A}$** . Check: $I = 6.0 \text{ V} / 40. \Omega = 0.15 \text{ A}$. Current is **inversely proportional** to resistance.

Part B: Solving with Ohm's Law

Show your knowns, equation, substitution, and answer with units.

2. A toy car's motor has a resistance of 8.0Ω and draws a current of 0.75 A . What voltage does its battery pack supply?

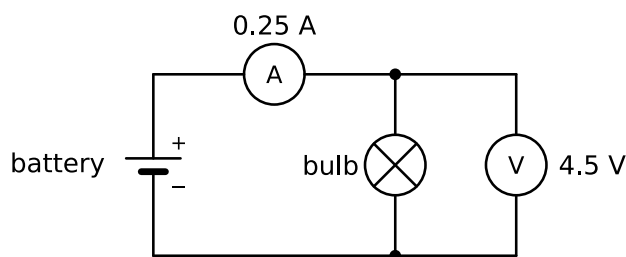
Knowns: $R = 8.0 \Omega$, $I = 0.75 \text{ A}$

Equation: $V = IR$

Substitute: $V = (0.75 \text{ A})(8.0 \Omega)$

Answer: **$V = 6.0 \text{ V}$**

3. Priya measures a bulb with the meters shown. What is the resistance of the bulb?



Knowns: $I = 0.25 \text{ A}$ (ammeter, in the loop), $V = 4.5 \text{ V}$ (voltmeter, across the bulb)

Equation: $V = IR$, so $R = V/I$

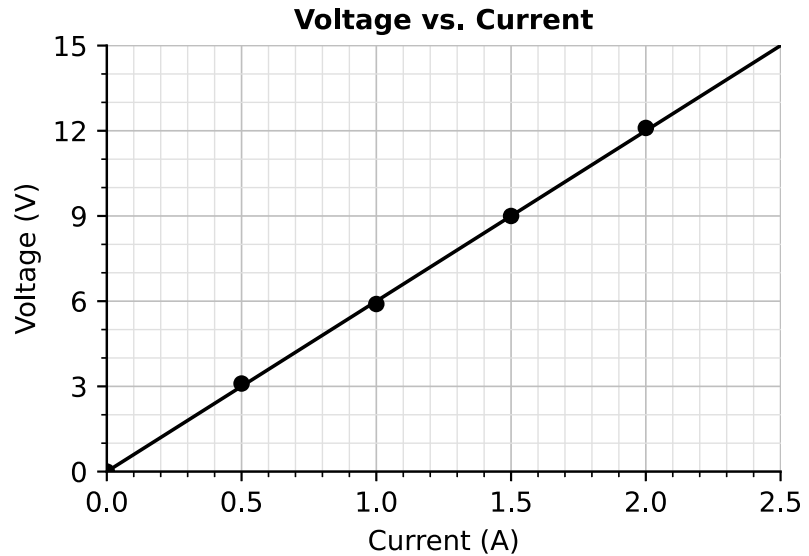
Substitute: $R = 4.5 \text{ V} / 0.25 \text{ A}$

Answer: **$R = 18 \Omega$**

Part C: Graphs

4. Marcus measures the voltage across a resistor and the current through it. Plot his data with current on the x-axis and draw a straight line of best fit.

Current (A)	Voltage (V)
0.00	0.0
0.50	3.1
1.00	5.9
1.50	9.0
2.00	12.1

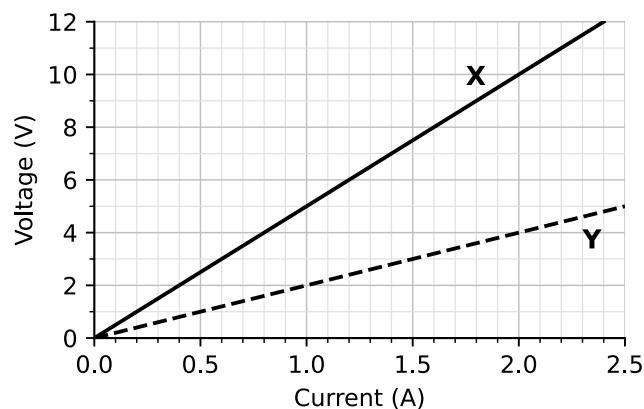


- Find the slope of your line, with units. What does the slope tell you?
- Use the resistance to predict the current when the voltage is 15 V.

Line through (0 A, 0 V) and (2.0 A, 12 V), with points on both sides.

- slope = $\Delta V / \Delta I = (12 \text{ V} - 0 \text{ V}) / (2.0 \text{ A} - 0 \text{ A}) = \mathbf{6.0 \, \Omega}$ (5.8 to 6.2 Ω is fine). On a V vs. I graph the slope is the resistance, so $R = 6.0 \, \Omega$.
- $I = V/R = 15 \text{ V} / 6.0 \, \Omega = \mathbf{2.5 \text{ A}}$

5. The graph shows voltage vs. current for two resistors, X (solid) and Y (dashed).



- Without calculating, which resistor has more resistance? How can you tell?
 - Find the resistance of each resistor.
 - What current flows through resistor Y when the voltage across it is 6.0 V?
- X.** Its line is steeper, and on a V vs. I graph a steeper slope means a bigger resistance.
 - X:** $R = 10 \text{ V} / 2.0 \text{ A} = \mathbf{5.0 \, \Omega}$. **Y:** $R = 4.0 \text{ V} / 2.0 \text{ A} = \mathbf{2.0 \, \Omega}$.
 - $I = V/R = 6.0 \text{ V} / 2.0 \, \Omega = \mathbf{3.0 \text{ A}}$**