Parallel Circuit Analysis
Lesson Notes

Learning Outcomes
- How are the variety of circuit parameters mathematically related for parallel circuits?
- How do you analyze a parallel circuit?

Mathematical Equations
Voltage Drops: A charge making a loop of a parallel circuit will have a single voltage drop as it passes through one of the branches. Thus,

$$\Delta V_{battery} = \Delta V_1 = \Delta V_2 = \Delta V_3 = \ldots$$

Current: The flow rate outside the branches and in the battery equals the sum of the branch currents: $I_{battery} = I_1 + I_2 + I_3 + \ldots$

The branch currents depend on the battery voltage and the resistance of the resistor in that branch: $I_1 = \Delta V_{battery}/R_1$ $I_2 = \Delta V_{battery}/R_2$ $I_3 = \Delta V_{battery}/R_3$

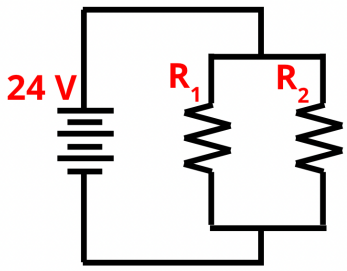
Equivalent Resistance: The equivalent resistance (R_{eq}) of a parallel circuit can be calculated using …

$$1/R_{eq} = 1/R_1 + 1/R_2 + 1/R_3 + \ldots$$

For the three example problems, fill in all blanks. Show your work clearly.

Example Problem 1
Two resistors - 4.0 Ω and 6.0 Ω - are connected to a 24-volt power supply. Determine the equivalent resistance, the current in each resistor and battery, and the voltage drops across each resistor.

$R_1 = 4.0\ \Omega$ $R_2 = 6.0\ \Omega$



R_{eq} = _____ $I_{battery}$ = _____

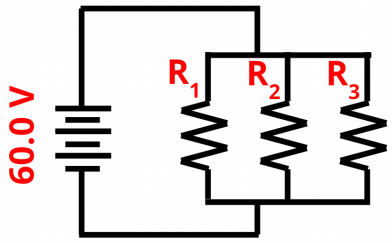
I_1 = _____ ΔV_1 = _____

I_2 = _____ ΔV_2 = _____

Example Problem 2

Consider the 3-resistor circuit below. Determine all the blanks.

$R_1 = 17\Omega$ $R_2 = 12\Omega$ $R_3 = 11\Omega$



R_{eq} = _____ $I_{battery}$ = _____

I_1 = _____ ΔV_1 = _____

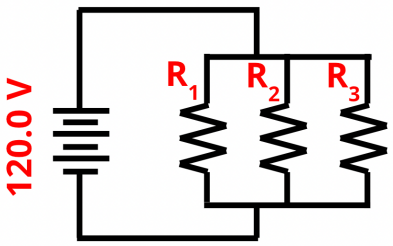
I_2 = _____ ΔV_2 = _____

I_3 = _____ ΔV_3 = _____

Example Problem 3

Consider the 3-resistor circuit below. Determine all the blanks.

$R_1 = 11\Omega$ $R_2 = 7.0\Omega$ $R_3 = 20.0\Omega$



R_{eq} = _____ $I_{battery}$ = _____

I_1 = _____ ΔV_1 = _____

I_2 = _____ ΔV_2 = _____

I_3 = _____ ΔV_3 = _____