Chapter 3 - Resistive Circuits

Lecture 6
Section 3.3

MEMS 0031 Electrical Circuits

Mechanical Engineering and Materials Science Department
University of Pittsburgh

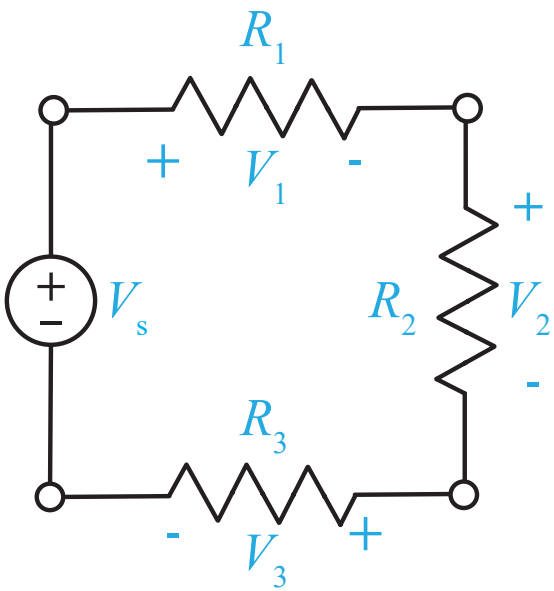
Student Learning Objectives

At the end of the lecture, students should be able to:

- Understand how resistors in series divide voltage
- Formulate an expression for the voltage across a resistor in series with other resistors

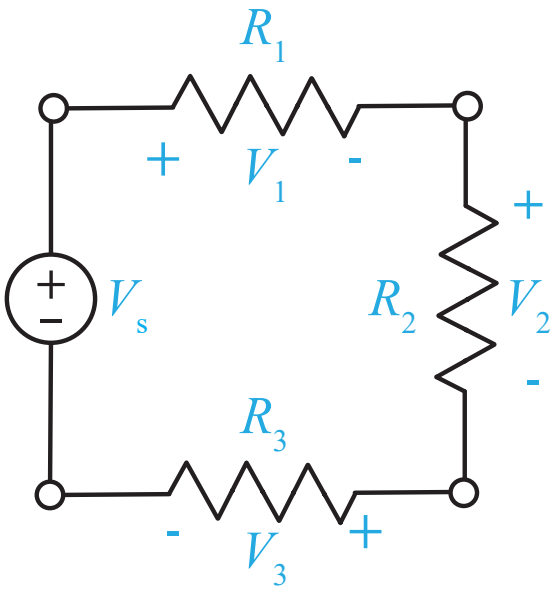
Series Resistors

- Considering the following circuit. What is the voltage drop across each resistor?



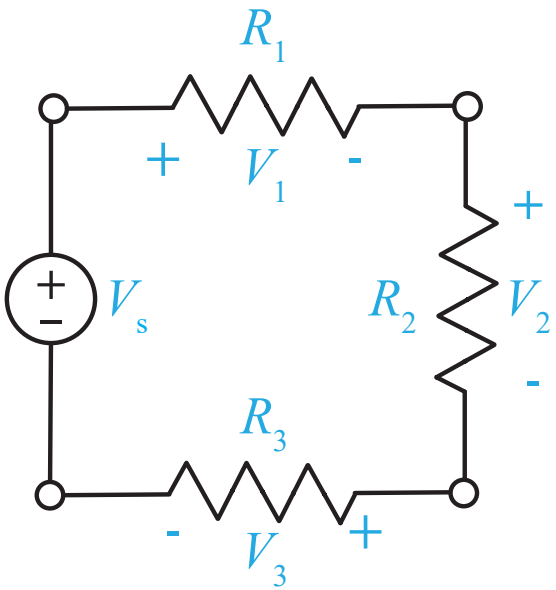
Series Resistors

- Can we formulate a general expression for the voltage drop across a resistor that exists in series?



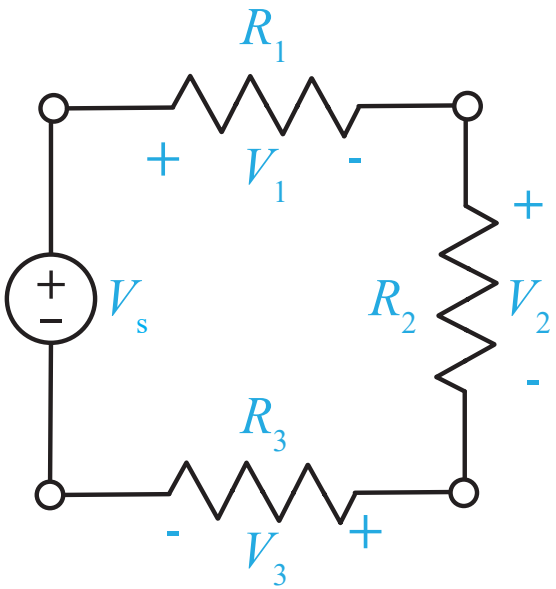
Equivalent Resistance

- Replace the resistors in series as one resistor.



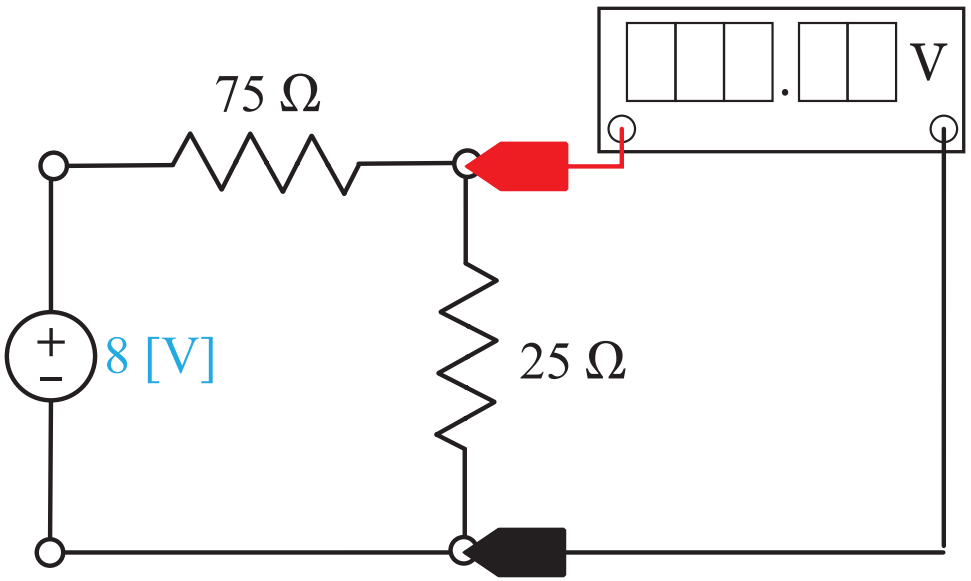
Equivalent Resistance

- Does the equivalent resistor satisfy the conservation of electrical power and Ohm's law?



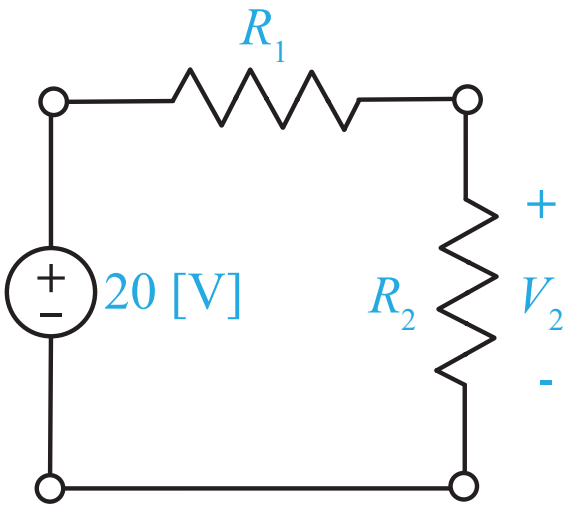
Example #1

- Determine the voltage measured by the voltmeter:



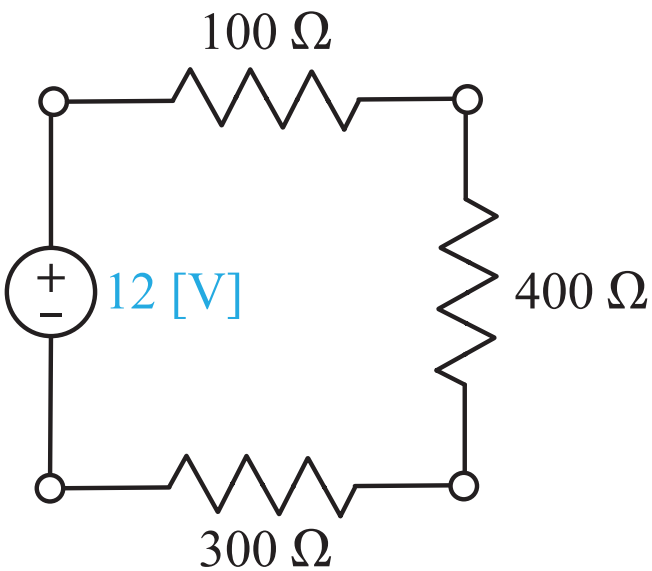
Example #2

- Design a voltage divider such that V_2=0.8V_s and no more than 1 [mW] of power is supplied by the source, given V_s=20 [V].



Example #3

- Find the voltage drop across each resistor:



Student Learning Objectives

At the end of the lecture, students should be able to:

- Understand how resistors in series divide voltage
  - Resistors in series carry the same current. However, there exists a potential to drive the current through all the resistors. Thus, the voltage drop across a resistor in series with other resistors is a proportion of the total potential.
- Formulate an expression for the voltage across a resistor in series with other resistors

$$V_j = \left(\frac{R_j}{\sum_{i=1}^{N} R_i} \right) V_s$$

Suggested Problems

- 3.3-1, 3.3-2, 3.3-3, 3.3-5, 3.3-6, 3.3-7