ELEMENT COMBINATION RULE

CIRCUIT ANALYSIS METHOD

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TOPIC OUTLINE

Ohm's Law

Series Network

Parallel Network

Series-Parallel Network

OHM'S LAW

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Ohm's Law states that the ratio of voltage (***V***) to current (***I***) is **constant** (***R***).

Mathematical Representation:

$$R = \frac{V}{I}$$

Basic Electrical Quantities:

1. **Voltage (V):**

The measure of electrical potential energy per unit charge. It is the "**push**" or "force" that drives electric current through a circuit.

Formula:

$$V = IR$$

unit: Volt (V)

OHM'S LAW

Ohm's Law states that the ratio of voltage (***V***) to current (***I***) is **constant** (***R***).

Mathematical Representation:

$$R = \frac{V}{I}$$

Basic Electrical Quantities:

2. **Current (I)**:

The **flow of electric charge**, typically carried by electrons in a conductor. It represents the rate at which charge flows through a point in a circuit.

Formula:

$$I = \frac{V}{R}$$

unit: Ampere (A)

OHM'S LAW

Ohm's Law states that the ratio of voltage (V) to current (I) is **constant** (R).

Mathematical Representation:

$$R = \frac{V}{I}$$

Basic Electrical Quantities:

3. **Resistance (R)**:

The **opposition** to the flow of electric current in a material or component. It determines how much current will flow for a given voltage.

Formula:

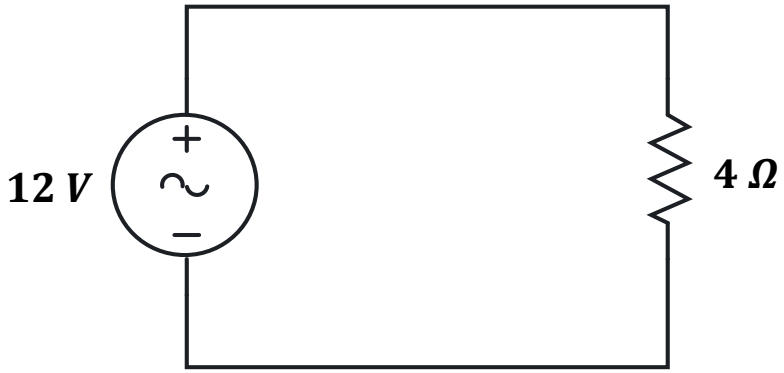
$$R = \frac{V}{I}$$

unit: Ohm (Ω)

EXERCISE

Determine the **current** flowing through a circuit with **4 ohms** resistance when a voltage of **12 volts** is applied.

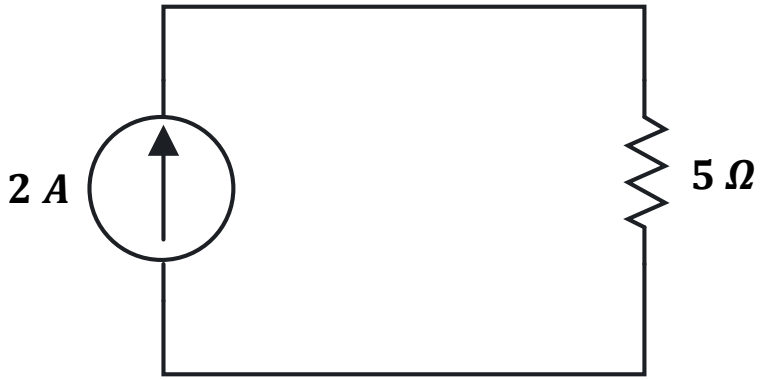
Solution:



EXERCISE

Determine the **voltage drop** across a circuit with a resistance of **5 ohms** when a current of **2 amps** flows through it.

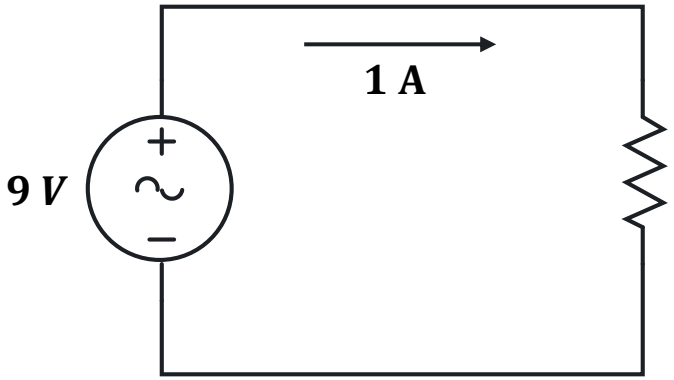
Solution:



EXERCISE

Determine the **resistance** of a circuit if a **9-volt** applied voltage results in a current flow of **1-ampere**.

Solution:

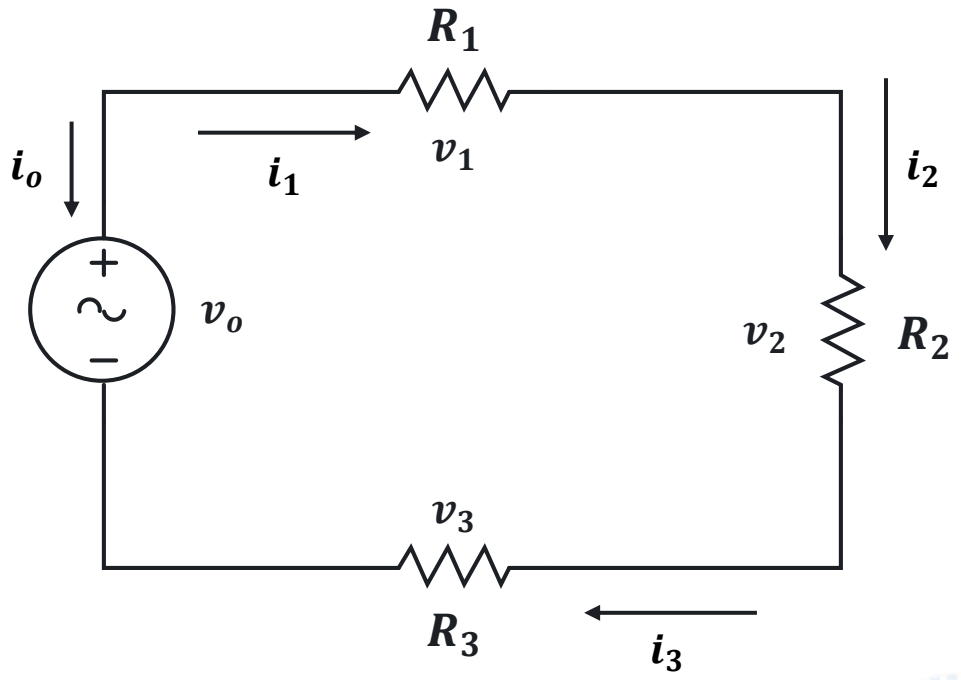


SERIES NETWORK

SERIES NETWORK

A **series network** refers to a configuration where components are connected end-to-end, forming a **single path** for current to flow.

Series Network:



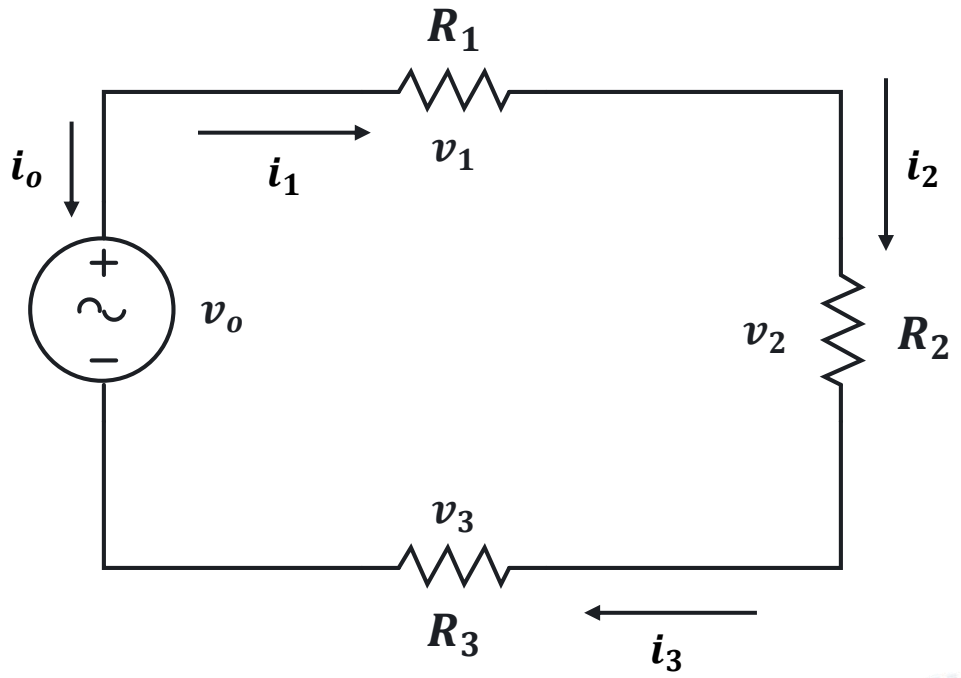
CURRENT

In a series network, the **same current** flows through all components.

Mathematical Representation:

$$i_o = i_1 = i_2 = i_3 = \cdots i_n$$

Series Network:



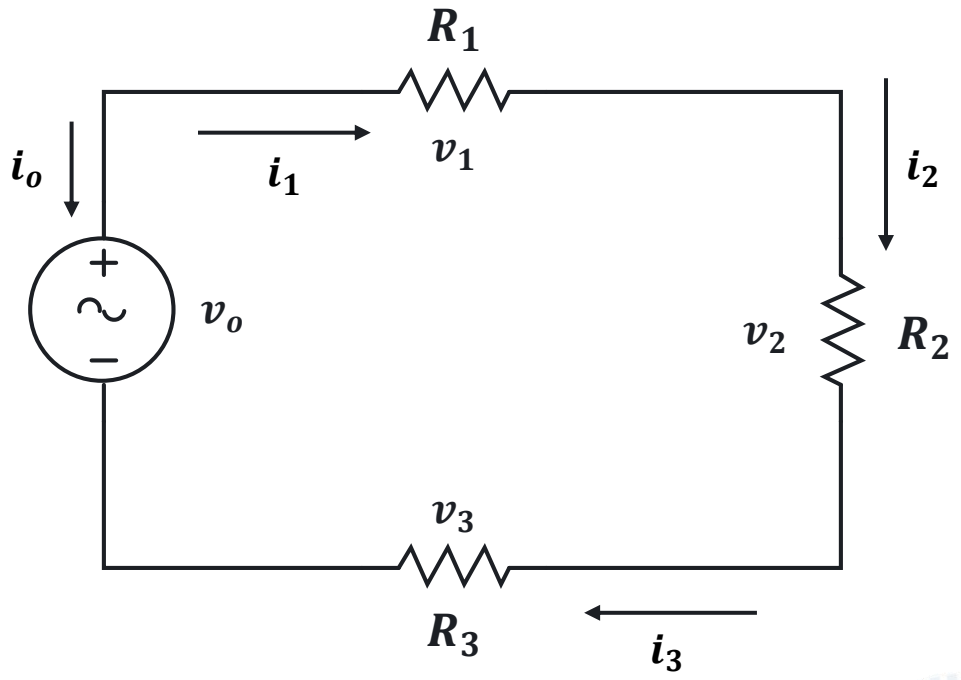
RESISTANCE

In a series network, the **total resistance** is the **sum** of the individual resistances.

Mathematical Representation:

$$R_o = R_1 + R_2 + R_3 + \cdots R_n$$

Series Network:



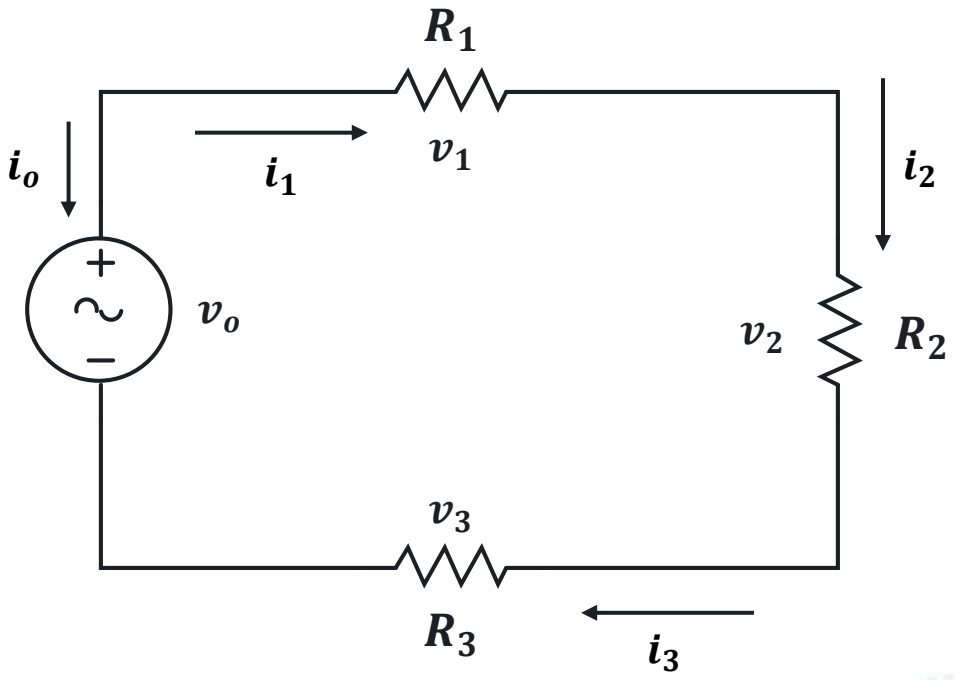
VOLTAGE

In a series network, the **total voltage** is the **sum** of the voltages across each individual component.

Mathematical Representation:

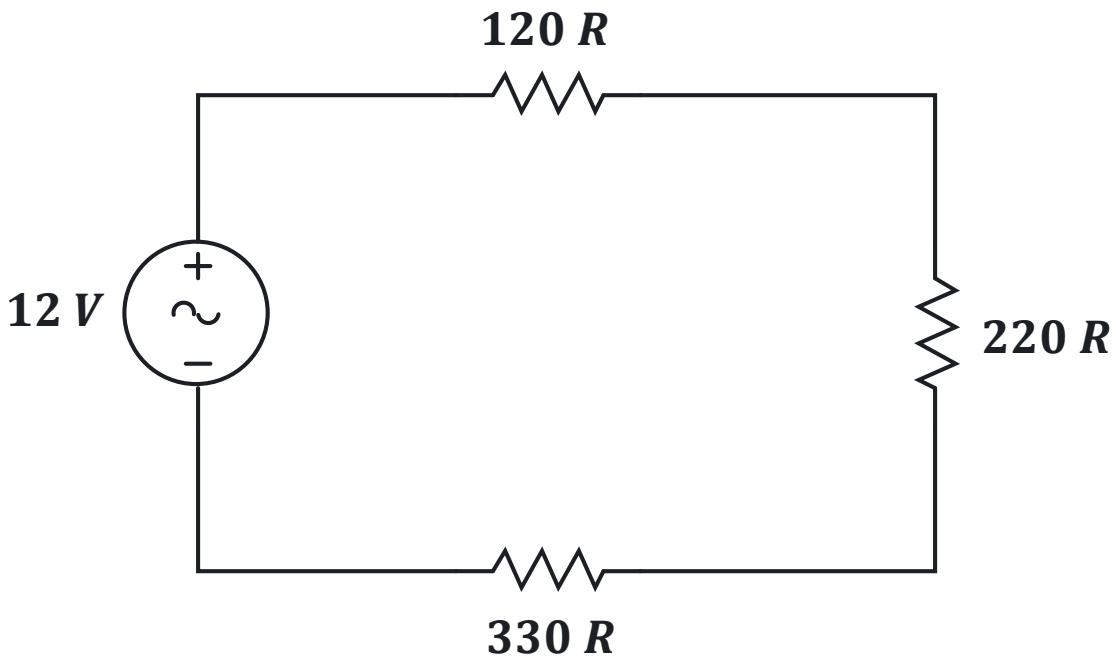
$$v_o = v_1 + v_2 + v_3 + \cdots v_n$$

Series Network:



EXERCISE

Determine the **voltage** drop across each resistor of the given circuit.

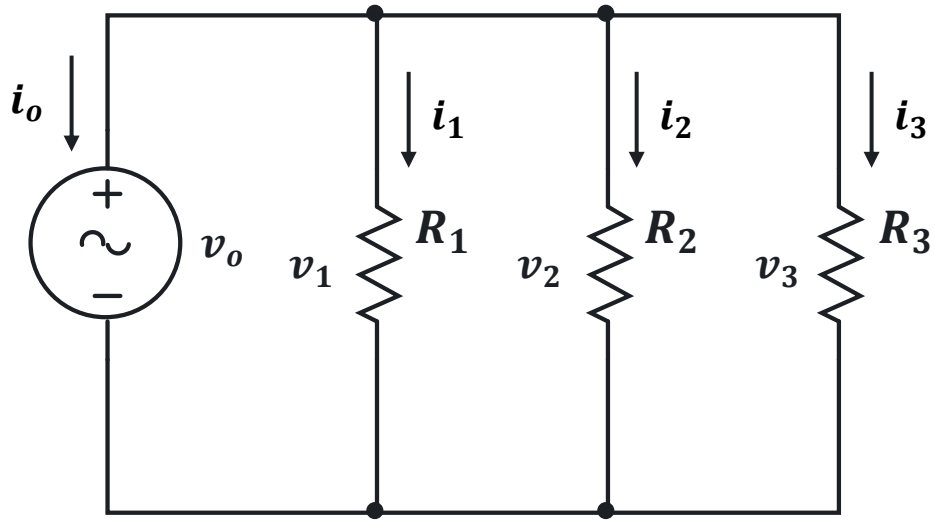


Solution:

PARALLEL NETWORK

A **parallel network** is a configuration where components are connected across the **same two points**, providing multiple paths for current to flow.

Parallel Network:



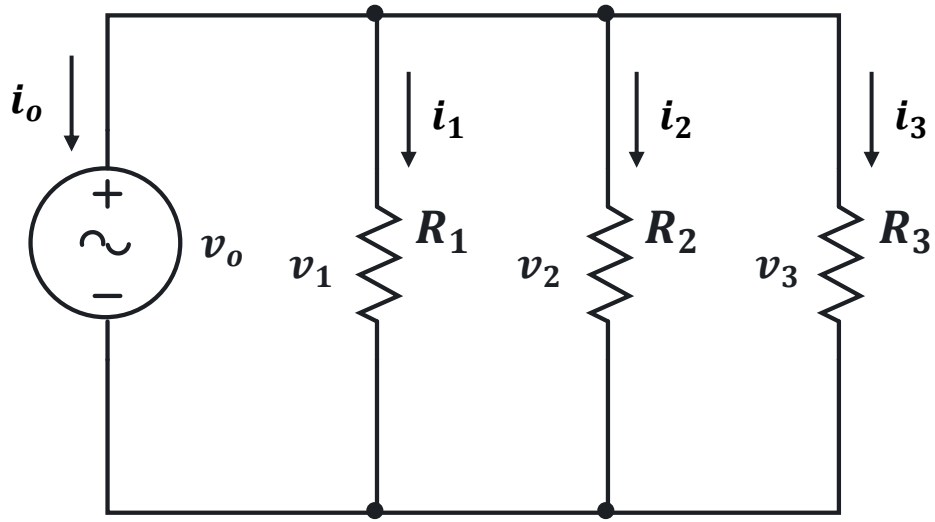
VOLTAGE

In a parallel network, the voltage across all components is the **same**.

Mathematical Representation:

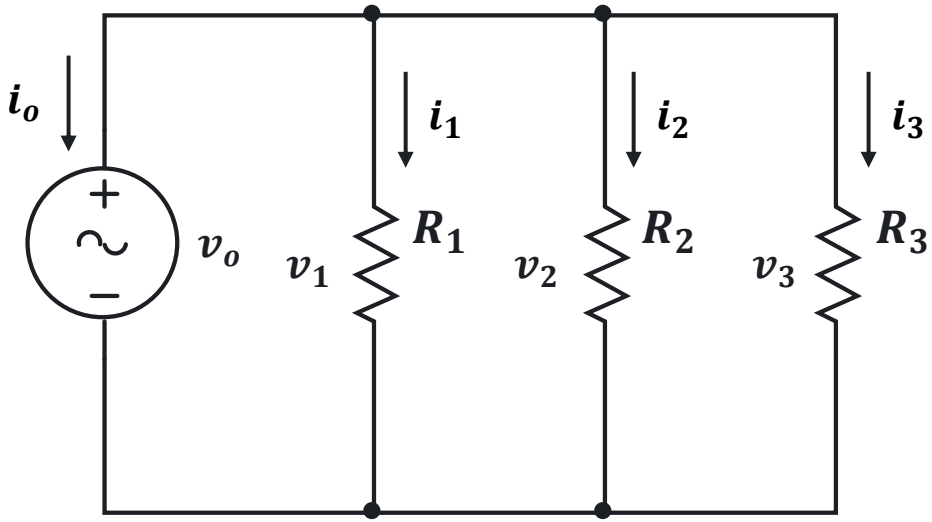
$$v_o = v_1 = v_2 = v_3 = \cdots v_n$$

Parallel Network:



CONDUCTANCE

Parallel Network:



Conductance refers to the ability of the network to allow the flow of electric current. It is the **reciprocal of resistance** and is measured in siemens (***S***).

Mathematical Representation:

$$G = \frac{1}{R}$$

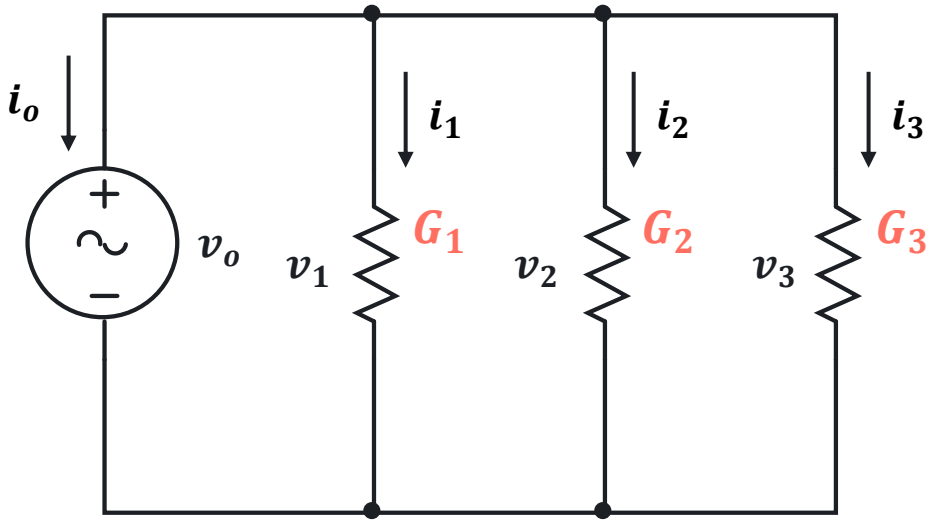
CONDUCTANCE

In a parallel network, the **total conductance** is the **sum** of the individual conductance of each resistor.

Mathematical Representation:

$$G_o = G_1 + G_2 + G_3 + \cdots G_n$$

Parallel Network:



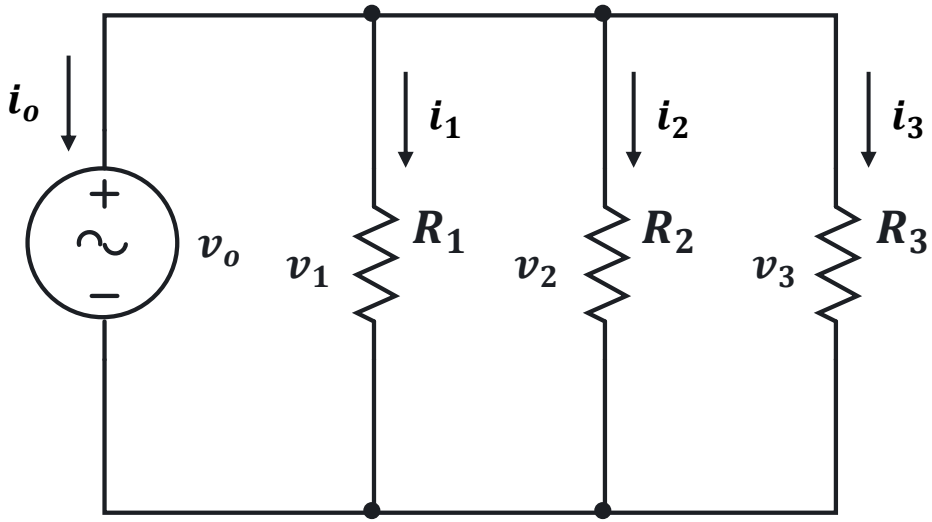
CURRENT

In a parallel network, the **total current** is the **sum** of the current flowing through each individual component.

Mathematical Representation:

$$i_o = i_1 + i_2 + i_3 + \cdots i_n$$

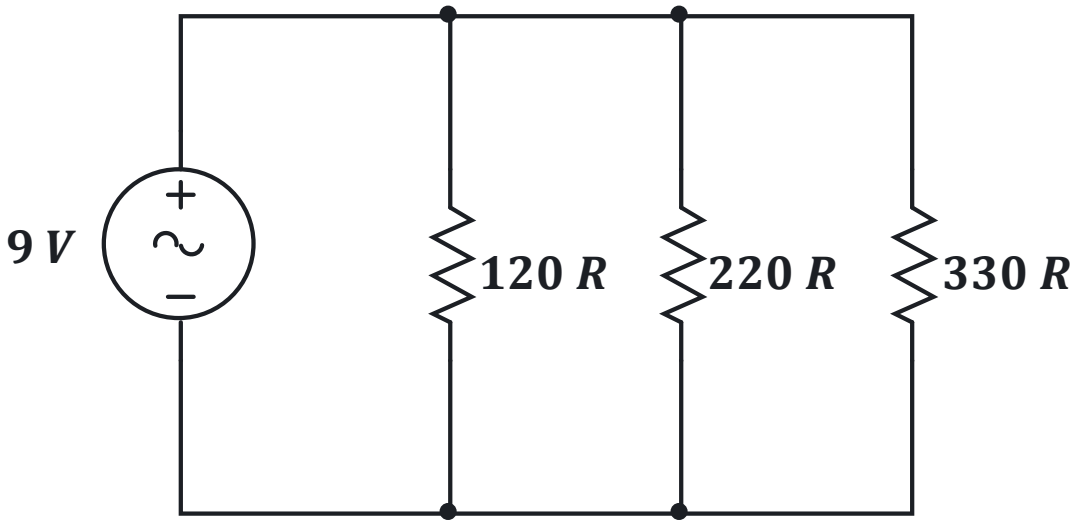
Parallel Network:



EXERCISE

Determine the **current** flowing through each resistor of the given circuit.

Solution:



SERIES PARALLEL NETWORK

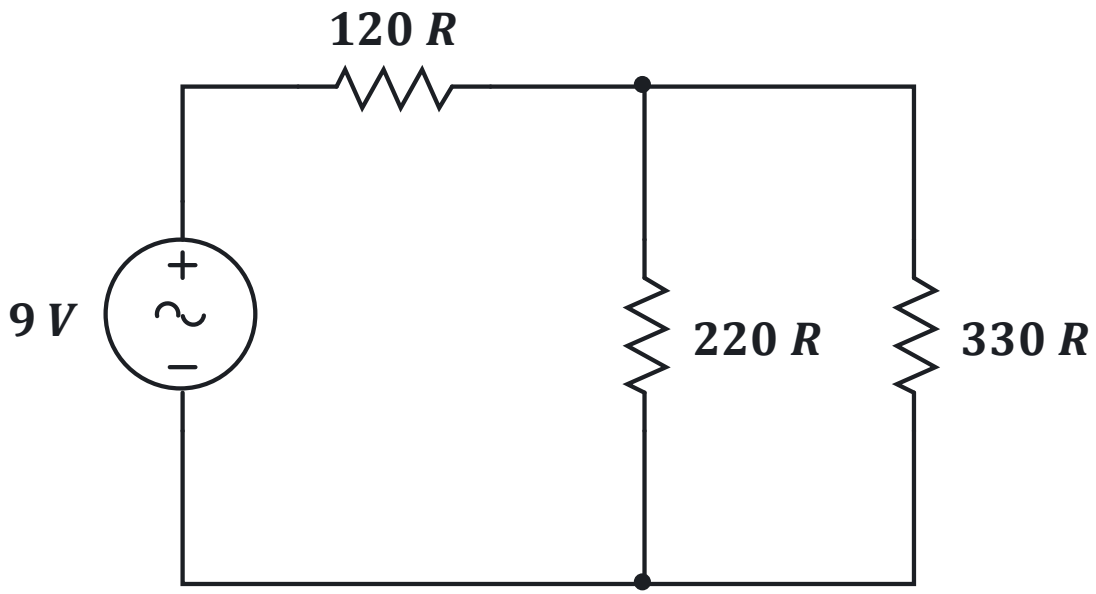
SERIEL-PARALLEL NETWORK

A series-parallel network is a type of electrical network that combines elements of both **series** and **parallel** circuits. These networks are commonly used in electrical and electronic systems to achieve desired voltage, current, and resistance characteristics.

EXERCISE

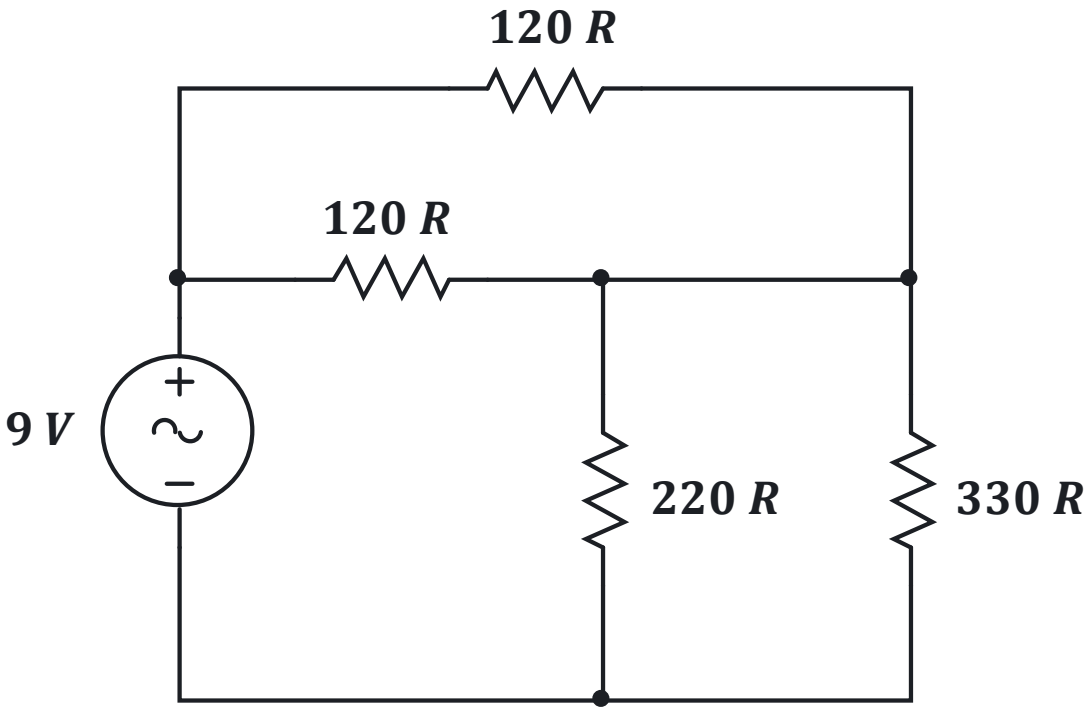
Determine the **current** flowing through each resistor and the **voltage** drop across each resistor of the given circuit.

Solution:



EXERCISE

Determine the **current** flowing through each resistor and the **voltage** drop across each resistor of the given circuit.

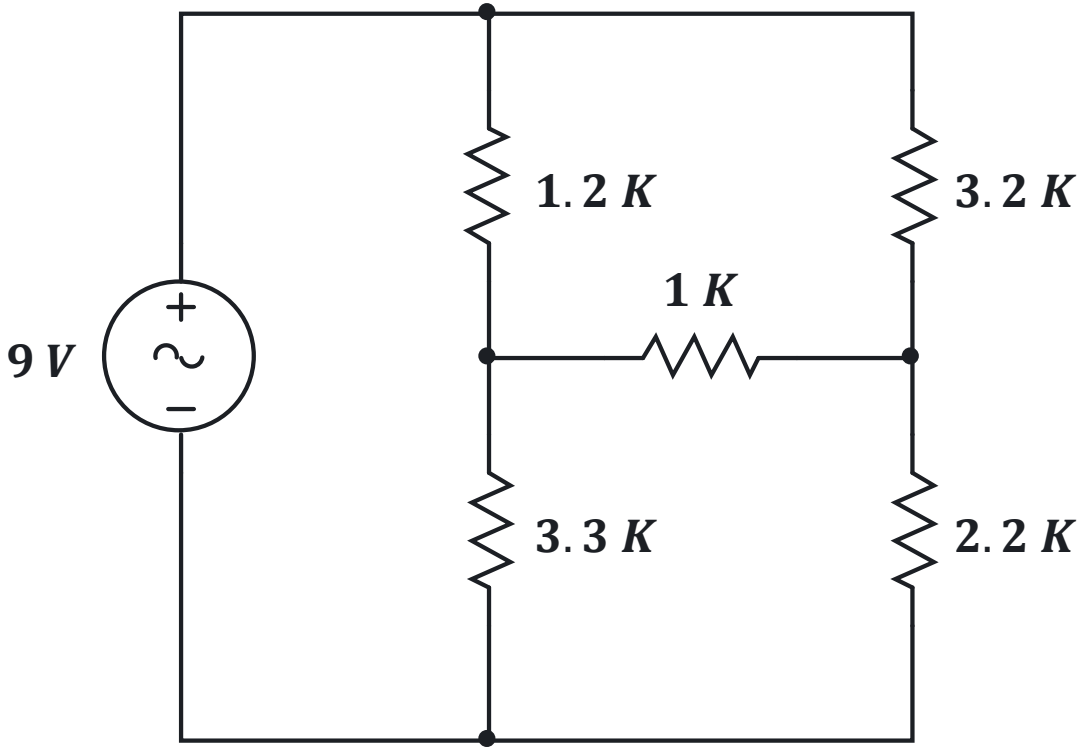


Solution:

EXERCISE

Determine the **current** flowing through each resistor and the **voltage** drop across each resistor of the given circuit.

Solution:



LABORATORY

LABORATORY 1

Reference File:

student notes\laboratory exercises\L1-Lab 1 Measuring Voltage-Current-Resistance.pdf