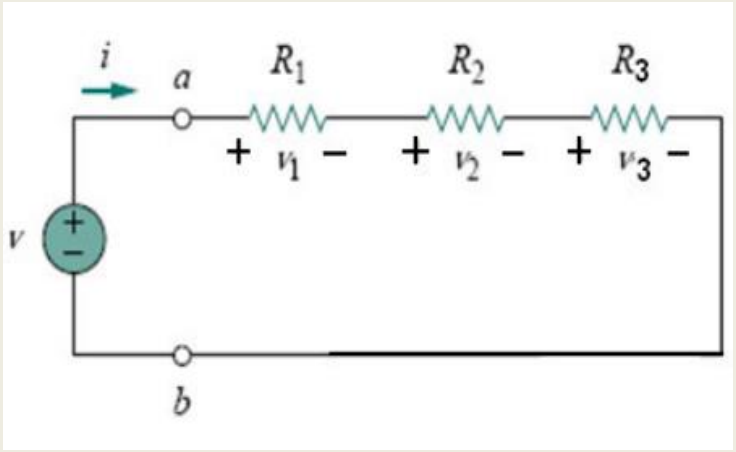
National University

# Faculty of Engineering and Architecture

## Voltage and Current Division

# 1- Voltage Division:

- The source voltage v is divided among the resistors in direct proportion to their resistances
- The larger the resistance, the larger the voltage drop.

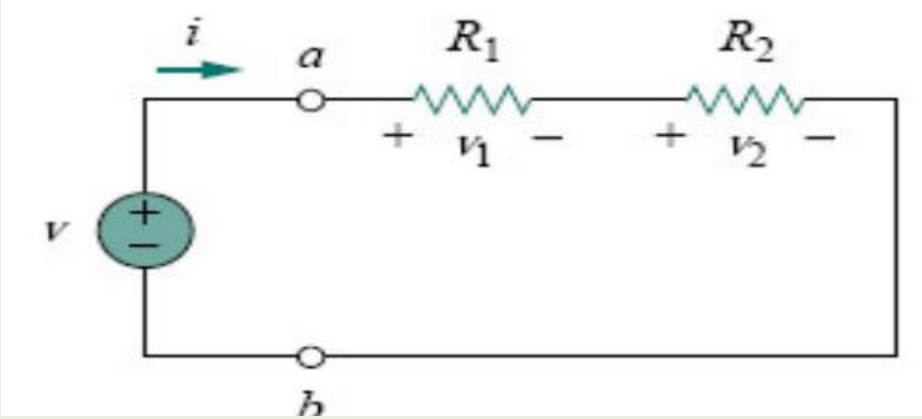



**we know i = VTOTAL / (R1 + R2 + R3)**
**so the voltage over the first resistor is**
**V1=i R1 V1= R1 VTOTAL / (R1 + R2 + R3)**

$$v_1 = V \frac{R_1}{R_1 + R_2 + R_3}$$

# Example:

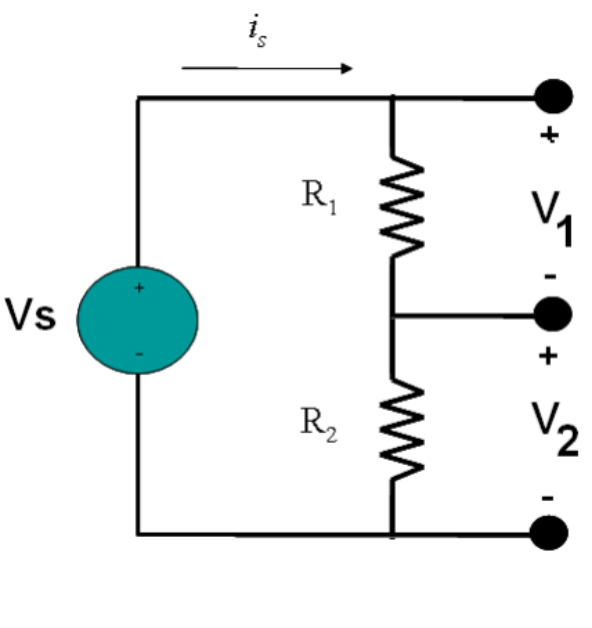
- determine the voltage across each resistor




$$v_1 = \frac{R_1}{R_1 + R_2} v \qquad v_2 = \frac{R_2}{R_1 + R_2} v$$

# Example:

- determine the voltage  across each resistor



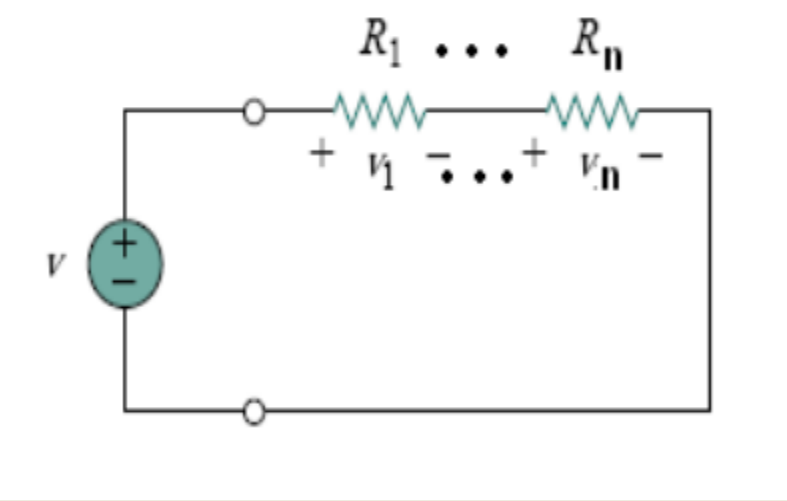

$$i_s = \frac{v_s}{R_1 + R_2}$$

$$v_1 = \frac{R_1}{R_1 + R_2} v_s \qquad i_s$$

$$v_2 = \frac{R_2}{R_1 + R_2} v_s \qquad i_s$$

# In general :

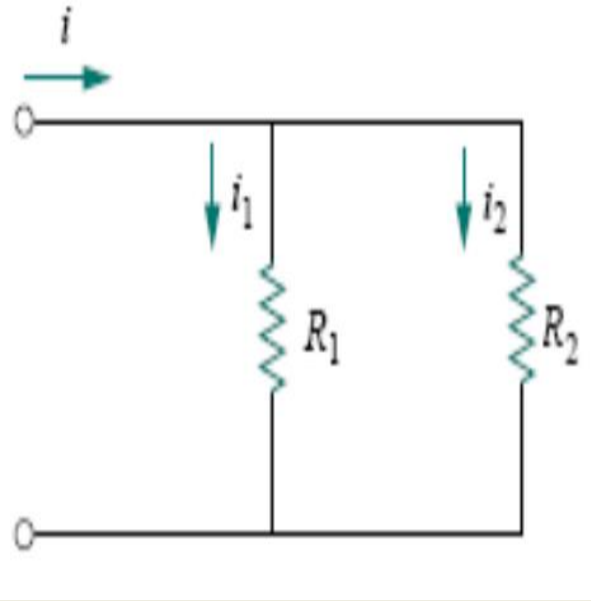
- If a voltage divider has N resistors (R1,R2, . . . , RN) in series with the source voltage v, the nth resistor (Rn) will have a voltage drop of:




$$v_n = \frac{R_n}{R_1 + R_2 + \cdots + R_N} v$$

# 2- Current Division:

- If we know the current flowing into two parallel resistors:




$$v = i\frac{R_1 R_2}{R_1 + R_2} \leftarrow R_{Eq}$$

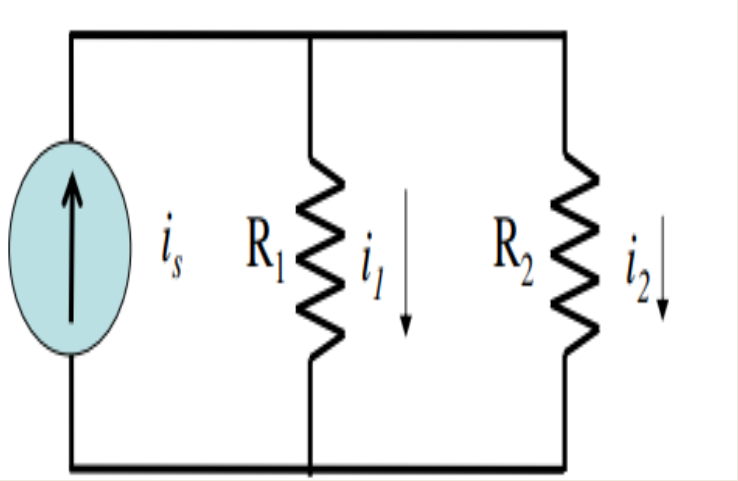
$$i_1 = \frac{v}{R_1}$$

$$i_1 = \frac{1}{R_1}\left[ i\frac{R_1 R_2}{R_1 + R_2} \right]$$

$$i_1 = i\frac{R_2}{R_1 + R_2}$$

# Example:

- Find i1 and i2 in terms of is




$$i_s = i_1 + i_2$$

$$v_1 = v_2$$

$$i_1 R_1 = i_2 R_2$$

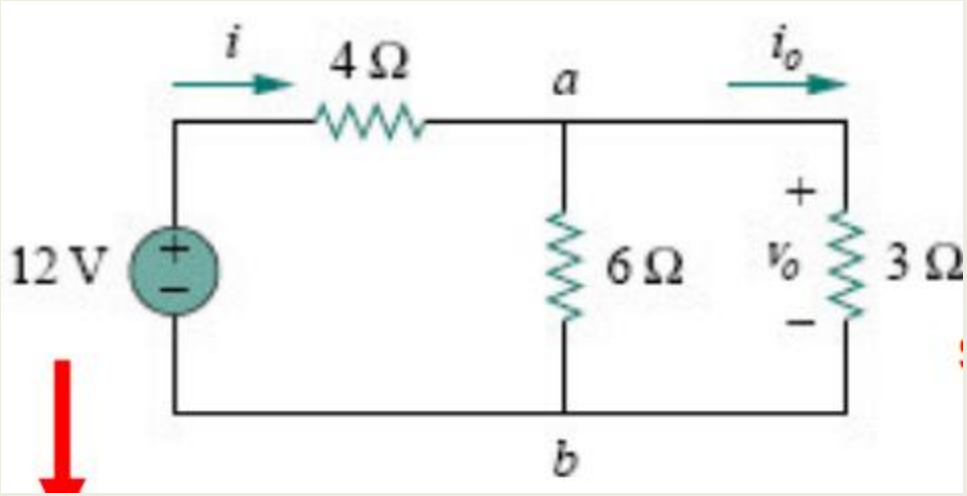
$$i_2 = i_1 \frac{R_1}{R_2} \Rightarrow i_s = i_1 + i_1 \frac{R_1}{R_2} = i_1 \left( \frac{R_2 + R_1}{R_2} \right)$$

$$i_1 = i_s \left( \frac{R_2}{R_1 + R_2} \right)$$

$$i_2 = i_s \left( \frac{R_1}{R_1 + R_2} \right)$$

# Example:

- Use Voltage and current division rules to find $V_o$ and $i_o$:



# For more examples:

- **https://youtu.be/diI7O8vRsy0**