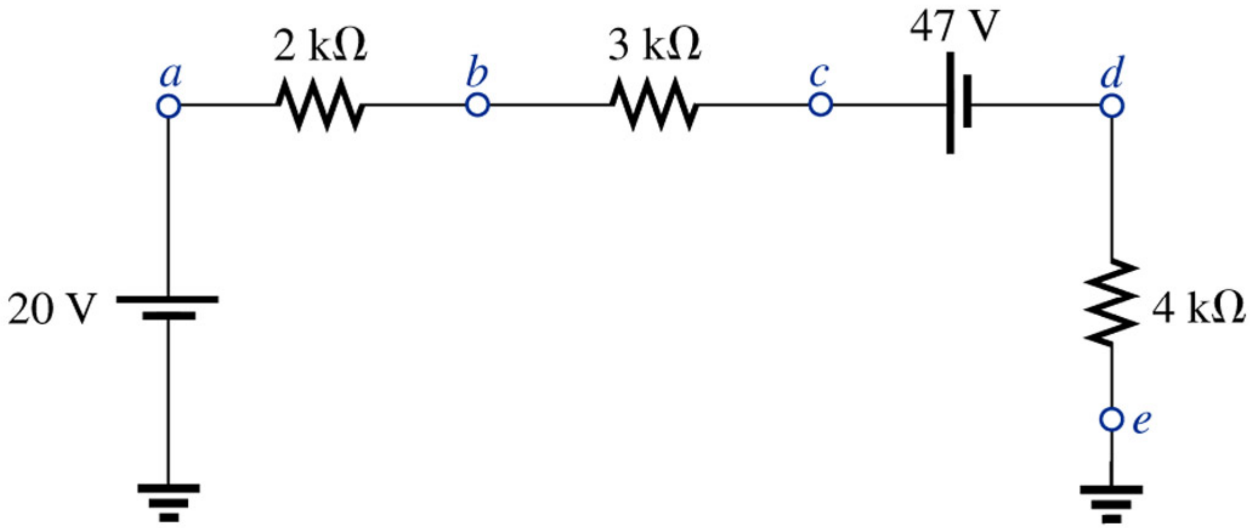
Today's Material

- Breakout #1 and #2
  - Review (Chapter 5)
- Parallel Resistors
  - Introduction and examples
  - Breakout #3
- Kirchhoff's Current Law (KCL)
  - Introduction
  - Examples

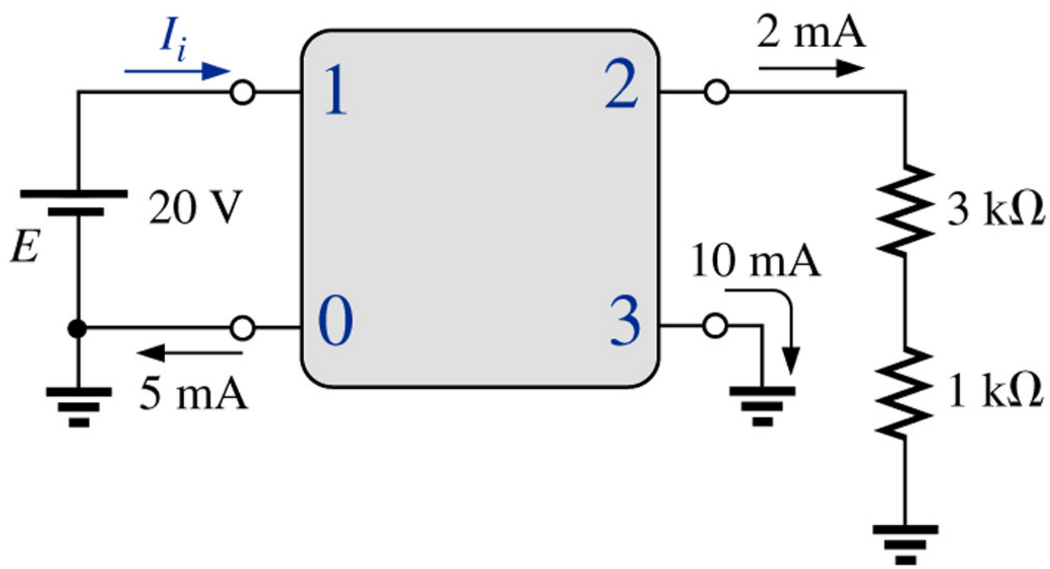
Breakout #1

- Find
  - The magnitude and direction of current flow
  - V_b, V_c, V_d
  - V_{ab}, V_{cd}, V_{de}



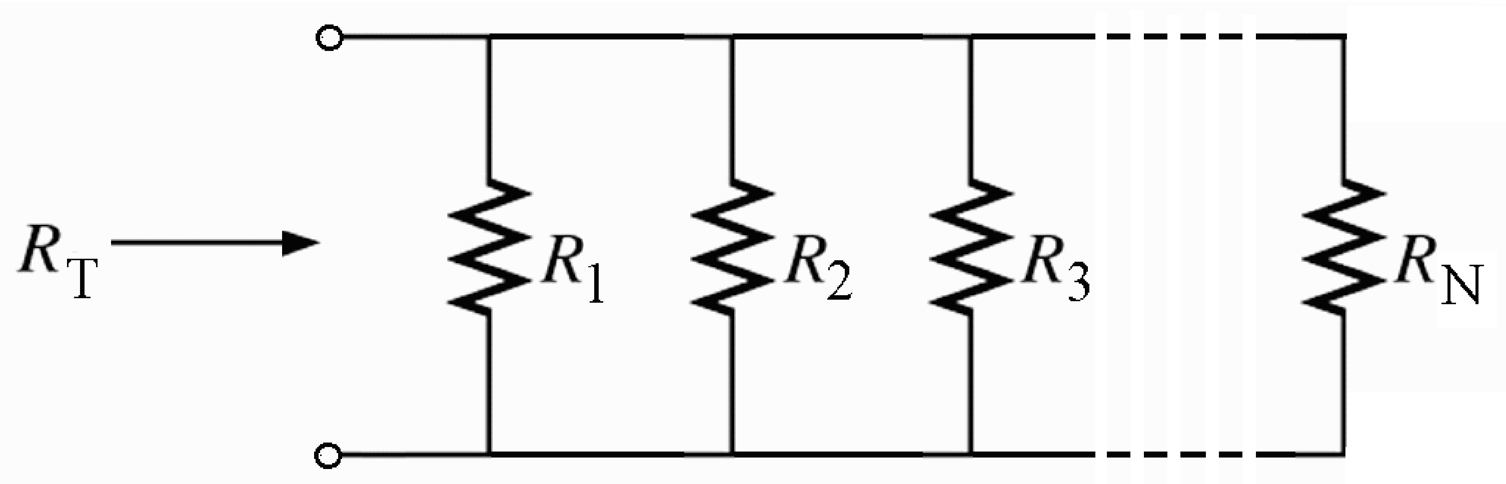
Breakout #2

- Find
  - V_0, V_2, V_{12}, I_i



Parallel Resistors

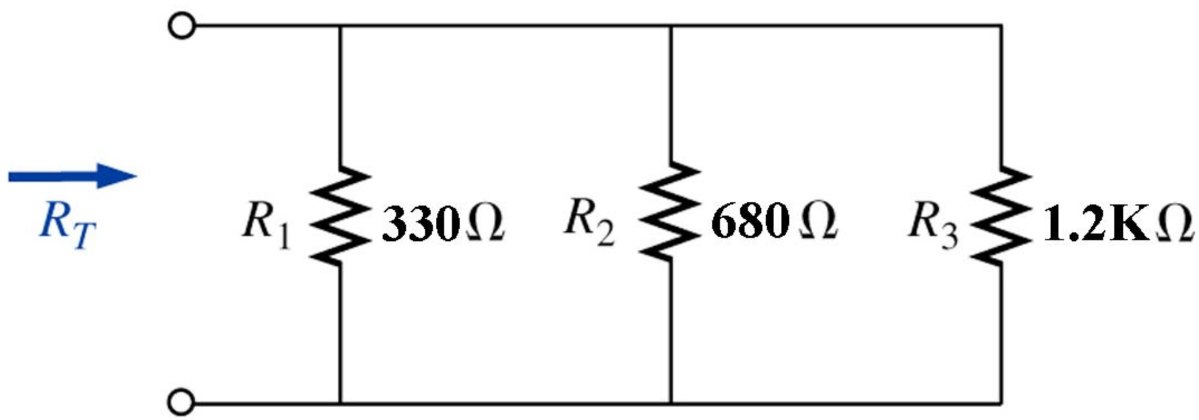
The total resistance of a parallel configuration is the reciprocal of the sum of the reciprocals of all the individual resistor values.



$$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots + \frac{1}{R_N}}$$

Example – Parallel Resistors

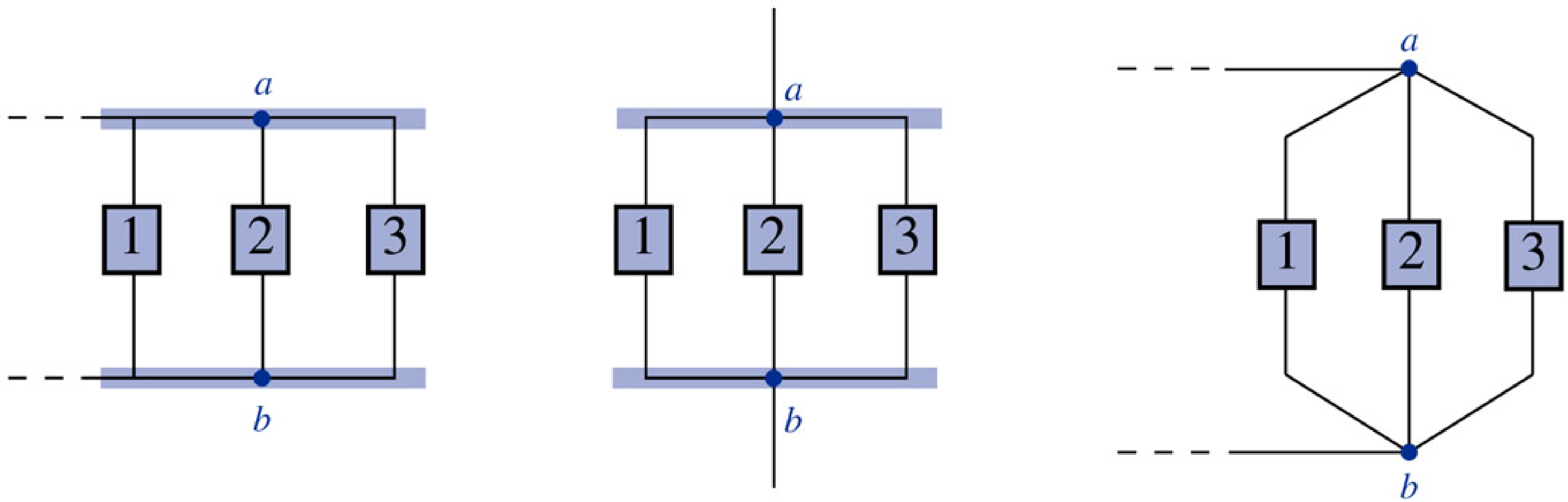
Find R_T for the parallel circuit shown below…



$$R_T = \frac{1}{\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}} = \frac{1}{\frac{1}{330\,\Omega}+\frac{1}{680\,\Omega}+\frac{1}{1.2\,\mathrm{K}\Omega}}$$

$$R_T = 187.47\,\Omega$$

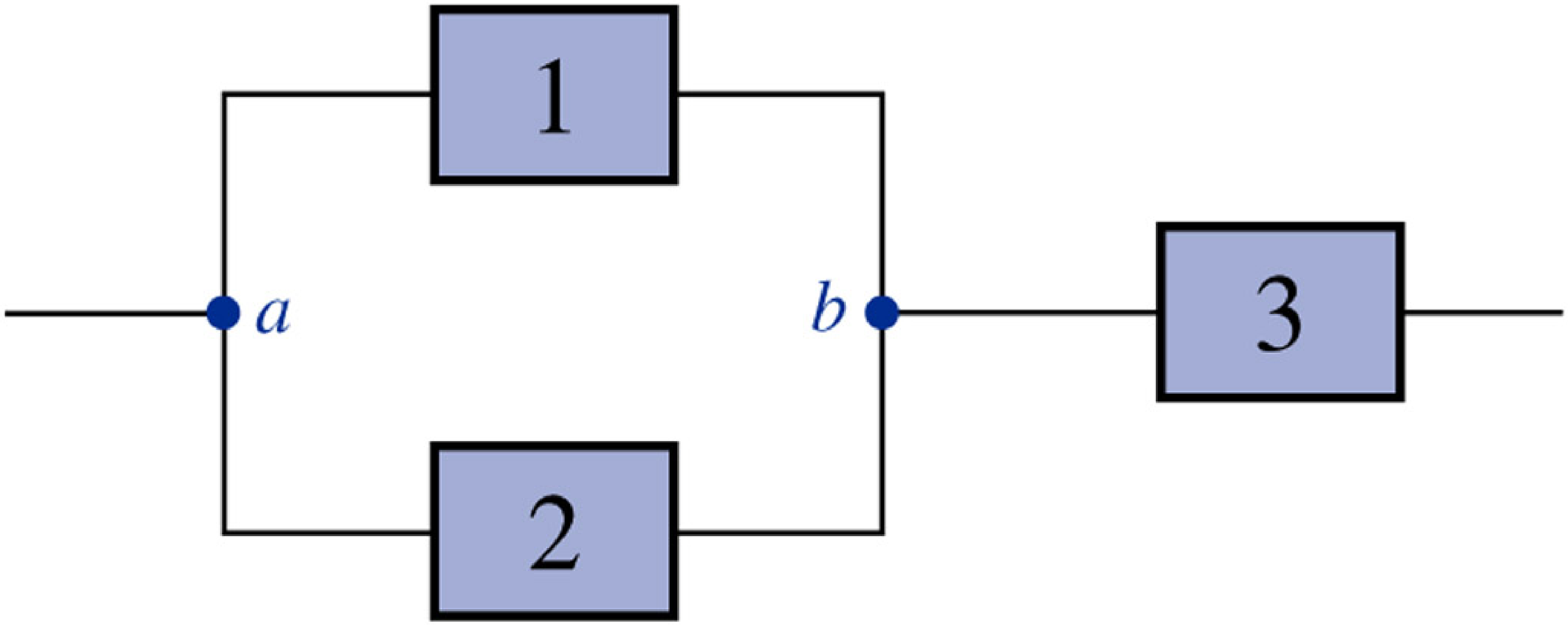
Example – Parallel Components



(a) (b) (c)

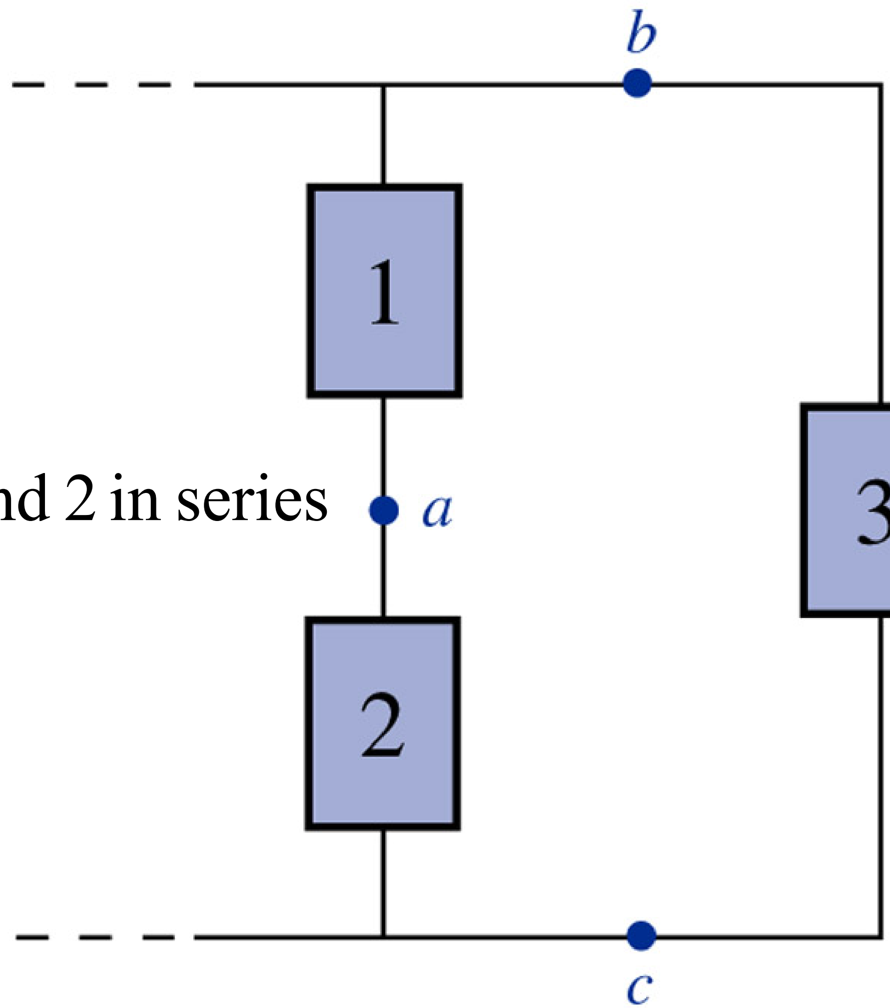
Which Elements are in Parallel? Series?

(1 and 2 in parallel) in series with 3

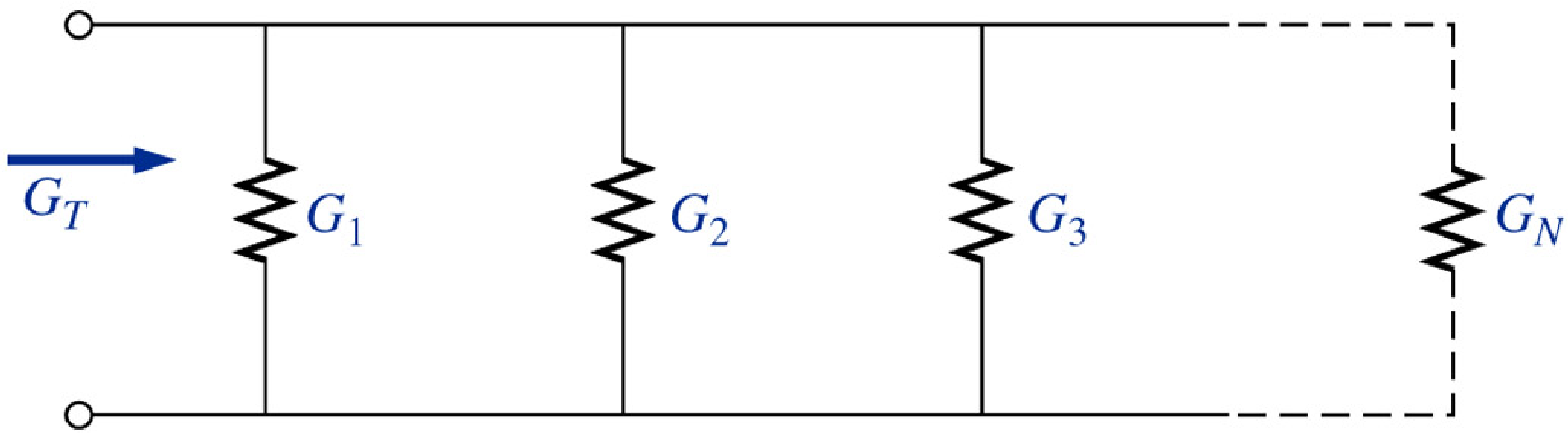


1 and 2 in parallel

Which Elements are in Parallel? Series?

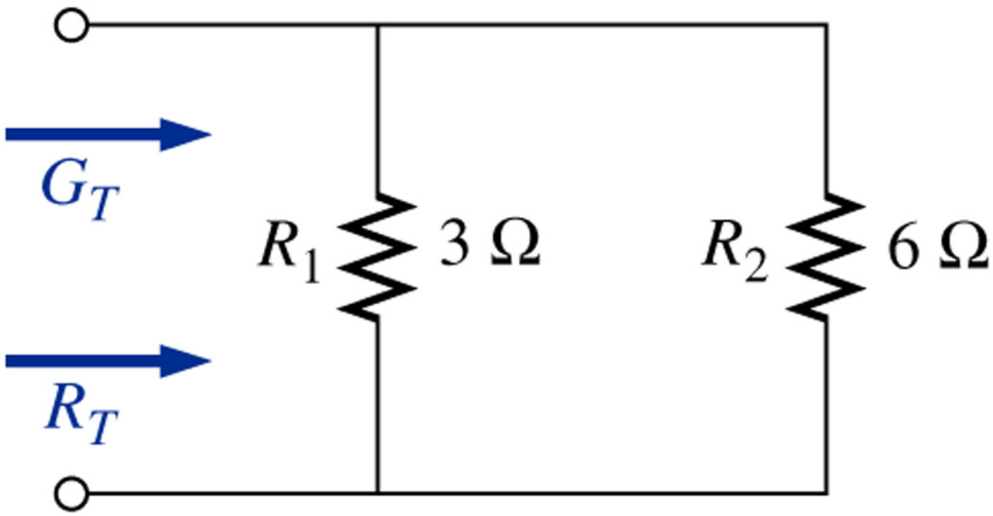


Conductance in Parallel



$$G_T = G_1 + G_2 + G_3 + \ldots + G_N$$

Conductance in Parallel - Example



$$G_1 = \frac{1}{3\Omega} = 333.33\,\text{mS}$$

$$G_2 = \frac{1}{6\Omega} = 166.67\,\text{mS}$$

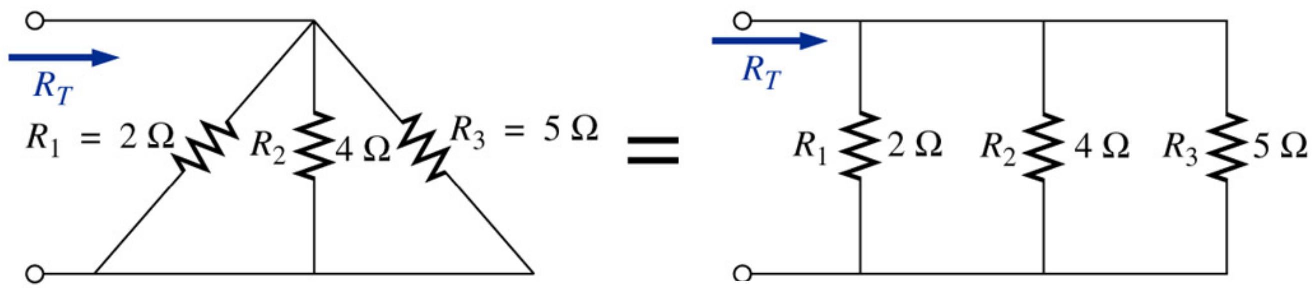
$$G_T = G_1 + G_2 = 0.5\,\text{S}$$

$$R_T = \frac{1}{G_T} = 2\Omega$$

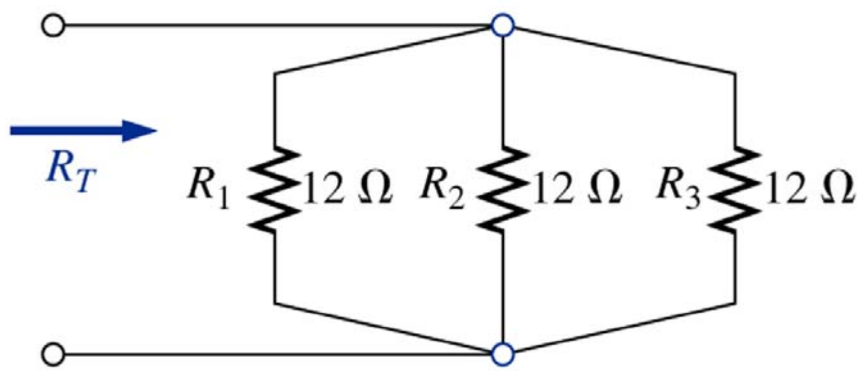
$$\text{or, use}: R_T = \frac{R_1 \cdot R_2}{R_1 + R_2} = \frac{18\Omega^2}{9\Omega} = 2\Omega$$

Breakout #3

- Find
  - R_T and G_T for each circuit



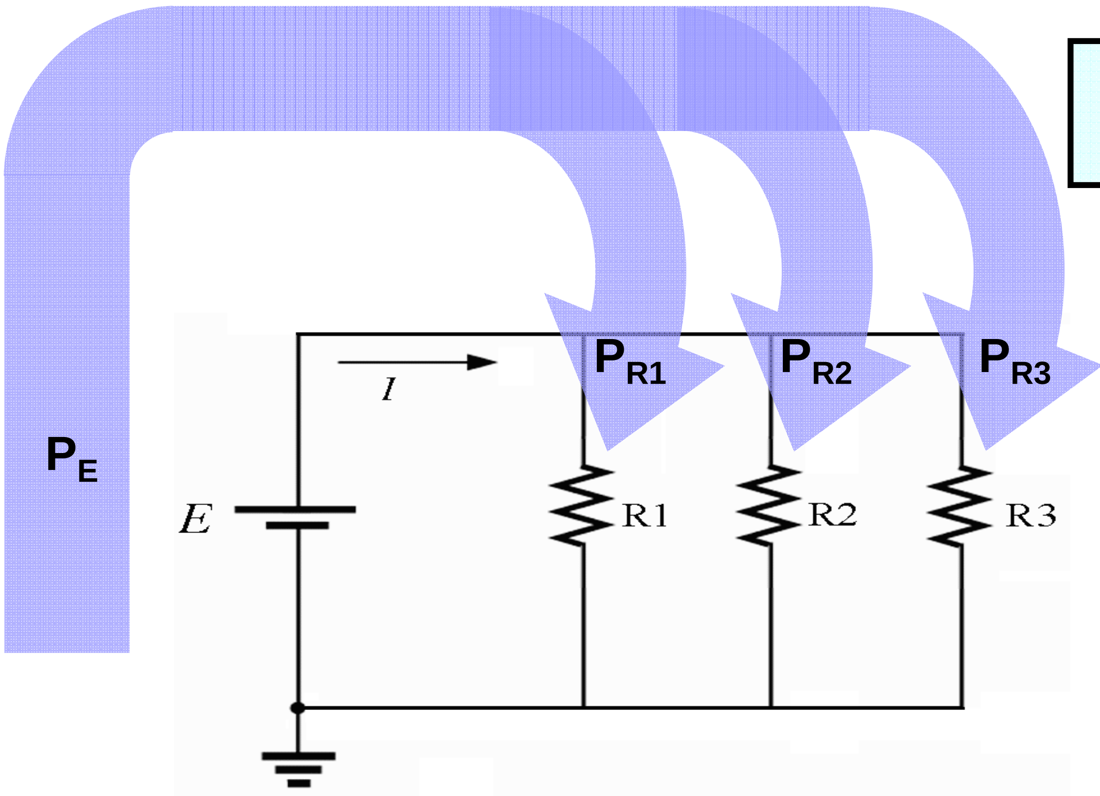
(A)



(B)

Power in a Parallel Circuit (Review)

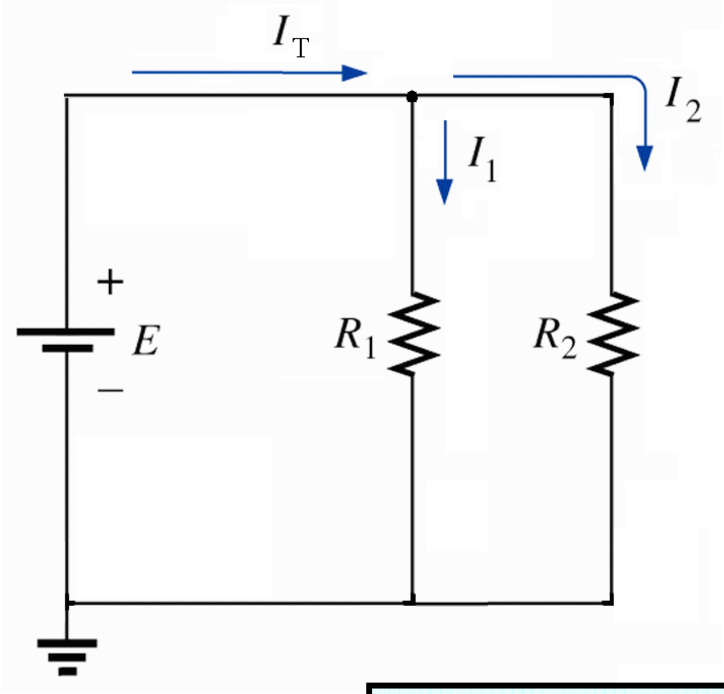
The total power delivered by the voltage source must equal the total power absorbed by the resistive elements.



$$P_E = P_{R1} + P_{R2} + P_{R3}$$

Kirchhoff's Current Law

The algebraic sum of the current entering and leaving a node is zero.

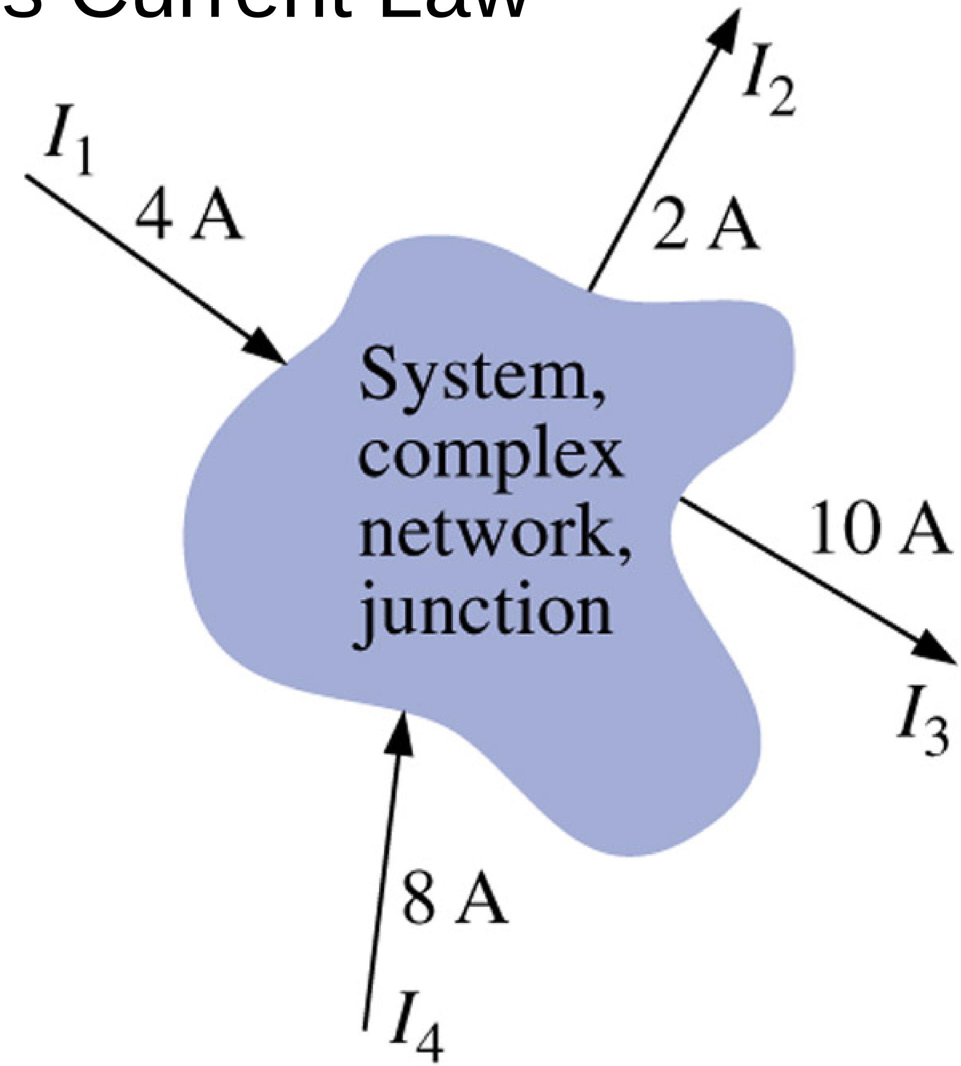


$$I_T - I_1 - I_2 = 0$$

$$I_T = I_1 + I_2$$

$$\boxed{\sum_{\curvearrowright} I_{IN} = \sum_{\curvearrowright} I_{OUT}}$$

Kirchhoff's Current Law



Kirchhoff’s Current Law