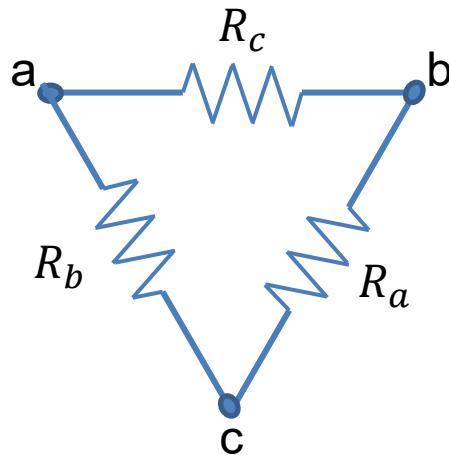
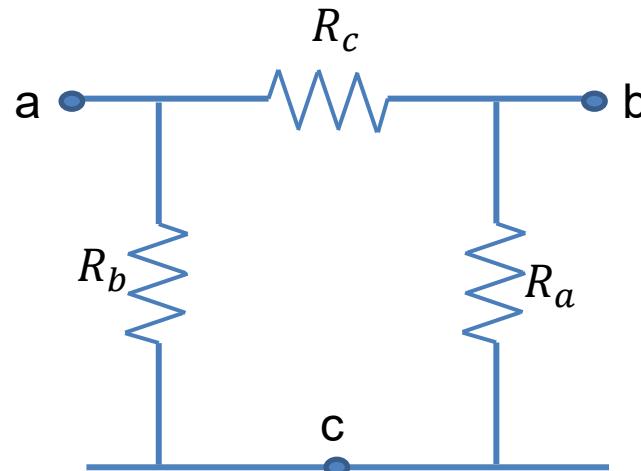


Δ - Υ (Π - T) Equivalent Circuits

Sometimes we encounter a triangular configuration of resistors. These cannot be simplified by series or parallel equivalents.



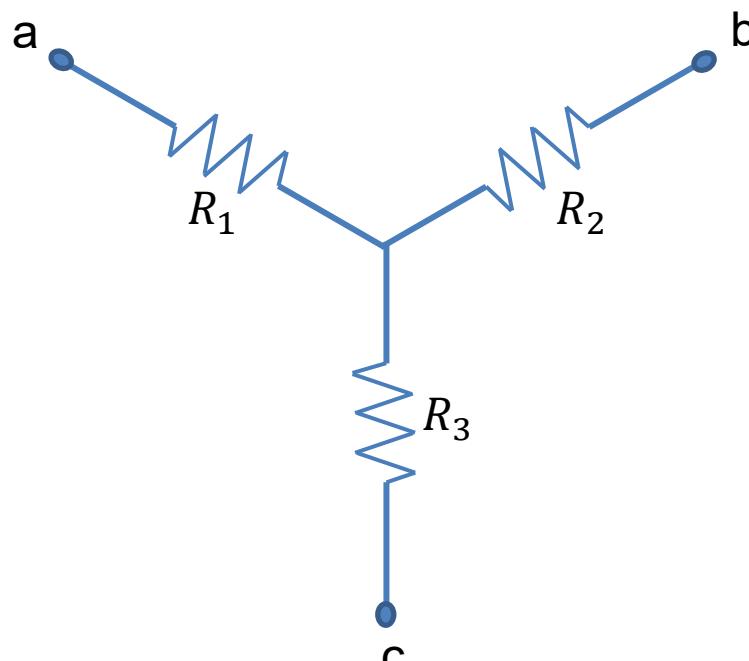
“Delta (Δ)” configuration



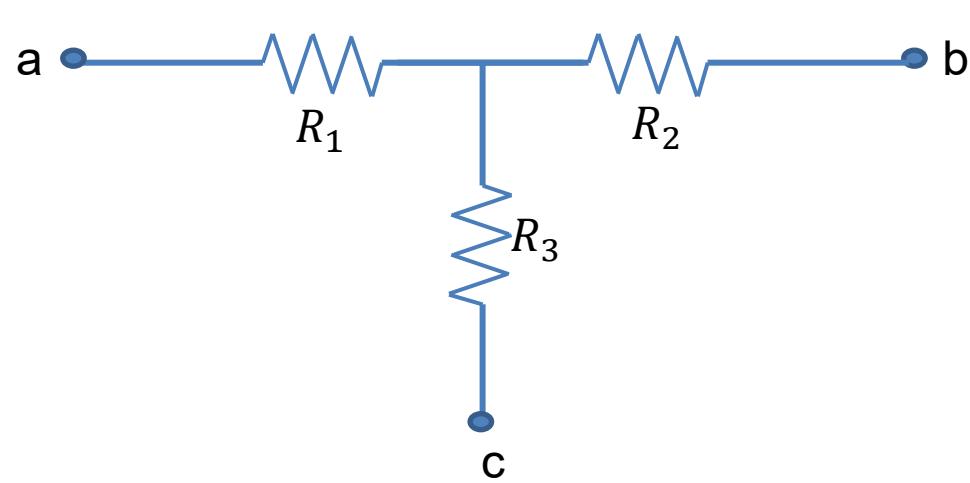
“Pi (Π)” configuration

Δ - Υ (Π - T) Equivalent Circuits

Δ/Π configurations can be transformed to a Υ (or T) configuration. Sometimes by doing so, the resulting circuit can be further simplified.

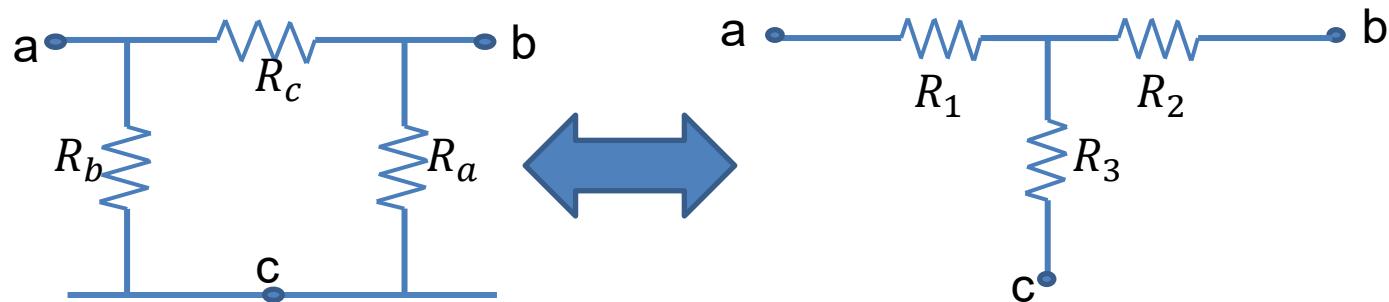


"Y" configuration



"T" configuration

Δ - Y (Π - T) Equivalent Circuits



For the Δ and Y configurations to be equivalent, the resistances between each pair of nodes must be equivalent.

	Δ -configuration	Y -configuration
R_{ab}	$\frac{R_c \cdot (R_a + R_b)}{R_a + R_b + R_c}$	$R_1 + R_2$
R_{ac}	$\frac{R_b \cdot (R_a + R_c)}{R_a + R_b + R_c}$	$R_1 + R_3$
R_{bc}	$\frac{R_a \cdot (R_b + R_c)}{R_a + R_b + R_c}$	$R_2 + R_3$

Δ -Y (Π -T) Equivalent Circuits

With some straightforward algebra, we can solve for R_a , R_b , and R_c in terms of R_1 , R_2 , and R_3 or vice-versa. The following relationships result.

$$R_1 = \frac{R_b \cdot R_c}{R_a + R_b + R_c}$$

$$R_2 = \frac{R_a \cdot R_c}{R_a + R_b + R_c}$$

$$R_3 = \frac{R_a \cdot R_b}{R_a + R_b + R_c}$$



These 3 equations allow us to replace a Δ structure with an equivalent Y structure.

See if you can derive these equations on your own...then put them on your “cheat sheet.”

$$R_a = \frac{R_1 R_2 + R_2 R_3 + R_1 R_3}{R_1}$$

$$R_b = \frac{R_1 R_2 + R_2 R_3 + R_1 R_3}{R_2}$$

$$R_c = \frac{R_1 R_2 + R_2 R_3 + R_1 R_3}{R_3}$$



These 3 equations allow us to replace a Y structure with an equivalent Δ structure.

Example

Find the voltage V in the circuit shown.

