

## Simplifying Circuit Diagrams

An electric circuit contains various components such as: power source (generating devices, batteries, etc.) switches, devices to do work (bulbs, motors, etc.) resistors, capacitors, inductors, and more – all connected in a continuous loop. This allows electricity to flow and power the components.

Every electrical circuit can be simplified to find the values of the various components. Complicated circuits can be simplified by identifying series, parallel, delta, and wye sections within the larger context of the circuit and solving progressively.

### Typical Problem Statements

- Using the information given on the circuits below, determine the unknown values for each circuit.
- For the circuit below, calculate: \_\_\_\_\_
- Solve the unknowns for the following circuit.

### Strategy for simplifying a resistor network

Set up a table for what you know and identify all elements – known and unknown – on your table.

Begin by looking at the overall circuit and seeing where you have groupings of resistors that can be solved for.

Replace groups of series or parallel resistors with their equivalent resistance value.

1. Add up the resistances that are only in series (this will collapse a section of 2 or more into a single value).
2. Group parallel resistances and solve (this will collapse a section of 2 or more into a single value).
3. As necessary, solve for Delta Wye elements.
4. Repeat steps one and two until you have only one resistance value for the whole circuit.

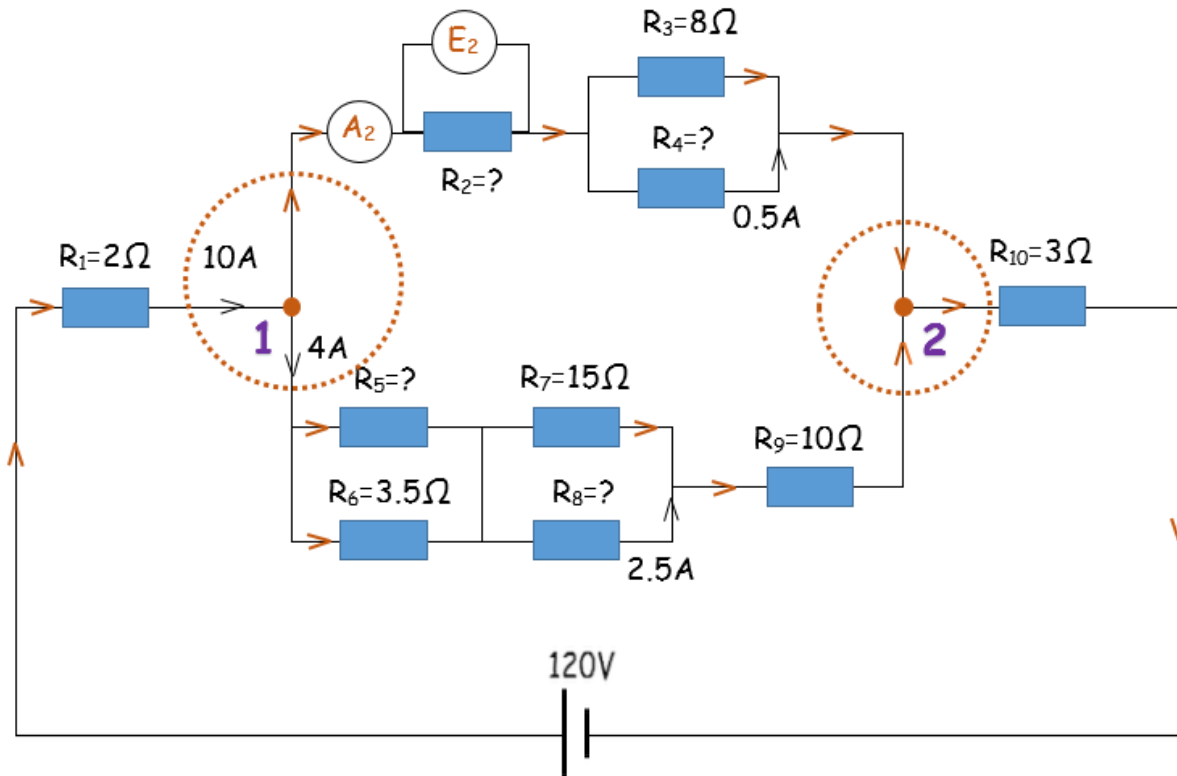
This process will take you from the voltage source until a single equivalent resistance represents the entire resistor network.

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|----------------------------|--|
| <b>Problem Elements</b>    | What is known and what needs to be known?  |
| <b>Components</b>          | Power, resistors, other devices            |
| <b>Relationships</b>       | Series, Parallel, DC, AC, Delta, Wye, etc. |
| <b>Equations</b>           | 1.<br>2.<br>3.                             |
| <b>Operations required</b> | 1.<br>2.<br>3.                             |
| <b>Isolate Sections</b>    |  |
| <b>Calculate</b>           | 1.<br>2.<br>3.                             |

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### Circuit Diagram Problem sample

Calculate the current demand on this circuit.



When asked to calculate the current demand on a complex resistor network you will be working to solve for:  $I = V / R$

Use the steps on the previous page to break the circuit into parts and calculate each part separately.

*See the expanded worksheet for detailed steps and solutions.*