Erlangen Programme - Klein approached geometry as the **study of invariants**

- **Invariant -** structure that is preserved under certain types of **transformations** (**symmetries**)

Noether's Theorem - For every continuous symmetry of the universe, there exists a conserved quantity

- This theorem applies to **continuous symmetries**
- Expands on Klein's work to Physics
- Allows us to figure out the **conserved quantities** for a system
- Captures the connection between conversation laws and symmetry
- All conversation laws arise from a more fundamental relationship, Noether's theorem

Conservation Laws - a result of Noether's Theorem

Symmetry

- **Discrete Symmetry -** Single flips around an axis, or symmetry with some fixed rotation
- **Continuous Symmetry -** Stays the same for **any size shift** in a **given coordinate**
    - Road is continuously symmetric in the direction in which it is directed in
    - A sphere is continuously symmetric around the rotational axes