## Some Important Boolean Identities

| **Identity** | **Name** |
|---|---|
| $\overline{\overline{x}} = x$ | Law of the double complement |
| $x + x = x$<br>$x \cdot x = x$ | Idempotent Laws |
| $x + 0 = x$<br>$x \cdot 1 = x$ | Identity Laws |
| $x + 1 = 1$<br>$x \cdot 0 = 0$ | Domination Laws |
| $x + y = y + x$<br>$xy = yx$ | Commutative Laws |
| $x + (y + z) = (x + y) + z$<br>$x(yz) = (xy)z$ | Associative Laws |
| $x + yz = (x + y)(x + z)$<br>$x(y + z) = xy + xz$ | Distributive Laws |
| $\overline{(xy)} = \overline{x} + \overline{y}$<br>$\overline{(x + y)} = \overline{x}\,\overline{y}$ | De Morgan's Laws |
| $x + xy = x$<br>$x(x + y) = x$ | Absorption Laws |
| $x + \overline{x} = 1$ | Unit Property |
| $x\overline{x} = 0$ | Zero Property |

## The Abstract Definition of a Boolean Algebra

A **Boolean Algebra** is a set $B$ with two binary operations $\vee$ and $\wedge$, elements 0 and 1, and a unary operation $\bar{\ }$ such that the following properties hold for all $x, y$ and $z \in B$:

| **Property** | **Name** |
|---|---|
| $x \vee 0 = x$<br>$x \wedge 1 = x$ | Identity Laws |
| $x \vee \overline{x} = 1$<br>$x \wedge \overline{x} = 0$ | Complement Laws |
| $(x \vee y) \vee z = x \vee (y \vee z)$<br>$(x \wedge y) \wedge z = x \wedge (y \wedge z)$ | Associative Laws |
| $x \vee y = y \vee x$<br>$x \wedge y = y \wedge x$ | Commutative Laws |
| $x \vee (y \wedge z) = (x \vee y) \wedge (x \vee z)$<br>$x \wedge (y \vee z) = (x \wedge y) \vee (x \wedge z)$ | Distributive Laws |