Logical equivalences

Conditional / Implication $A \to B \equiv \neg A \vee B$ and $A \to B \equiv \neg(A \wedge \neg B)$

Biconditional $A \leftrightarrow B \equiv (A \to B) \wedge (B \to A)$

De Morgan $\neg(A \wedge B) \equiv \neg A \vee \neg B$ and $\neg(A \vee B) \equiv \neg A \wedge \neg B$

Negation / Inverse $A \vee \neg A \equiv T$ and $A \wedge \neg A \equiv F$

Identity $A \wedge T \equiv A$ and $A \vee F \equiv A$

Double negation $\neg(\neg A) \equiv A$

Idempotent $A \wedge A \equiv A$ and $A \vee A \equiv A$

Commutative $A \wedge B \equiv B \wedge A$ and $A \vee B \equiv B \vee A$

Associative $(A \wedge B) \wedge C \equiv A \wedge (B \wedge C)$ and $(A \vee B) \vee C \equiv A \vee (B \vee C)$

Distributive $A \wedge (B \vee C) \equiv (A \wedge B) \vee (A \wedge C)$ and $A \vee (B \wedge C) \equiv (A \vee B) \wedge (A \vee C)$

Annihilation $A \vee T \equiv T$ and $A \wedge F \equiv F$

Absorption $A \vee (A \wedge B) \equiv A$ and $A \wedge (A \vee B) \equiv A$

Rules of inference

Name	**Tautology**	**Rule**
Modus ponens / Direct reasoning	$[A \wedge (A \to B)] \to B$	A $A \to B$ $\therefore\ B$
Modus tollens / Indirect reasoning	$[\neg B \wedge (A \to B)] \to \neg A$	$\neg B$ $A \to B$ $\therefore\ \neg A$
Hypothetical syllogism	$[(A \to B) \wedge (B \to C)] \to (A \to C)$	$A \to B$ $B \to C$ $\therefore\ A \to C$
Disjunctive syllogism	$[(A \vee B) \wedge \neg A] \to B$	$A \vee B$ $\neg A$ $\therefore\ B$
Addition	$A \to (A \vee B)$	A $\therefore\ A \vee B$
Simplification	$(A \wedge B) \to A$	$A \wedge B$ $\therefore\ A$
Resolution	$[(A \vee B) \wedge (\neg A \vee C)] \to (B \vee C)$	$A \vee B$ $\neg A \vee C$ $\therefore\ B \vee C$
Conjunction	$[(A) \wedge (B)] \to (A \wedge B)$	A B $\therefore\ A \wedge B$

Fallacies

Affirming the conclusion is incorrectly assuming that $[(A \to B) \wedge B] \to A$ is a tautology.

Denying the hypothesis is incorrectly assuming that $[(A \to B) \wedge \neg A] \to \neg B$ is a tautology.