Theorem 2.1.1 — Logical Equivalences (Epp page 35)

Given any statement variables p, q, and r, a tautology $\mathbf{t}$, and a contradiction $\mathbf{c}$, the following logical equivalences hold:

Commutative laws:	$p \wedge q \equiv q \wedge p$	$p \vee q \equiv q \vee p$
Associative laws:	$(p \wedge q) \wedge r \equiv p \wedge (q \wedge r)$	$(p \vee q) \vee r \equiv p \vee (q \vee r)$
Distributive laws:	$p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$	$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$
Identity laws:	$p \wedge \mathbf{t} \equiv p$	$p \vee \mathbf{c} \equiv p$
Negation laws:	$p \vee {\sim}p \equiv \mathbf{t}$	$p \wedge {\sim}p \equiv \mathbf{c}$
Double negative law:	${\sim}({\sim}p) \equiv p$	
Idempotent laws:	$p \wedge p \equiv p$	$p \vee p \equiv p$
Universal bound laws:	$p \vee \mathbf{t} \equiv \mathbf{t}$	$p \wedge \mathbf{c} \equiv \mathbf{c}$
De Morgan's laws:	${\sim}(p \wedge q) \equiv {\sim}p \vee {\sim}q$	${\sim}(p \vee q) \equiv {\sim}p \wedge {\sim}q$
Absorption laws:	$p \vee (p \wedge q) \equiv p$	$p \wedge (p \vee q) \equiv p$
Negations of $\mathbf{t}$ and $\mathbf{c}$:	${\sim}\mathbf{t} \equiv \mathbf{c}$	${\sim}\mathbf{c} \equiv \mathbf{t}$

Table 2.3.1 — Rules of Inference (Epp, page 60)

Modus ponens	$p \to q$ p $\therefore q$		Disjunctive syllogism	$p \vee q$ ${\sim}q$ $\therefore p$	$p \vee q$ ${\sim}p$ $\therefore q$
Modus tollens	$p \to q$ ${\sim}q$ $\therefore {\sim}p$		Hypothetical syllogism	$p \to q$ $q \to r$ $\therefore p \to r$	
Disjunctive addition	p $\therefore p \vee q$	q $\therefore p \vee q$	Dilemma, or Proof by division into cases	$p \vee q$ $p \to r$ $q \to r$ $\therefore r$	
Conjunctive simplification	$p \wedge q$ $\therefore p$	$p \wedge q$ $\therefore q$			
Conjunctive addition	p q $\therefore p \wedge q$		Contradiction rule	${\sim}p \to \mathbf{c}$ $\therefore p$	
Closing conditional world without contradiction	$\mid p$ (assumed) $\mid q$ (derived) $\therefore p \to q$		Closing conditional world with contradiction	$\mid p$ (assumed) $\mid q \wedge {\sim}q$ (derived) $\therefore {\sim}p$	

Other Logical Equivalences and Rules of Inference

Definition of implication:	$p \to q \equiv {\sim}p \vee q$	${\sim}(p \to q) \equiv p \wedge {\sim}q$
Contrapositive rule:	$p \to q \equiv {\sim}q \to {\sim}p$	
Definition of biconditional:	$p \leftrightarrow q \equiv (p \to q) \wedge (q \to p)$	
Negation of quantifiers:	${\sim}(\forall x\ P(x)) \equiv \exists x\ {\sim}P(x)$	${\sim}(\exists x\ P(x)) \equiv \forall x\ {\sim}P(x)$

Universal modus ponens:	$\forall x \in D, P(x) \to Q(x)$ $P(a)$ where $a \in D$ $\therefore Q(a)$	Universal modus tollens:	$\forall x \in D, P(x) \to Q(x)$ ${\sim}Q(a)$ where $a \in D$ $\therefore {\sim}P(a)$
Universal instantiation:	$\forall x \in D, P(x)$ $\therefore P(a)$ where $a \in D$	Existential instantiation*:	$\exists x \in D, P(x)$ $\therefore P(a)$ where $a \in D$
Universal generalization*:	$P(a)$ where $a \in D$ $\therefore \forall x \in D, P(x)$	Existential generalization:	$P(a)$ where $a \in D$ $\therefore \exists x \in D, P(x)$

*Remember the special circumstances required for the rules marked by the stars.