Some Equivalence Laws of Propositional Logic

$(P \wedge Q) \vee R$	$\equiv$	$(P \vee R) \wedge (Q \vee R)$	distributivity law
$P \vee P$	$\equiv$	P	idempotency law for $\vee$
$P \vee Q$	$\equiv$	$Q \vee P$	commutativity of $\vee$
$P \vee (Q \vee R)$	$\equiv$	$(P \vee Q) \vee R$	associativity of $\vee$
$P \vee \text{true}$	$\equiv$	true	true is right zero of $\vee$
$\text{true} \vee P$	$\equiv$	true	true is left zero of $\vee$
$P \vee \text{false}$	$\equiv$	P	false is right one of $\vee$
$\text{false} \vee P$	$\equiv$	P	false is left one of $\vee$
$P \wedge P$	$\equiv$	P	idempotency law for $\wedge$
$P \wedge Q$	$\equiv$	$Q \wedge P$	commutativity of $\wedge$
$P \wedge (Q \wedge R)$	$\equiv$	$(P \wedge Q) \wedge R$	associativity of $\wedge$
$P \wedge \text{true}$	$\equiv$	P	true is right one of $\wedge$
$\text{true} \wedge P$	$\equiv$	P	true is left one of $\wedge$
$P \wedge \text{false}$	$\equiv$	false	false is right zero of $\wedge$
$\text{false} \wedge P$	$\equiv$	false	false is left zero of $\wedge$
$\neg \neg P$	$\equiv$	P	double negation law
$P \Rightarrow Q$	$\equiv$	$\neg P \vee Q$	implication in terms of $\vee$
$P \Rightarrow Q$	$\equiv$	$\neg Q \Rightarrow \neg P$	contrapositive law
$\text{true} \Rightarrow P$	$\equiv$	P	true absorbed in implication
$\text{false} \Rightarrow P$	$\equiv$	true	false implies anything
$P \Rightarrow \text{true}$	$\equiv$	true	anything implies true
$P \Rightarrow \text{false}$	$\equiv$	$\neg P$	implication and negation law
$P \Leftrightarrow Q$	$\equiv$	$(P \wedge Q) \vee (\neg P \wedge \neg Q)$	bi-implication in terms of $\vee$ and $\wedge$
$P \Leftrightarrow Q$	$\equiv$	$(P \Rightarrow Q) \wedge (Q \Rightarrow P)$	bi-implication in terms of implication
$P \wedge Q$	$\equiv$	$\neg (\neg P \vee \neg Q)$	De Morgan's law
$P \vee Q$	$\equiv$	$\neg (\neg P \wedge \neg Q)$	De Morgan's law
$P \wedge (Q \vee R)$	$\equiv$	$(P \wedge Q) \vee (P \wedge R)$	distributivity law
$(P \vee Q) \wedge R$	$\equiv$	$(P \wedge R) \vee (Q \wedge R)$	distributivity law
$P \vee (Q \wedge R)$	$\equiv$	$(P \vee Q) \wedge (P \vee R)$	distributivity law
$(P \wedge Q) \vee R$	$\equiv$	$(P \vee R) \wedge (Q \vee R)$	distributivity law
$(P \vee Q) \Rightarrow R$	$\equiv$	$(P \Rightarrow R) \wedge (Q \Rightarrow R)$	distributivity law
$P \Rightarrow (Q \wedge R)$	$\equiv$	$(P \Rightarrow Q) \wedge (P \Rightarrow R)$	distributivity law

Some Equivalence Laws of Predicate Logic

$\exists\, x : X \cdot P$	$\equiv$	P	provided $x \backslash P$
$\exists\, x : X \cdot P \vee Q$	$\equiv$	$(\exists\, x : X \cdot P) \vee (\exists\, x : X \cdot Q)$	existential quantification and disjunction
$\exists\, x : X \cdot P \wedge x = e$	$\equiv$	$P[e/x]$	one point rule
$\forall\, x : X \cdot P$	$\equiv$	P	provided $x \backslash P$
$\forall\, x : X \cdot P \wedge Q$	$\equiv$	$(\forall\, x : X \cdot P) \wedge (\forall\, x : X \cdot Q)$	existential quantification and disjunction
$\exists\, x : X \cdot P$	$\equiv$	$\neg\, \forall\, x : X \cdot \neg\, P$	existential and universal quantification
$\forall\, x : X \cdot P$	$\equiv$	$\neg\, \exists\, x : X \cdot \neg\, P$	existential and universal quantification

Some Equivalence Laws of Set Operators

$x \notin X$	$\equiv$	$\neg (x \in X)$	definition of not an element of
$x \in X \cup Y$	$\equiv$	$x \in X \vee x \in Y$	from definition of union
$x \in X \cap Y$	$\equiv$	$x \in X \wedge x \in Y$	from definition of intersection
$x \in X \backslash Y$	$\equiv$	$x \in X \wedge x \notin Y$	from definition of set difference
$x \in X^c$	$\equiv$	$x \notin X$	from definition of set complement
$x \in \mathbb{P} X$	$\equiv$	$x \subseteq X$	from definition of power set

Some Equivalence Laws of Relation and Function Operators

$(x, y) \in r^{-1}$	$\equiv$	$(y, x) \in r$	from definition of relational inverse
$x \in \operatorname{dom}(r)$	$\equiv$	$\exists\, y : T \cdot (x, y) \in r$	from definition of domain
$x \in \operatorname{ran}(r)$	$\equiv$	$\exists\, y : T \cdot (y, x) \in r$	from definition of range
$(x, z) \in r \fatsemi s$	$\equiv$	$\exists\, y : T \cdot (x, y) \in r \land (y, z) \in s$	from definition of relational composition
$(r^{-1})^{-1}$	$\equiv$	r	double inverse
$x \in X$	$\equiv$	$(x, x) \in r$	provided r is reflexive
$(x, y) \in r$	$\equiv$	$(y, x) \in r$	provided r is symmetric
$(x, y) \in r \land (y, z) \in r$	$\Rightarrow$	$(x, z) \in r$	provided r is transitive
$(x, y) \in r^*$	$\equiv$	$\exists\, n : \mathbb{N} \cdot (x, y) \in r^n$	from definition of r^*
$(x, y) \in r^+$	$\equiv$	$\exists\, n : \mathbb{N}^+ \cdot (x, y) \in r^n$	from definition of r^+
$r^n \fatsemi r^m$	$\equiv$	r^{n+m}	composition of iterated relations
$r^* \fatsemi r^*$	$\equiv$	r^*	composition of transitive closure
$r^* \fatsemi r^+$	$\equiv$	r^+	composition of transitive closure
$r^+ \fatsemi r^*$	$\equiv$	r^+	composition of transitive closure
$r \fatsemi r^*$	$\equiv$	r^+	composition of transitive closure
$r^* \fatsemi r$	$\equiv$	r^+	composition of transitive closure