Correspondence Between Logic and Set Theory

Logic	Set Theory
Is a proposition A true?	Is an object x in a set A?
A is True	$x \in A$
A is False	$x \notin A$
$\neg A$	$\overline{A}$
$A \vee B$	$A \cup B$
$A \wedge B$	$A \cap B$
$A \wedge \neg B$	$A \setminus B$
$A \to B$ is a tautology	$A \subseteq B$
$A \leftrightarrow B$ is a tautology	$A = B$
$A, B \vdash A \wedge B$	If $x \in A$ and $x \in B$ then $x \in A \cap B$
$A \wedge B \vdash A$	If $x \in A \cap B$ then $x \in A$
Modus ponens: $A, A \to B \vdash B$	If $x \in A$ and $A \subseteq B$ then $x \in B$.
If we assume A and deduce B then $A \to B$.	If we can take an arbitrary $x \in A$ and show that $x \in B$ then $A \subseteq B$.
$A \vdash A \vee B$	If $x \in A$ then $x \in A \cup B$
$A \vee B, A \to C, B \to C \vdash C$	If $x \in A \cup B$, $A \subseteq C$, and $B \subseteq C$ then $x \in C$.
$\bot \vdash A$	For any set A, $\emptyset \subseteq A$
True	Universe U
False	$\emptyset$

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Distributive Laws: $A\wedge(B\vee C)\Leftrightarrow(A\wedge B)\vee(A\wedge C)$ $A\vee(B\wedge C)\Leftrightarrow(A\vee B)\wedge(A\vee C)$	$A\cap(B\cup C)=(A\cap B)\cup(A\cap C)$ $A\cup(B\cap C)=(A\cup B)\cap(A\cup C)$
De Morgan's Laws: $\neg(A\vee B)\Leftrightarrow\neg A\wedge\neg B$ $\neg(A\wedge B)\Leftrightarrow\neg A\vee\neg B$	$\overline{A\cup B}=\overline{A}\cap\overline{B}$ $\overline{A\cap B}=\overline{A}\cup\overline{B}$
$\to$ is transitive. $A\to B, B\to C + A\to C$	$\subseteq$ is transitive. If $A\subseteq B$ and $B\subseteq C$ then $A\subseteq C$.
Law of the Excluded Middle: $A\vee\neg A$	For any object x and set A, either $x\in A$ or $x\notin A$.
Principle of Double Negation: $\neg\neg A\Leftrightarrow A$	$\overline{\overline{A}}=A$
Law of Contraposition: $A\to B\Leftrightarrow\neg B\to\neg A$	$A\subseteq B$ if and only if $\overline{B}\subseteq\overline{A}$