

Problem 1. Write "Stop, or I'll shoot" as an implication.

"(You) stop, or I'll shoot" rewrites as "If you do not stop, then I will shoot." since $\neg p \vee q \equiv p \Rightarrow q$ as in **Problem 3A**.

Problem 2. Negate the if-then statement: "If Sara lives in Athens, then she lives in Greece."

Since $\neg(p \Rightarrow q) \equiv p \wedge \neg q$, we can write the negation of the implication as "Sara lives in Athens and she does not live in Greece."

Problem 3A. Show $p \Rightarrow q \equiv \neg p \vee q$.

We write the truth table of $p \Rightarrow q$ out:

p	q	$p \Rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

We also write the truth table of $\neg p \vee q$ out:

p	q	$\neg p$	$\neg p \vee q$
T	T	F	T
T	F	F	F
F	T	T	T
F	F	T	T

Because the columns for $p \Rightarrow q$ and $\neg p \vee q$ have identical T and F values, $p \Rightarrow q$ and $\neg p \vee q$ are logically equivalent.

Problem 3B. Show $p \Rightarrow q \equiv \neg q \Rightarrow \neg p$.

We write the truth table of $p \Rightarrow q$ out:

p	q	$p \Rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

We also write the truth table of $\neg q \Rightarrow \neg p$ out:

p	q	$\neg p$	$\neg q$	$\neg q \Rightarrow \neg p$
T	T	F	F	T
T	F	F	T	F
F	T	T	F	T
F	F	T	T	T

Because the columns for $p \Rightarrow q$ and $\neg q \Rightarrow \neg p$ have identical T and F values, $p \Rightarrow q$ and $\neg q \Rightarrow \neg p$ are logically equivalent.

Problem 3C. Show $(p \Rightarrow q) \Rightarrow q \equiv p \vee q$.

We write the truth table of $(p \Rightarrow q) \Rightarrow q$ out:

p	q	$p \Rightarrow q$	$(p \Rightarrow q) \Rightarrow q$
T	T	T	T
T	F	F	T
F	T	T	T
F	F	T	F

We also write the truth table of $p \vee q$ out:

p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

Both $(p \Rightarrow q) \Rightarrow q$ and $p \vee q$ output the same T and F values, so $(p \Rightarrow q) \Rightarrow q$ and $p \vee q$ are logically equivalent.