

Section 9.6 Inverse, Converse, Contrapositive

Related Conditional Statements		
Original Statement	$p \Rightarrow q$	if p, then q
Inverse	$\neg p \Rightarrow \neg q$	if not p, then not q
Converse	$q \Rightarrow p$	if q, then p
Contrapositive	$\neg q \Rightarrow \neg p$	if not q, then not p

Example: Write the inverse, converse, and contrapositive of the following statement. Then give its truth value.

If it is 8 PM, then the sun has already set.

Inverse:

If it is not 8 PM, then the sun has not already set.

Truth Value ~ False, it could be 10 PM. If so, the sun would have already set.

Converse:

If the sun has already set, then it is 8 PM.

Truth Value ~ False. The sun could have set but it is 7 PM.

Contrapositive:

If the sun has not already set, then it is not 8 PM.

Truth Value ~ True. The sun would already have set by 8 PM.

Example: Write the inverse, converse, and contrapositive of the following statements

a) $P \Rightarrow Q$

Inverse: $\neg P \Rightarrow \neg Q$

Converse: $Q \Rightarrow P$

Contrapositive: $\neg Q \Rightarrow \neg P$

b) $P \Rightarrow \neg Q$

Inverse: $\neg P \Rightarrow Q$

Converse: $\neg Q \Rightarrow P$

Contrapositive: $Q \Rightarrow \neg P$

c) $(P \vee Q) \Rightarrow P$

Inverse: $\neg(P \vee Q) \Rightarrow \neg P$

Converse: $P \Rightarrow (P \vee Q)$

Contrapositive: $\neg P \Rightarrow \neg(P \vee Q)$

Example: Write down in words the meaning of $\neg Q \Rightarrow \neg P$

P: It is raining.

Q: I will bring an umbrella.

Answer: If I will not bring an umbrella then it is not raining.

Complete the truth table below

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