

Logic: Lesson 1

Statement: A statement in mathematics is a sentence, which is either true or false. Statements are often represented by the symbols p and q .

Compound Statement (2 kinds):

- Conjunction: p AND q ... written $p \wedge q$
- Disjunction: p OR q ... written $p \vee q$

Truth of a Compound Statement:

- $p \wedge q$ is true if and only if p is true AND q is true
- $p \vee q$ is true unless p and q are false.

Truth Table: Used to analyze the logical truth of a statement.

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

Negation of a statement: When representing any statement with p , the statement “ p is false” is called the **NEGATION** of p . This is written $\neg p$ or $\sim p$.

p	$\sim p$
T	F
F	T

Negation of a Compound Statement:

- Conjunction: $p \wedge q$ Negation ... $\sim (p \wedge q) = \sim p \vee \sim q$
- Disjunction: $p \vee q$ Negation ... $\sim (p \vee q) = \sim p \wedge \sim q$

Conditional Sentence: Where p and q represent statements, the statement “if p then q ” is called a conditional sentence. It is expressed by the symbols $p \rightarrow q$. The statement p is the hypothesis and the statement q is the conclusion. $p \rightarrow q$ can also be written by saying “ q if p ”, “ p implies q ”, “ q follows p ”... in each case, q is the conclusion.

If we interchange the hypothesis (p) with the conclusion (q) we get the **CONVERSE** $q \rightarrow p$

p	q	$p \rightarrow q$	$q \rightarrow p$
T	T	T	T
T	F	F	T
F	T	T	F
F	F	T	T

Notice that the **ONLY TIME** a conditional is false is when p is true and q is false.

The table shows truth values for a conditional sentence as they are defined in the study of logic. There **MAY** or **MAY NOT** be any connection between the hypothesis and conclusion. No cause and effect relationship is necessary.