## 1.8 Logic Statements

**Lesson Objective** *After studying this section, you will be able to:*

- *Recognize conditional statements*
- *Recognize the negation of a statement*
- *Recongnize the converse, the inverse, and the contrapositive of a statement*
- *Use the chain rule to draw conclusions*

Besides writing the converse, there are two more ways to manipulate a conditional statement.

***Remember:*** *You begin with the conditional "If p, then q", where p is the hypothesis and q is the conclusion:*

| | |
|---|---|
| ***Conditonal:*** | *"If p, then q"* |
| ***Converse:*** | *"If q, then p"* |
| ***Inverse:*** | *"If not p, then not q"* |
| ***Contrapositive:*** | "If not q, then not p" |

***New Logic Symbols!***

***~ means "not" or the negation***

***⇒ means "implies"***

***Definition of Inverse:*** The inverse of a conditional statement is the NEGATION of the conditional (i.e., the opposite of both the conditional hypothesis and conclusion).

Using logic symbols:
$\sim p \Rightarrow \sim q$

***Definition of Contrapostive:*** The contrapostitive of a conditional statement is the NEGATION of the converse of the conditional. (i.e., the opposite of both the conclusion and hypothesis).

Using logic symbols:
$\sim q \Rightarrow \sim p$

**Example**

| | |
|---|---|
| **Conditional:** | If an angle measures 40°, then the angle is acute. |
| **Converse:** | If an angle is acute, then it measures 40°. |
| **Inverse:** | If an angle does not measure 40°, then it is not acute. |
| **Contrapositive:** | If an angle is not acute, then it does not measure 40°. |

**Note:** In this case, the converse and the inverse are false statements. To prove they are false, a counterexample is given. This is an example that disproves the statement.

"An angle that is acute could be an angle that measures 50°."

***LOGICALLY EQUIVALENT:*** If the original conditional statement is true, then the contrapositive must also be true. They are what is referred to as "logically equivalent."

***Chain Reasoning:*** When more than one conditional is given and a connection between the **conclusion** of one to the **hypothesis** of the next is made, this is referred to as "chain reasoning."

**Below is an example of chain reasoning:**

**If *the team scores enough points*, then they will win the game.**

**If the team wins the game, *then they will go to the districts*.**

**If *the team goes to the districts*, then *they will miss school*.**

**Conclusion:** ***If*** *the team scores enough points*, ***then*** *they will miss school.*

**Example using logic symbols:**

If **p** then **q**,

If **q** then **r**,

If **r** then **t**.

**Conclusion:** If **p** then **t**.

Notice the links in the "chain!"

***IMPORTANT!*** *If the second conditional statement were* ***"~r then ~q,"***
*it could be turned into* ***"q then r"***
*since the contrapositive and the conditional are* *logically equivalent.*