

## 1.8 Logic Statements

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

- Recognize conditional statements
- Recognize the negation of a statement
- Recognize 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:

<b>Conditional:</b>	“If $p$ , then $q$ ”
<b>Converse:</b>	“If $q$ , then $p$ ”
<b>Inverse:</b>	“If not $p$ , then not $q$ ”
<b>Contrapositive:</b>	“If not $q$ , then not $p$ ”

### New Logic Symbols!

$\sim$  means “not” or the negation

$\Rightarrow$  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 Contrapositive:** The contrapositive 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

<b>Conditional:</b>	If an angle measures $40^\circ$ , then the angle is acute.
<b>Converse:</b>	If an angle is acute, then it measures $40^\circ$ .
<b>Inverse:</b>	If an angle does not measure $40^\circ$ , then it is not acute.
<b>Contrapositive:</b>	If an angle is not acute, then it does not measure $40^\circ$ .

**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  $50^\circ$ .”

**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:**

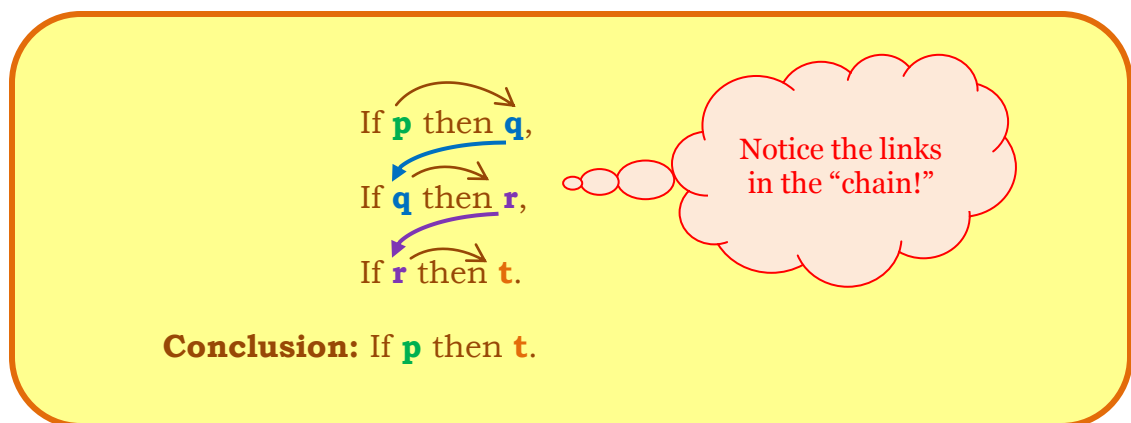
**If the team scores enough points, then they will win the game.**

**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:**



**IMPORTANT!** If the second conditional statement were “ $\sim r$  then  $\sim q$ ,” it could be turned into “**q then r**” since the contrapositive and the conditional are logically equivalent.