

## 2.3: Deductive Reasoning

Objective: - use symbolic notation to represent logical statements  
- form conclusions using the law of logic

Warm-up: Write the contrapositive

- 1) If it thunders, the golf tournament is canceled
- 2) If  $x(x-1) = 0$ , then  $x = 0$  or  $1$
- 3) If  $m\angle A = 45^\circ$ , then  $\angle A$  is  $\cong$  to  $\angle B$

### Using symbolic notation

We know a conditional statement has a hypothesis + conclusion

We can use symbols to represent it.

$p \rightarrow q$  reads  $p$  implies  $q$  where  $p$  is the hypothesis and  $q$  is the conclusion

ex: If  $\underbrace{\text{the sun is out}}_p$ , then  $\underbrace{\text{the weather is good}}_q$

What is the converse and how can it be written using symbols

$$q \rightarrow p$$

What about a biconditional statement?

If  $p$  then  $q$  and if  $q$  then  $p$  /  $p \leftrightarrow q$  /  $p$  iff  $q$

Try: Exercise for example 1,

How would the inverse and contrapositive be written using symbols

inverse:  $\sim p \rightarrow \sim q$

contrapositive:  $\sim q \rightarrow \sim p$

Try: Exercise for example 2

H.M. 2.3a

\* The conditional statement is equivalent to the contrapositive  
The converse is equivalent to the inverse.

$$p \rightarrow q = \sim q \rightarrow \sim p$$

$$q \rightarrow p = \sim p \rightarrow \sim q$$

### Laws of deductive reasoning

#### Law of detachment

If  $p \rightarrow q$  is a true statement and  $p$  is true, then  $q$  must be true

ex: If an angle is acute, then it is not obtuse  
- what is  $p$ ,  $q$ ? Use the law of detachment  
An angle is acute

Therefore, the angle is not obtuse

ex 2: If Alberto finds a summer job, then he will buy a car  
Alberto found a summer job  
Therefore, he will buy a car

#### Law of syllogism

If  $p \rightarrow q$  is true and  $q \rightarrow r$  is true, then  $p \rightarrow r$  must be true

ex:  $\uparrow p$  Tim gets stung by a bee, then he will get very ill  
If Tim gets very ill, then he will go to the hospital  
Tim was stung by a bee

#### Try example 5

Closure: How can we write conditional statements using symbols?

What does  $p$  contain?  $q$ ? The conditional statement is equivalent to what? Converse  $\equiv$  to what?

What does the law of detachment say? Law of syllogism? Difference between inductive and deductive