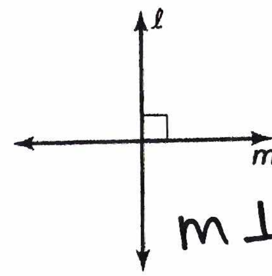
Name ____________________ Date ______________ Period 4

Writing Biconditional Statements // Truth Tables

Lesson Objective IWBAT write biconditional statements; ~~[illegible]~~ use ~~[illegible]~~ biconditional statements to write conditional + converse; fill out truth tables.

Using Definitions

You can write a definition as a conditional statement in "if-then" form or as its converse. Both the conditional statement AND converse are true for definitions. For example, consider the following definition of *perpendicular lines*:



If two lines intersect to form a right angle, then they are perpendicular lines.

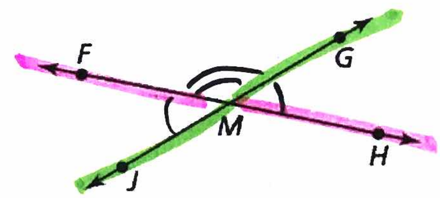
p q

Now, write the converse of the definition:

If 2 lines are perpendicular (⊥), then they intersect to form a right angle.

m ⊥ ℓ

Example: Use the diagram. Decide whether each statement is true. Explain your answer using the definitions you have learned from Chapter 1 and above.



1. $\angle JMF$ and $\angle FMG$ are supplementary.

   T

2. Point M is the midpoint of $\overline{FH}$.

   F

3. $\angle JMF$ and $\angle HMG$ are vertical angles.

   T

4. $\overleftrightarrow{FH} \perp \overrightarrow{JG}$

   F

p → q q → p

Biconditional Statements: When a conditional statement and its converse are both TRUE, you can write them as a single biconditional statement.

➔ A biconditional statement is a statement that contains the phrase " if and only if "

Words: p if and only if q **Symbols:** $p \leftrightarrow q$

**We saw above that definitions have true conditional and converse statements. So, ANY definition can be written as biconditional statements!

Example:

5. Rewrite the definition of perpendicular lines above as a single biconditional statemen.

   2 lines intersect to form a right angle if and only if they are perpendicular lines.

6. Rewrite the definition of congruent segments (shown below) as a single biconditional statement:
"If two line segments have the same length, then they are congruent segments."

2 line segments have the same length if and only if they are congruent segments.

7. Write the conditional statement and converse within the biconditional.
"An angle is a right angle if and only if its measure is 90°."

Conditional: If an ∠ is a right ∠, then its measure is 90°

Converse: If an ∠'s measure is 90°, then it is a right ∠.

<u>Truth Tables</u>

<u>Truth Value</u>: The truth value of a statement is either true (T) or false (F). You can determine the conditions under which a conditional statement if true by using a **truth table.**

Let's look at conditional statements bring TRUE or FALSE in the context of keeping a promise.

	Conditional		
	p	*q*	*p* → *q*
1.	T	T	T
2.	T	F	F
3.	F	T	T
4.	F	F	T

<u>MY PROMISE</u>: If there is an elephant in the library, then I will give you $100.

1. Suppose there really IS an elephant in the library, and I give you $100. T T

2. Suppose there really IS an elephant in the library, and I don't give you any money. T F

3. Suppose there is not an elephant in the library, but I give you $100 anyway. (SWEET!)

4. Suppose there is not an elephant in the library, and I don't give you any money.

Now, let's fill out the following truth tables for the converse, inverse, and contrapositive of a conditional statement:

Converse		
p	*q*	*q* → *p*
T	T	T
T	F	T
F	T	F
F	F	T

Inverse				
p	*q*	~*p*	~*q*	~*p* → ~*q*
T	T	F	F	T
T	F	F	T	T
F	T	T	F	F
F	F	T	T	T

Contrapositive				
p	*q*	~*p*	~*q*	~*q* → ~*p*
T	T	F	F	T
T	F	F	T	F
F	T	T	F	T
F	F	T	T	T

Think About It... Two statements are logically equivalent when they have the same truth table.

So, which statements define the term above? (HINT: look at their truth table outcomes!)

conditional and contrapositive

converse and inverse