Geometry (H) Date NOTES

Unit 1

Reasoning and Proof

Warm-Up: The other day, you were introduced to two types of reasoning. Describe each type of reasoning.

Inductive reasoning: When a generalization is made from a few examples.

Deductive reasoning: When a conclusion is made based on true premises.

Conjecture: is a conclusion you reach using inductive reasoning; is not always true; needs to be checked multiple times;

Counterexample: An example used to prove that an if-then statement is false

In geometry, we must identify relationships between shapes and situations. We are almost always drawing conclusions from given definitions and other information. We carry out this process when we have to prove a result (proofs) or when we have to solve a problem. One strategy we use is the **If-then** statement. These are also known as conditional statements In order for the conclusion ("then" part of the statement, often represented by "q") to be true, the condition(s) must be true (the "if"part of the statement, often represented by "p"). One can also think of true condition(s) results in a true conclusion. We will now look at some examples and different ways of writing a conditional statement.

Examples of conditional statements in the "if-then" form (if p, then q) :

1. If I live in Alaska, then I live in the United States.
2. If a polygon has three sides, then the polygon is a triangle.

Notes:

Hypothesis (plural : hypotheses): the phrase immediately following the word if.

Conclusion: the phrase immediately following the word then

Other forms of the conditional statement:

A implies B

B only if A

B if A

CORRECTION!

Often, conditional statements are written without any of the above forms. They are written as declarative statements. Below are two examples of this form. Write each statement using the four forms given above.

3. Parallel lines have equal slopes.

a) If lines are parallel, then they have equal slopes.

b) Parallel lines implies equal slopes

c) Slopes are equal only if lines are parallel.

d) Slopes are equal if lines are parallel.

4. Freshman students take Geometry Honors.

a) If students are freshmen, then they take Geo H.

b) Freshman students imply that they take Geo H.

c) Students take Geo H only if they are freshmen.

d) Students take Geo H if they are freshmen.

Now, there are three other types of statements related to the conditional. When you have to write these statements, it often helps to think of the conditional as the "main" statement .

Three other related statements: **the converse, the inverse, and the contrapositive.**

STATEMENT	EXAMPLE	FORMED BY.....	True or false
Conditional	If I live in NJ, then I live in the United States.	Hypothesis and conclusion $p \rightarrow q$	T
Converse	If I live in the United States, then I live in NJ.	reverse conditional $q \rightarrow p$	F
inverse	If I don't live in NJ, then I don't live in the United States.	negate conditional $\sim p \rightarrow \sim q$	F
Contrapositive	If I don't live in the United States, then I don't live in NJ.	reverse, negate negate, reverse $\sim q \rightarrow \sim p$	T

5. Practice writing each type of statement for the given conditional. Then determine if each statement is true or false.

Given conditional: If I like all kinds of music, then I like hip-hop.

Converse: If ~~ hip hop, then I like all music (T /F) F

Inverse: If I don't like ~~, then I don't like hip hop (T/F) F

Contrapositive: If I don't like ~~all music~~ hip hop (T/F) T
then I don't like all kinds music.

Notes: Look at the true/false results of the condiitonals, converses, inverses, and contrapositives above. Can you find a pattern to complete the statements below?

- Conditional and contrapositive will always be true or false together. The same is true for converse and inverse. Such statements that are both true or both false are called **logically equivalent** statements.

- **Biconditional statements**: When the conditionals and its converse are both true, you can combine them into one statement. This combined statement is called a biconditional statement.

6. Let's write a biconditional statement: uses "if and only if"

Conditional: If two lines never intersect each other, then they are parallel lines.

Converse: If lines are parallel, then they never intersect each other.

Biconditional statement:
Two lines never intersect if and only if they never intersect each other.

7. Write a biconditional statement for the definition of a midpoint.

A point is a midpoint if and only if it divides a segment into 2 congruent parts.

Therefore, a definition is a biconditional statement.

Definition, postulate, and theorem related to ANGLES:

Def: Supplementary angles: two $\angle$s whose sum is 180°.

The Linear Pair Theorem (also known as **the Linear Pair Postulate**):

If two angles form a linear pair, then they are supplementary.