Geometry Notes G.1 Inductive Reasoning, Conditional Statements Mrs. Grieser

Name: ________________________ Date: ______________ Block: _______

Introduction to Logic

What comes next?

a) 9^2 = _________,
99^2 = _________,
999^2 =_________,
$9,999^2$ =_________,
$99,999^2$ = _________,
_________ = _________

b) 12345·9 =____________,
12345·18 =____________,
12345·27 =____________,
_________=____________

c) 2, 4, ____, _____, ______

- How did you know what came next in the above examples?
- You used **inductive reasoning**; you looked for a pattern, and applied it as a rule.

Examples of **conjectures** using inductive reasoning:

- All ice I have ever observed in cold, therefore all ice is cold.
- The sun has risen every day of my life, therefore it will rise tomorrow.
- I have always gotten an A in math class, therefore I will get an A in this math class
- All members of a sample got well from a medication, therefore the entire population will get well from this medication.
- ____

What are some problems with inductive reasoning? ______________________

What is useful about inductive reasoning?

- Use inductive reasoning to **disprove** a conjecture by finding a **counterexample**

Example: **All odd numbers are prime**.

Prove this conjecture **false** by finding a **counterexample**, an odd number that is not prime.

- A counterexample to this conjecture is the number ________.
- An example of a conjecture that uses inductive reasoning that can be disproved by a counterexample is (give the counterexample, too): ______________________

Vocabulary Review Fill in the descriptions for each term…

Notation/Term	***Description***
conjecture	
inductive reasoning	
counterexample	

Conditional Statements

Conditional Statements (If-Then):

hypothesis — conclusion

If an animal meows, then it is a cat.

- Examples:
  - If the weather is nice, then I will wash the car.
  - If 2 divides evenly into x, then x is a positive number.
  - Your turn: ____
- Sometimes have to put into if-then form…
  - All birds have feathers

    ____
  - Two angles are supplementary if they are a linear pair.

    ____

Forms of Conditional Statements

Notation: Let p represent the hypothesis of a conditional, and q represent the conclusion

- ***If p then q*** also written as $\boldsymbol{p \rightarrow q}$; stated as "**p implies q**"
- Conditionals have **converse**, **inverse**, and **contrapositive** statements
- *Example 1*: All birds have feathers
- **Conditional**: If an animal is a bird, then it has feathers
- **Converse**: $q \rightarrow p$; exchange hypothesis and conclusion

  ____
- **Inverse**: $\sim(p \rightarrow q)$ or $\sim p \rightarrow \sim q$; negate hypothesis and conclusion

  ____
- **Contrapositive**: $\sim q \rightarrow \sim p$; converse of the inverse

  ____
- Example 2: Two angles are supplementary if they are a linear pair.
- Conditional: ____
- Converse: ____
- Inverse ____
- Contrapositive ____

Write the conditional if-then form, converse, inverse, and contrapositive forms of the following statements. Assuming the original statement is true; decide whether the other forms are true or false.

1) All cats are mammals. if-then: converse: inverse: contrapositive:	2) Baseball players are athletes. if-then: converse: inverse: contrapositive:	3) All 180° $\angle$s are straight $\angle$s. if-then: converse: inverse: contrapositive:

You Try…

1) Guitar players are musicians. if-then: converse: inverse: contrapositive:	2) All Great Danes are large. if-then: converse: inverse: contrapositive:	3) A polygon is regular if it is equilateral. if-then: converse: inverse: contrapositive:

- What can we inductively conclude about the converse and inverse of a statement?
- What can we inductively conclude about a conditional statement and its contrapositive?
- They are ________________________________ statements (have the same truth value).

Biconditional Statements

- Statements where the **original** statement and **converse** are **BOTH true**
- Use the words "if and only if" (IFF)
- Notation: $p \leftrightarrow q$
- Example: An animal meows IFF it is a cat. Other examples?
- Which of the previous examples are biconditional?

Compound Logic Statements

- **conjunction**: A compound logic statement formed using the word ***and***
- **disjunction**: A compound logic statement formed using the word ***or***
- Example:
  - p: Joes eats fries q: Maria drinks soda
  - $p \wedge q$: Joe eats fries and Maria drinks soda
  - $p \vee q$: Joe eats fries or Maria drinks soda
  - A conjunction is true IFF only both parts are true
  - A disjunction is false IFF only both parts are false
- You try: Write the statement in symbolic form, or translate the symbols to English…

a: We go to school on a holiday b: Arbor Day is a holiday c: We work on Arbor Day

1) We work on Arbor Day or Arbor Day is a holiday. ____________________
2) Arbor Day is a holiday and we do not work on Arbor Day.____________________
3) If we go to school on a holiday and Arbor Day is a holiday then we work on Arbor Day ____________________
4) $a \wedge c$ ____________________
5) $b \vee c \wedge \sim a$ ____________________
6) $(\sim a \wedge b) \rightarrow c$ ____________________

Vocabulary Review

Term	*Description*	*Notation*
conditional statement	A logical statement that has a hypothesis and conclusion; can be put in the form "if-then."	$p \rightarrow q$
hypothesis	The "if" part of a conditional statement.	p
conclusion	The "then" part of a conditional statement.	q
negation	The opposite of the original statement or clause.	$\sim p$
converse	The statement formed if the hypothesis and conclusion are switched.	$q \rightarrow p$
inverse	The statement formed by negating both the hypotheses and conclusion.	$\sim p \rightarrow \sim q$
contrapositive	The statement formed by writing the converse of the inverse.	$\sim q \rightarrow \sim p$
biconditional statement	A statement whose converse is equivalent to the original form of the statement; contains "if and only if" (IFF).	$p \leftrightarrow q$
equivalent statements	Statements that have the same truth value (true or false).	N/A
conjunction	Compound logic statement using *and.*	$p \wedge q$
disjunction	Compound logic statement using *or.*	$p \vee q$