F Math 12

3.6 The Inverse and the Contrapositive of Conditional Statements p. 208

Name ________________

Date ________________

Goal: Understand and interpret the contrapositive and inverse of a conditional statement.

1. **inverse**: A statement that is formed by negating both the hypothesis and the conclusion of a conditional statement; for example, for the statement "If a number is even, then it is divisible by 2," the inverse is "If a number is **not** even, then it is **not** divisible by 2."

2. **contrapositive**: A statement that is formed by negating both the hypothesis and the conclusion of the **converse** of a conditional statement; for example, for the statement "If a number is even, then it is divisible by 2," the contrapositive is "If a number is **not** divisible by 2, then it is **not** even."

p	q	$p \Rightarrow q$
T	T	T
F	F	T
F	T	T
T	F	F

Communication | *Notation*

In logic notation, the inverse of "if *p*, then *q*" is written as "If $\neg p$, then $\neg q$."

Communication | *Notation*

In logic notation, the contrapositive of "if *p*, then *q*" is written as "If $\neg q$, then $\neg p$."

Example 1: Verifying the inverse and contrapositive of a conditional Statement (p. 209)
Consider the following conditional statement: "If today is February 29, then this year is a leap year."

a) Verify the statement, or disprove it with a counterexample.

Hypothesis (p):______________________________

Conditional statement: if p, then q.

Conclusion (q):______________________________

p	q	$p \Rightarrow q$

b) Verify the converse, or disprove it with a counterexample.

converse:____

Hypothesis (p):______________________________

Converse: if q, then p.

Conclusion (q):______________________________

q	p	$q \Rightarrow p$

c) Verify the inverse, or disprove it with a counterexample.

Inverse:____

Hypothesis ($\neg p$):____________________________

Inverse: if _________, then ______.

Conclusion ($\neg q$):____________________________

$\neg p$	$\neg q$	$\neg p \Rightarrow \neg q$

d) Verify the contrapositive, or disprove it with a counterexample.

Contrapositive:____

Hypothesis ($\neg q$):____________________________

Contrapositive: if ___, then ______.

Conclusion ($\neg p$):____________________________

$\neg q$	$\neg p$	$\neg q \Rightarrow \neg p$

Example 2: Examining the relationship between a conditional statement and its contrapositive (p. 210)

Consider the following conditional statement: “If a number is a multiple of 10, then it is a multiple of 5.”

a) Write the contrapositive of this statement.

b) Verify that the conditional and contrapositive statements are both true.

In Summary:

- You form the **inverse** of a conditional statement by ________________________ the hypothesis and the conclusion.
- You form the **converse** of a conditional statement by _______________________ the hypothesis and the conclusion
- You form the contrapositive of a conditional statement by ___________________ the hypothesis and the conclusion of it's ____________________.
- If a conditional statement is true, then it's _________________________ is true, and vice versa
- If the inverse of a conditional statement is true, then the ___________________ of the statement is also true, and vice versa.

HW: 3.6 p. 214-216 #1, 5, 6, 7, 9 & 12