

H.W #6

- 1) Given the following conditional: "If you visit Mr. H's shop tomorrow, then he will give you a free coffee." Write the converse, inverse, and the contrapositive of the conditional.

Swap order

Converse: If you get a free coffee, then you visit Mr. H's shop tomorrow.

negate:

Inverse: If you do not visit Mr. H's shop tomorrow, then he will not give you a free coffee.

Both:

Contrapositive: If you do not get a free coffee, then you do not visit Mr. H's shop tomorrow.

- 2) What is the converse of the converse of the statement "If Shiki goes shopping today, then I will go with her?" Two converses switch and switch back. Thus:

"If Shiki goes shopping today, then I will go with her."

- 3) What conditional is logically equivalent to the statement "If the Giants win the Super Bowl, then they will go to Disney World?" Contrapositive:

"If they do not go to Disney World, then the Giants do not win the Super Bowl."

For problems 4 and 5, assume that p is a true statement and q is a false statement. Write the converse, inverse, and contrapositive of the given statements and state all four of their truth values.

4) $\sim p \rightarrow q$
 Conv: $q \rightarrow \sim p$: $F \rightarrow \sim T = F \rightarrow F = \text{True.}$
 Inv: $p \rightarrow \sim q$: $T \rightarrow \sim F = T \rightarrow T = \text{True.}$
 Cont: $\sim q \rightarrow p$: $\sim F \rightarrow T = T \rightarrow T = \text{True.}$

5) $\sim q \rightarrow p$
 Conv: $p \rightarrow \sim q$: $T \rightarrow \sim F = T \rightarrow T = \text{True.}$
 Inv: $q \rightarrow \sim p$: $F \rightarrow \sim T = F \rightarrow F = \text{True.}$
 Cont: $\sim p \rightarrow q$: $\sim T \rightarrow F = F \rightarrow F = \text{True.}$

- 6) What is the statement whose converse is the inverse of the statement "If Joshua enters the tournament, then I will not win a prize"? Use symbols. Now, we have converse is inv. of $J \rightarrow \sim p$ so we seek the statement whose converse is $\sim J \rightarrow p$. This is $p \rightarrow \sim J$. Convert to words
- "If I win a prize, then Joshua does not enter the tournament."

For problems 7-12, assume that there are three statements— p , q , and r . p is true, q is false, and r 's truth value is unknown at this time. Tell whether each of the following compound statements is true, false, or cannot be determined at this time.

7) $p \vee r$ $T \vee ?$
True since at least one is true.

8) $p \wedge r$ $T \wedge ?$ = Unknown since if ? is T, then T, otherwise F.

9) $r \rightarrow p$ $? \rightarrow T$
True since T or F in the ? make the sentence true.

10) $r \rightarrow q$ $? \rightarrow F$ = Unknown

11) $(q \wedge r) \leftrightarrow r$
 $(F \wedge ?) \leftrightarrow ?$ Cannot be determined.

12) $(q \vee r) \leftrightarrow r$
 $(F \vee ?) \leftrightarrow ?$ True.

Logic is the hygiene the mathematician practices to keep his ideas healthy and strong. —Hermann Weyl

11) Substitute:
 $(F \wedge T) \leftrightarrow T$ $(F \wedge F) \leftrightarrow F$
 $F \leftrightarrow T = F$ $F \leftrightarrow F = T$

12) Substitute:
 $(F \vee T) \leftrightarrow T$ $(F \vee F) \leftrightarrow F$
 $T \leftrightarrow T = \text{True.}$ $F \leftrightarrow F = \text{True.}$