Geometry (H) Name: ______________________________

Truth Tables & The Laws of Inference

Part I. Prove each law setting up a truth table. Remember to be a law the statement must be a tautology.

a. Law of Detachment: $[(p \rightarrow q) \wedge p] \rightarrow q$

b. Law of Disjunctive Inference (one version): $[(p \vee q) \wedge \sim p] \rightarrow q$

c. DeMorgan's Law (one version): $\sim (p \vee q) \leftrightarrow (\sim p \wedge \sim q)$

Part II. Can the following be considered a law? Why or why not?
(Set up a truth table to find out)

$[(p \rightarrow q) \wedge q] \rightarrow p$

Part III. Draw a conclusion and then name the law that you are applying.

a. $f \wedge \sim g$

____

∴

b. $\sim t \vee p$
$\sim p$

____

∴

c. $\sim b \rightarrow r$
$\sim r$

____

∴

d. $p \rightarrow y$
$y \rightarrow \sim w$

____

∴

e. $\sim t \vee \sim p$

____

∴

f. $\sim z \rightarrow r$
$\sim z$

____

∴

g. $\sim(e \wedge \sim g)$

____

∴

h. $\sim k \vee \sim p$
k

____

∴

i. $v \rightarrow x$
$\sim x$

____

∴

j. $\sim j \wedge \sim s$

____

∴

k. $\sim t \rightarrow \sim p$
$\sim p \rightarrow h$

____

∴

l. $d \rightarrow \sim r$
d

____

∴

Part IV. Use the laws to write a flow proof for each of the following. Remember you proof is 2 part – statements & reasons. The reasons are either Given or one of the Laws.

a. $A \rightarrow B$
$\sim(C \wedge B)$
C

____

∴ $\sim A$

b. $\sim A \wedge C$

$A \vee W$

$R \rightarrow \sim W$

$\therefore \sim R$

c. $Q \rightarrow T$

$\sim(R \wedge \sim Q)$

R

$\therefore T$

Part V. Mixed review.

a. Write the following statement as a conditional. Determine if it is true or false.

A four-sided figure is a square.

Conditional: ____

b. Write the converse, inverse and contrapositive of the conditional from part (a). Determine if each statement is true or false.

Converse:

Inverse:

Contrapositive:

c. Write the definition of an acute angle as a biconditional statement.

e. Determine if each compound statement is a tautology.

1. $[(p \vee q) \wedge \sim (p \wedge q)] \rightarrow (p \leftrightarrow q)$

2. $[(r \rightarrow s) \wedge (t \rightarrow \sim s)] \leftrightarrow (r \rightarrow t)$

(hint: There are 2 variables ... you will need 8 combinations of T's & F's)

Part VI.

Represent using connectives and write a logical proof for the following:

a) Given:

If the radio is on and the television works, then there is electricity.
There is no electricity if the lights go out.
The lights go out.
The radio is on.

Let R represent: "The radio is on."
Let T represent: "The television works."
Let E represent: "There is electricity."
Let L represent: "The lights go out."

Using R, T, E, and L, prove: "The television does not work."

b) Given
Either Demi went to college or she joined the army.
If she joined the army, then her hair was cut short.
If her hair was cut short, it does not cover her ears.
Demi's hair covers her ears.

Let J represent "Demi went to college."
Let A represent "She joined the army."
Let N represent "Her hair was cut short."
Let E represent "Her hair covers her ears."

a. Using J, A, N, E, and proper connectives, express each sentence in symbolic form.

b. Using laws of inference, show that Demi went to college.

c) Use a truth table to prove the Law of Disjunctive Inference.