Logic Statements

Theorems = Statements that have been proven true.

Thm: If two angles are right angles, then they are congruent.

Conditional

If ______ Then ______

If $\rightarrow$ Hypothesis (p)

Then $\rightarrow$ Conclusion (q)

If p , then q

$p \rightarrow q$

If and only if p , then q

$p \leftrightarrow q$

Statements of Logic - Notation

Conditional $p \dashrightarrow q$ (If p, then q)

Converse q --> p (switch order AKA converse shoes help you do back flips)

Inverse $\sim p$ --> $\sim q$ (~ means NOT Negate/change sign)

Contrapositive $\sim q$ --> $\sim p$ *(switch order and sign)*

Statements of Logic - Example #1 (Definition)

Conditional $p \dashrightarrow q$ (If p, then q)

If an angle is a right angle then it has a measure of 90 degrees.

Converse $q \dashrightarrow p$

If an angle has a measure of 90 degrees, then it is a right angle.

Inverse $\sim p \dashrightarrow \sim q$

If an angle is a not a right angle, then it does not have a measure of 90 degrees.

Contrapositive $\sim q \dashrightarrow \sim p$

If an angle does not have a measure of 90 degrees, then it is not a right angle.

For Definitions, the Converse is always true.

Statements of Logic - Example #2 (Theorem)

Conditional $p \dashrightarrow q$ (If p, then q)

If two angles are right angles, then they are congruent.

Converse $q \dashrightarrow p$

If two angles are congruent, then they are right angles.

Inverse $\sim p \dashrightarrow \sim q$

If two angles are not right angles, then they are not congruent.

Contrapositive $\sim q \dashrightarrow \sim p$

If two angles are not congruent, then they are not right angles.

For Theorems, the Converse is Not always true.

Statements of Logic - Example #3 (Random)

Conditional $p \dashrightarrow q$ (If p, then q)

If my car has a flat tire, then I am late for work.

Converse $q \dashrightarrow p$

If I am late for work, then my car has a flat tire.

Inverse $\sim p \dashrightarrow \sim q$

If my car does not have a flat tire, then I am not late for work.

Contrapositive $\sim q \dashrightarrow \sim p$

If I am not late for work, then my car does not have a flat tire.

Statements of Logic

Conditional $p \dashrightarrow q$ (If p, then q)

If my car has a flat tire, then I am late for work.

Contrapositive $\sim q \dashrightarrow \sim p$

If I am not late for work, then my car does not have a flat tire.

The conditional and the contrapositive will always have the same truth value (true or false). If one is true, then both will be true. If one is false, both will be false.

Statements of Logic

Conditional	p --> q (If p, then q)
Contrapositive	~q --> ~p

The conditional and the contrapositive will always have the same truth value (true or false). If one is true, then both will be true. If one is false, both will be false.

Linking Logic Statements

If my car has a flat tire, then I am late for work.	t --> w
If I am late for work, then I will be fined.	w --> f
If I am fined, then I will not be able to make my car payment.	f --> ~p

Conclusion:

If my car has a flat tire, then I will not be able to make my car payment.

Linking Logic Statements

If my cats do not die, then they will not starve.	~d --> ~s
If I am not able to get into my house, then my cats will starve.	~h --> s
If I lose my keys, then I will not be able to get into my house.	k --> ~h
If my cats do not haunt me in my sleep, then they will not die.	~x --> ~d

Conclusion:

If I lose my keys, then my cats will haunt me in my sleep.

Linking Logic Statements - No Words

~a --> ~d $\quad$ ~a → c

~w --> ~r $\quad$ r → w $\quad$ $\boxed{r \to c}$

~d --> c $\quad$ Conclusion?

w --> ~b $\quad$ ~b → c

a --> b $\quad$ ~b → ~a

w → c

5 Write a concluding statement for each of the following chains of reasoning.

a $a \Rightarrow b$
$d \Rightarrow \sim c$
$\sim c \Rightarrow a$
$b \Rightarrow f$

if $a \to b$ and $b \to f$
then $a \to f$

if $\sim c \to a$ and $a \to f$
then $\sim c \to f$

if $d \to \sim c$ and $\sim c \to f$
then $\boxed{d \to f}$

b $p \Rightarrow \sim q$ → $q \to p$
$r \Rightarrow q$ $\quad r \to p$
$s \Rightarrow r$ $\quad s \to p$

if $r \to q$ then $\sim q \to \sim r$

if $p \to \sim q$ and $\sim q \to \sim r$
then $p \to \sim r$

if $s \to r$ then $\sim r \to s$

if $p \to \sim r$ and $\sim r \to s$
then $p \to s$
and $s \to p$

9 What conclusion can be drawn from the following?

$\sim c \Rightarrow \sim f \qquad g \Rightarrow b \qquad p \Rightarrow f \qquad c \Rightarrow \sim b$

$\sim b \to \sim g$

$f \to c$ + $c \to \sim b$

$f \to \sim b$ + $\sim b \to \sim g$

$f \to \sim g$ + $p \to f$

$p \to \sim g$

10 What conclusion can be drawn from the following?

If the line is long, then Quincy will go home. $l \rightarrow h$

If it is morning, then Quincy will not go home. $m \rightarrow \sim h$

If the line is long, then it is morning. $l \rightarrow m$

if $l \rightarrow m$ and $m \rightarrow \sim h$

then $l \rightarrow \sim h$

if the line is long

then Quincy will not go home