

2-3 Conditional Statements Master

A **conditional statement** is a statement that can be written in if-then form.

- It has 2 parts, the hypothesis and the conclusion.
 - Hypothesis (p): the phrase that immediately follows the word if.
 - Conclusion (q): the phrase that immediately follows the word then.
- There are three statements that are based on a given conditional statement.
- These are known as related conditionals.
- These three statements are inverse, converse, & contrapositive.
- You must always put a conditional statement in it's proper form first (if-then form).

Example #1: Erik can play outside after he finishes his homework. (First, rewrite in if-then form.)

If Erik finishes his homework, then he can play outside.

	Words	Symbols	Examples
Conditional	If p, then q	$p \rightarrow q$	If hypothesis , then conclusion .
Converse:	If q, then p	$q \rightarrow p$	formed by switching the hypothesis and conclusion
Inverse:	If not p, then not q	$\sim p \rightarrow \sim q$	formed by negating the hypothesis and conclusion
Contrapositive:	If not q, then not p.	$\sim q \rightarrow \sim p$	formed by switching and negating at the same time

Example #2: Use the conditional statement: If you go to PAHS, then you are a Cavalier.

T or F

Hypothesis:

you go to PAHS

Conclusion:

you are a Cavalier

Converse:

If you are a Cavalier, then you go to PAHS.

T or F

Inverse:

If you don't go to PAHS, then you are not a Cavalier.

T or F

Contrapositive:

If you are not a Cav., then you don't go to PA.

T or F

Example #3: We will go to the beach if the weather is nice. (First, rewrite in if-then form!)

Conditional ($p \rightarrow q$):

If the weather is nice, then we will go to the beach.

T or F

Hypothesis only (p):

the weather is nice

Conclusion only (q):

we will go to the beach

Converse ($q \rightarrow p$):

if we go to the beach, then the weather is nice.

T or F

Inverse ($\sim p \rightarrow \sim q$):

If the weather isn't nice, then we won't go to the beach.

T or F

Contrapositive ($\sim q \rightarrow \sim p$):

if we don't go to the beach, then the weather is not nice.

T or F

- Statements with the same truth values are said to be logically equivalent.
- Logically equivalent means that either both statements are true or both are false.

o A conditional and its contrapositive are always logically equivalent.

o A converse and inverse of a conditional are also logically equivalent.

2-3 Biconditional Statements

Biconditional statement: a statement that contains the phrase "if and only if" and may be abbreviated iff.

- a) a biconditional is the combination of a true conditional statement and its true converse with iff joining the hypothesis and the conclusion.

Example:

$p \rightarrow q$ (conditional) If two lines are perpendicular, then they form a right angle. T or F?

$q \rightarrow p$ (converse) If two lines form a right angle, then they are perpendicular. T or F?

$p \leftrightarrow q$ (biconditional) Two lines are perpendicular if and only if they form a right angle.

For a biconditional statement to be true, both its **converse** and its **conditional** statements must be true.

Example 1: If an angle measures 30 degrees, then it is an acute angle.

- Write the converse: Converse: If an angle is acute, then it measures 30 degrees.
- Is it true? Not necessarily. Therefore, you cannot write a biconditional statement.
- Give a counterexample: An acute angle could measure any degree less than 90 degrees!

Example 2: If two angles are congruent, then they have the same measure.

- Write the converse: Converse: If two angles have the same measure, then they are congruent
- Is it true? Yes
- If true, rewrite it as a biconditional! Two angles are congruent iff they have the same measure.

Practice: Write each biconditional as a) a conditional and b) its converse. Then determine whether the biconditional is c) true or false. If false, give c) a counterexample.

1. $|2x|=4$ if and only if $x=2$.

- If $|2x|=4$, then $x=2$ T or F? x could = -2
- If $x=2$, then $|2x|=4$ T or F?
- False b/c x could = -2

2. There is no school if and only if it is Saturday.

- If there is no school, then it is Saturday T or F?
- If it is Saturday, then there is no school T or F?
- False b/c we could have Sat. school b/c of snow make-up days

3. An angle is a right angle if and only if its measure is 90° .

- If an angle is a right angle, then its measure is 90° T or F?
- If an angle measures 90° , then it is a right angle T or F?
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