Hypothesis conclusion

The only way to make the conditional statement $p \to q$ false is to ____

The **hypothesis** of $p \to q$ is _____________ The **antecedent** of $p \to q$ is _____________

The **conclusion** of $p \to q$ is _____________ The **consequent** of $p \to q$ is _____________

Converse inverse contrapositive

The **converse** of $p \to q$ is ____________________________

The **inverse** of $p \to q$ is _______________________________

The **contrapositive** of $p \to q$ is ______________________________

Logical operators english synonyms

Common ways to express logical operators in English:

Negation $\neg p$ can be said in English as

- Not p.
- It's not the case that p.
- p is false.

Conjunction $p \wedge q$ can be said in English as

- p and q.
- Both p and q are true.
- p but q.

Exclusive or $p \oplus q$ can be said in English as

- p or q, but not both.
- Exactly one of p and q is true.

Disjunction $p \vee q$ can be said in English as

- p or q, or both.
- p or q (inclusive).
- At least one of p and q is true.

Conditional $p \to q$ can be said in English as

- if p, then q.
- p is sufficient for q.
- q when p.
- q whenever p.
- p implies q.
- q follows from p.
- p is sufficient for q.
- q is necessary for p.
- p only if q.

Biconditional

- p if and only if q.
- p iff q.
- If p then q, and conversely.
- p is necessary and sufficient for q.

Compound propositions translation

Translation: Express each of the following sentences as compound propositions, using the given propositions.

"A sufficient condition for the warranty to be good is that you bought the computer less than a year ago"

w is "the warranty is good"
b is "you bought the computer less than a year ago"

"Whenever the message was sent from an unknown system, it is scanned for viruses."

s is "The message is scanned for viruses"
u is "The message was sent from an unknown system"

"I will complete my to-do list only if I put a reminder in my calendar"

d is "I will complete my to-do list"
c is "I put a reminder in my calendar"

Compound proposition definitions

Proposition: Declarative sentence that is true or false (not both).

Propositional variable: Variable that represents a proposition.

Compound proposition: New proposition formed from existing propositions (potentially) using logical operators. *Note*: A propositional variable is one example of a compound proposition.

Truth table: Table with one row for each of the possible combinations of truth values of the input and an additional column that shows the truth value of the result of the operation corresponding to a particular row.

Definitions set prereqs

Term	**Notation Example(s)**	**We say in English ...**
all reals	$\mathbb{R}$	The (set of all) real numbers (numbers on the number line)
all integers	$\mathbb{Z}$	The (set of all) integers (whole numbers including negatives, zero, and positives)
all positive integers	$\mathbb{Z}^+$	The (set of all) strictly positive integers
all natural numbers	$\mathbb{N}$	The (set of all) natural numbers. **Note**: we use the convention that 0 is a natural number.

Definitions functions prereqs

Term	Notation Example(s)	We say in English ...
sequence	$x_1, \ldots, x_n$	A sequence x_1 to x_n
summation	$\sum_{i=1}^{n} x_i$ or $\displaystyle\sum_{i=1}^{n} x_i$	The sum of the terms of the sequence x_1 to x_n
piecewise rule definition	$f(x) = \begin{cases} \text{rule 1 for } x & \text{when COND 1} \\ \text{rule 2 for } x & \text{when COND 2} \end{cases}$	Define f of x to be the result of applying rule 1 to x when condition COND 1 is true and the result of applying rule 2 to x when condition COND 2 is true. This can be generalized to having more than two conditions (or cases).
function application	$f(7)$	f of 7 **or** f applied to 7 **or** the image of 7 under f
	$f(z)$	f of z **or** f applied to z **or** the image of z under f
	$f(g(z))$	f of g of z **or** f applied to the result of g applied to z
absolute value	$\lvert -3 \rvert$	The absolute value of -3
square root	$\sqrt{9}$	The non-negative square root of 9

Pro-tip: the meaning of two vertical lines $\lvert \quad \rvert$ depends on the data-types of what's between the lines. For example, when placed around a number, the two vertical lines represent absolute value. We've seen a single vertial line $\mid$ used as part of set builder definitions to represent "such that". Again, this is (one of the many reasons) why is it very important to declare the data-type of variables before we use them.