

## Hypothesis conclusion

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

The **hypothesis** of  $p \rightarrow q$  is \_\_\_\_\_ The **antecedent** of  $p \rightarrow q$  is \_\_\_\_\_

The **conclusion** of  $p \rightarrow q$  is \_\_\_\_\_ The **consequent** of  $p \rightarrow q$  is \_\_\_\_\_

## Converse inverse contrapositive

The **converse** of  $p \rightarrow q$  is \_\_\_\_\_

The **inverse** of  $p \rightarrow q$  is \_\_\_\_\_

The **contrapositive** of  $p \rightarrow q$  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**  $p \rightarrow q$  can be said in English as

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

**Biconditional**

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



# Definitions functions prereqs

Term	Notation	Example(s)	We say in English ...
sequence	$x_1, \dots, x_n$		A sequence $x_1$ to $x_n$
summation	$\sum_{i=1}^n x_i$ or $\sum_{i=1}^n x_i$		The sum of the terms of the sequence $x_1$ to $x_n$
piecewise definition	rule	$f(x) = \begin{cases} \text{rule 1 for } x & \text{when COND 1} \\ \text{rule 2 for } x & \text{when COND 2} \end{cases}$	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		$f(7)$ $f(z)$ $f(g(z))$	$f$ of 7 <b>or</b> $f$ applied to 7 <b>or</b> the image of 7 under $f$ $f$ of $z$ <b>or</b> $f$ applied to $z$ <b>or</b> the image of $z$ under $f$ $f$ of $g$ of $z$ <b>or</b> $f$ applied to the result of $g$ applied to $z$
absolute value	$ -3 $		The absolute value of $-3$
square root	$\sqrt{9}$		The non-negative square root of 9

**Pro-tip:** the meaning of two vertical lines  $| \quad |$  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 vertical line  $|$  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.