

Example 6

Truth tables can be used to verify the truth of conditional statements and their converse, inverse, and contrapositive. Consider the following statement:

p q
 "If I am eating an orange then I am eating a fruit."
(orange is p, fruit is q)

Use the mini truth table below to verify the truth of the original statement.

orange fruit

p	q	$p \Rightarrow q$
T	T	T

Orange is a fruit, so the statement is True.

Now use mini truth tables to verify the converse, the inverse, and the contrapositive of the original conditional statement.

If I am eating a fruit, then I am eating an orange.

Converse: Fruit orange

q	p	$q \Rightarrow p$
T	F	F

Counter example

If you are eating a fruit is doesn't mean its an orange. It could be an apple, etc. Orange is NOT the only fruit you could eat.

Inverse: (NOT)

$\neg p$	$\neg q$	$\neg p \Rightarrow \neg q$
T	F	F

Inverse: If I am NOT eating an orange, then I am NOT eating a fruit

(negating the converse)
Contrapositive:

$\neg q$	$\neg p$	$\neg q \Rightarrow \neg p$
T	T	T

NOT NOT

→ counter example: you could be eating an apple, which is a fruit

contrapositive (negating the converse)

If I am NOT eating a fruit, then I am NOT eating an orange.

(orange is a fruit, since I am NOT eating a fruit, then it could not be an orange)