## Implication recap

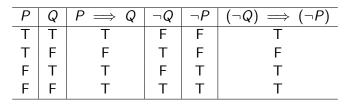
"P implies Q" or "if P, then Q" has the following truth table:

Р	Q	$P \implies Q$
Т	Т	Т
Т	F	F
F	Т	Т
F	F	Т

You can rephrase "P implies Q" as "P is a sufficient condition for Q" or as "Q is a necessary condition for P."

## Contrapositive

Logically equivalent to the implication  $P \implies Q$  is the implication  $(\neg Q) \implies (\neg P)$ , called the *contrapositive*. Example: "If it is Tuesday, then Math 220 meets." The contrapositive statement is, "If Math 220 is not meeting, then it is not Tuesday."



## Converse

The *converse* of  $P \implies Q$  is the statement  $Q \implies P$ , not logically equivalent.

"If it is Tuesday, then Math 220 meets" means something different from "If Math 220 meets, then it is Tuesday."

## Biconditional

The conjunction of a statement and the converse is the *biconditional*  $P \iff Q$ , "*P* if and only if *Q*," or  $(P \implies Q) \land (Q \implies P)$ .

 $P \iff Q$  means "Q is necessary and sufficient for P."

Assignment to hand in next time

Type up a solution to Exercise 17 on page 37 in complete sentences.