

Math 321

Math = Toys (+) Rules

FMT
Propositional
Logic

Declarative Sentence
that is True or False,
but not both.

Representing Propositions

P : "My teacher is Mark"

Q : "The apple is yellow"

P
T
F

2 Vars

P	Q
T	T
T	F
F	T
F	F

3 Vars

P	Q	R
T	T	T
T	T	F
T	F	T
T	F	F
F	T	T
F	T	F
F	F	T
F	F	F

Rules

Make compound propositions from simple ones.

① negation "It is not the case that P "

P	$\neg P$
T	F
F	T

$\neg P$

not

② Conjunction: "p and q"

$$p \wedge q$$

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

③ Disjunction: "p or q"

$$p \vee q$$

p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

(inclusive or)

④ Exclusive Or: "p or q, but not both"

$$p \oplus q$$

p	q	$p \oplus q$
T	T	F
T	F	T
F	T	T
F	F	F

⑤ Implication

"If p, then q"

$$p \rightarrow q$$

"p, only if q"

p is suff. for q

q is nec. for p

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

Vacuous truth

⑥ biconditional

"P if and only if Q"

$P \leftrightarrow Q$

P	Q	$P \leftrightarrow Q$
T	T	T
T	F	F
F	T	F
F	F	T

Order of operations

grouping
 \neg

\wedge, \vee

$\rightarrow, \leftrightarrow$

P	Q	\neg	$P \wedge Q$	$\neg \neg$	$(P \wedge Q) \rightarrow (\neg \neg)$
T	T	T	T	F	F
T	T	F	T	T	T
T	F	T	F	F	T
T	F	F	F	T	T
F	T	T	F	F	T
F	T	F	F	T	T
F	F	T	F	F	T
F	F	F	F	T	T