

Example 1 Negate these

(1) $\underline{a < b}$

$\underline{a \geq b}$

(2) $2 + 2 \neq 5$

$2 + 2 = 5$

P	$\neg P$ ^{not}
T	F
F	T

truth table for $\neg P$.

Example 2

P: There are integers a and b such that

$\underline{\frac{a}{b} = \sqrt{2}}$.

$\neg P$: There are no integers a & b such that

$\frac{a}{b} = \sqrt{2}$.

P	Q	$P \wedge Q$
T	T	T
T	F	F
F	T	F
F	F	F

Truth table for \wedge .

$P \vee Q$: $P \vee Q$

P	Q	$P \vee Q$
T	T	T
T	F	T

T	T	T
⊕	F	T
F	⊕	T
F	F	F

Example 4

Let $P: 3 < 4$; $Q: 4 < 3$.

- (a) $P \vee Q$ (b) $\neg P$ (c) $(\neg P) \vee (\neg Q)$

Soln:

(a) $P \vee Q: 3 < 4 \vee 4 < 3.$

(b) $\neg P: \underline{3 \geq 4}.$

(c) $(\neg P) \vee (\neg Q): 3 \geq 4 \vee 4 \geq 3.$

Example 6

Construct the truth table for $\neg(P \vee Q)$.

P	Q	$P \vee Q$	$\neg(P \vee Q)$
T	T	T	F
T	F	T	F
F	T	T	F
F	F	F	T

Example 7

Construct the truth table for $(\neg P) \wedge (\neg Q)$.

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

$$\neg(P \vee Q) \equiv (\neg P) \wedge (\neg Q) \text{ equivalent}$$

I. 1.5. Implication.

Ex 11

$$(P \Rightarrow Q) \equiv (\neg P) \vee Q$$

Soln:

P	Q	$\neg P$	$(\neg P) \vee Q$	$P \Rightarrow Q$
T	T	F	T	T
T	F	F	F	F
F	T	T	T	T
F	F	T	T	T

Hence

$$\underline{(P \Rightarrow Q) \equiv (\neg P) \vee Q}$$