

Acharya A. V. Patel Jr. College  
Excellence Program. - 2019-20.

SYJC COMMERCE

Mathematics

Topic: Mathematical logic.

Hsc Weightage: (08)

1.	P	Q	$P \wedge Q$	$P \vee Q$	$P \rightarrow Q$	$P \leftrightarrow Q$	$\sim P$
	T	T	T	T	T	T	F
	T	F	F	T	F	F	F
	F	T	F	T	T	F	T
	F	F	F	F	T	T	T

2. Algebra of Statements.

Idempotent Laws.

$$P \vee P \equiv P$$

$$P \wedge P \equiv P$$

Associative Laws

$$\begin{aligned} P \vee (Q \vee R) \\ \equiv (P \vee Q) \vee R \\ \equiv P \vee Q \vee R \end{aligned}$$

$$\begin{aligned} P \wedge (Q \wedge R) \\ \equiv (P \wedge Q) \wedge R \\ \equiv P \wedge Q \wedge R. \end{aligned}$$

Commutative Laws

$$P \vee Q \equiv Q \vee P$$

$$P \wedge Q \equiv Q \wedge P$$

Distributive laws

$$\begin{aligned} P \vee (Q \wedge R) \\ \equiv (P \vee Q) \wedge (P \vee R) \end{aligned}$$

$$\begin{aligned} P \wedge (Q \vee R) \\ \equiv (P \wedge Q) \vee (P \wedge R) \end{aligned}$$

Identity laws

$$\begin{aligned} P \vee C &\equiv P \\ P \vee t &\equiv t \end{aligned}$$

$$\begin{aligned} P \wedge C &= C \\ P \wedge t &= P. \end{aligned}$$

Complement laws

$$\begin{aligned} P \vee \sim P &= t \\ \sim t &\equiv C \end{aligned}$$

$$\begin{aligned} P \wedge \sim P &\equiv C \\ \sim C &\equiv t \end{aligned}$$

DeMorgan's laws

$$\begin{aligned}\sim(P \vee Q) \\ \equiv \sim P \wedge \sim Q\end{aligned}$$

$$\begin{aligned}\sim(P \wedge Q) \\ \equiv \sim P \vee \sim Q\end{aligned}$$

Contra positive law

$$\begin{aligned}P \rightarrow Q \\ \equiv \sim Q \rightarrow \sim P\end{aligned}$$

law of double  
negation

$$\sim(\sim P) \equiv P$$

Note : (i)  $P \rightarrow Q \equiv \sim Q \rightarrow \sim P$   
 $\equiv \sim P \vee Q$

$$\begin{aligned}\text{(ii)} \quad P \leftrightarrow Q &\equiv (P \rightarrow Q) \wedge (Q \rightarrow P) \\ &\equiv (\sim P \vee Q) \wedge (\sim Q \vee P)\end{aligned}$$

### 3. Converse, Inverse and Contrapositive:

From the conditional statement :  $P \rightarrow Q$ .

Converse:  $Q \rightarrow P$ .

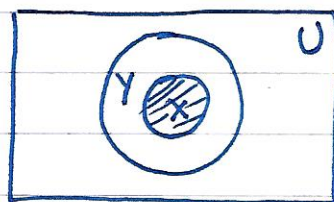
Inverse:  $\sim P \rightarrow \sim Q$

Contrapositive:  $\sim Q \rightarrow \sim P$ .



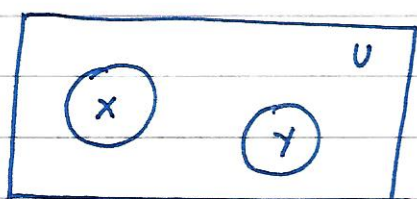
#### 4. Venn - diagrams.

(1) All X's are Y's"



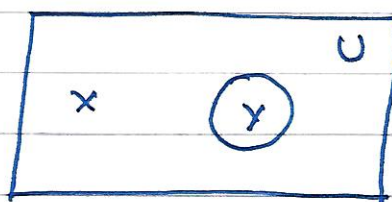
$$X \cap Y = X$$

(2) No X's are Y's"



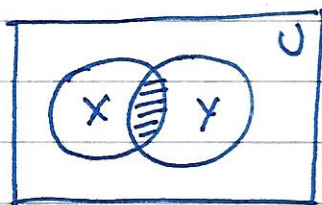
$$X \cap Y = \emptyset$$

or



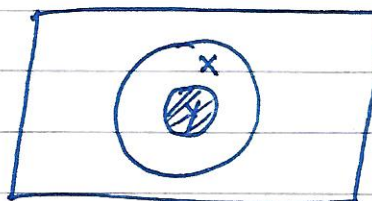
$$X \cap Y = \emptyset$$

(3) Some X's are Y's"



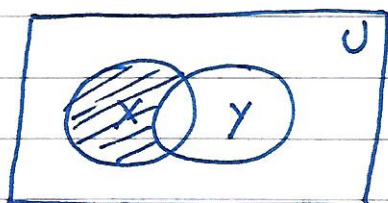
$$X \cap Y \neq \emptyset$$

or



$$X \cap Y = Y \neq \emptyset$$

4 Some X's are not Y's"



$$X - Y \neq \emptyset$$

or



$$X - Y \neq \emptyset$$