SESSION : 2025-26

DPP
DAILY PRACTICE PROBLEMS

CLASS : XIth
DATE :

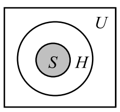
Solutions

SUBJECT : MATHS
DPP NO. :1

Topic :-MATHEMATICAL REASONING

1 **(c)**

The required Venn diagram of given statement is given below



2 **(a)**

$(p \vee q) \wedge (p \vee \sim q)$

$= p \vee (q \wedge \sim q)$ (distributive law)

$= p \vee 0$ (complement law)

$= p$ (0 is identify for v)

4 **(c)**

We have

$p \rightarrow q \cong \sim p \vee q$

and, $\sim q \rightarrow \sim p \cong \sim (\sim q) \vee \sim p \cong q \vee \sim p \cong \sim p \vee q \cong p \rightarrow q$

5 **(c)**

We have,

$p \rightarrow q \cong \sim p \vee q$

$\therefore p \rightarrow \sim q \cong \sim p \vee \sim q \cong \sim (p \wedge q)$

So, option (a) is not correct

$\sim p \vee \sim q = \sim (p \wedge q)$

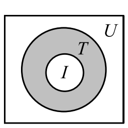
So, option (b) is not correct

$\sim (p \rightarrow \sim q) = \sim (\sim p \vee \sim q) = p \wedge q$

So, option (c) is incorrect

6 **(b)**

Some triangles are not isosceles.



8 **(a)**

$\sim (p \vee q) \vee (\sim p \wedge q)$

$\cong (\sim p \wedge \sim q) \vee (\sim p \wedge q)$

$\cong \sim p \wedge (\sim q \vee q) \cong \sim p \vee t \cong \sim p$

9 **(b)**

A compound sentence formed by two simple statements p and q using connective 'or' is called disjunction

12 **(c)**

By truth table

p	q	$\sim q$	$q \wedge \sim q$	$p \Rightarrow q \wedge \sim q$
T	T	F	F	F
T	F	T	F	F
F	T	F	F	T
F	F	T	F	T

Hence, it is neither a tautology nor contradiction

13 **(d)**

We have,

$p \rightarrow q \cong \sim p \vee q$

$\therefore \sim (\sim p \rightarrow q) \cong \sim (p \vee q) \cong \sim p \wedge \sim q$

16 **(d)**

$\sim (p \vee q) \equiv \sim p \wedge \sim q$

$\therefore$ 7 is greater than 4 and Paris is not in France.

17 **(c)**

From the truth table of $p \leftrightarrow q$ it is evident that $p \leftrightarrow q$ is true when p and q both are true or both are false

$\therefore p \leftrightarrow \sim q$ is true when p is false and $\sim q$ is false

i. e. $p$is false and q is true

18 **(b)**

Let p:Pairs is in France and q: London is in England

Given, $p \wedge q$

Its negation is $\sim(p \wedge q) \equiv \sim p \vee \sim q$

Hence, paris is not in France or London is not in England.

20 **(b)**

$(p \Rightarrow q) \wedge (q \Rightarrow p)$ means $p \Leftrightarrow q$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	C	A	A	C	C	B	C	A	B	B
Q.	11	12	13	14	15	16	17	18	19	20
A.	D	C	D	A	A	D	C	B	A	B

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DPP
DAILY PRACTICE PROBLEMS

CLASS : XIth
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Solutions

SUBJECT : MATHS
DPP NO. :2

Topic :-MATHEMATICAL REASONING

2 **(c)**

$(\sim p \wedge q) \wedge \sim q = \sim p \wedge (q \wedge \sim q) = \sim p \wedge c = c$

3 **(c)**

$p \wedge q$ means Mathematics is interesting and Mathematics is difficult

4 **(a)**

Truth Table

p	q	r	$\sim p$	$\sim r$	$p \wedge \sim r$	$(\sim p \vee q)$	$(p \wedge \sim r) \rightarrow (\sim p \vee q)$
T	T	T	F	F	F	T	T
T	T	F	F	T	T	T	T
T	F	T	F	F	F	F	T
T	F	F	F	T	T	F	F
F	T	T	T	F	F	T	T
F	T	F	T	T	F	T	T
F	F	T	T	F	F	T	T
F	F	F	T	T	F	T	T

Hence, $(p \wedge \sim r) \rightarrow (\sim p \vee q)$ is F.

When $p = \mathrm{T}, q = \mathrm{F}, r = \mathrm{F}$

6 **(a)**

By truth table

p	q	$p \vee q$	$\sim p$	$(p \vee q) \vee \sim p$
T	T	T	F	T
T	F	T	F	T
F	T	T	T	T
F	F	F	T	T

It is clear that $(p \vee q) \vee \sim p$ is a tautology

7 **(a)**

Let p: Two triangles are identical

q: Two triangles are similar

Clearly, the given statement in symbolic form is $p \rightarrow q$.

$\therefore$ Its contrapositive is given by $\sim q \rightarrow \sim p$.

ie, If two triangles are not similar, then these are not identical.

8 **(a)**

$(p \vee q) \wedge (p \vee r) = p \vee (q \wedge r)$

9 **(c)**

Truth table

p	q	$\sim p$	$\sim q$	$\sim q \wedge p$	$(\sim q \wedge p) \wedge q$	$(p \wedge \sim p)$	$(\sim q \wedge p) \vee (p \wedge \sim p)$	$(\sim q \wedge p) \vee (p \wedge \sim p)$
T	T	F	F	F	F	T	F	T
T	F	F	T	T	F	T	F	T
F	T	T	F	F	F	T	F	T
F	F	T	T	F	F	T	F	T

It is clear from the table that last column have all true values. Hence option (c) is correct

10 **(b)**

Let $p = 2$ is prime

and $q = 3$ is odd

Given, $p \rightarrow q$

Negation of $p \rightarrow q$ is $\sim (p \rightarrow q)$

$\Rightarrow \quad p \wedge \sim q$

$\Rightarrow$ 2 is prime and 3 is not odd.

11 **(a)**

p	q	r	$\sim p$	$\sim q$	$\sim p \vee q$	$(\sim p \vee q) \wedge \sim q$	$(\sim p \vee q) \wedge \sim q \rightarrow p$
T	F	T	F	T	F	F	T

12 **(a)**

Since, switches a and b and a', b' and c' are parallel which is denoted by $a \wedge b$ and $a' \wedge b' \wedge c'$ respectively

Now, $(a \wedge b), c$ and $(a' \wedge b' \wedge c')$ are connected in series, then switching function of complete network is

$(a \wedge b) \vee c \vee (a' \wedge b' \wedge c')$

13 **(b)**

The negation of $q \vee \sim (p \wedge r)$ is given by

$\sim \{q \vee \sim (p \wedge r)\} \cong \sim q \wedge (p \wedge r)$

15 **(d)**

$(\sim p \wedge q) \vee \sim q \equiv \sim q \vee (\sim p \wedge q)$ (By Commutative law)

$\equiv \sim q \vee (q \wedge q \sim p)$ (By Commutative law)

$\equiv \sim q \vee q(\sim q \vee \sim p)$ (By Distributive law)

$\equiv \sim (q \wedge p)$

$\equiv \sim (p \wedge q)$

16 **(b)**

p	q	$p \wedge q$	$\sim p$	$\sim p \vee q$	$(p \wedge q) \rightarrow (\sim p \vee q)$	$\sim[(p \wedge q) \rightarrow (\sim p \vee q)]$
T	T	T	F	T	T	F
T	F	F	F	F	T	F
F	T	F	T	T	T	F
F	F	F	T	T	T	F

It is clear from the table that

$\sim[(p \wedge q) \rightarrow (\sim p \vee q)]$

is a contradiction.

19 **(c)**

Plants are living objects is not a statement.

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	D	C	C	A	B	A	A	A	C	B
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	A	B	A	D	B	C	A	C	A

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DPP
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CLASS : XIth
DATE :

Solutions

SUBJECT : MATHS
DPP NO. :3

Topic :-MATHEMATICAL REASONING

1 **(c)**

We know that the contrapositive of $p \to q$ is $\sim q \to \sim p$. Therefore, contrapositive of $(\sim p \wedge q) \to \sim r$ is $r \to \sim (\sim p \wedge q)$ or, $r \to p \vee \sim q$

2 **(d)**

p	q	$\sim p$	$\sim p \wedge q$	$q \to p$	$\sim(q \to p)$
T	T	F	F	T	F
T	F	F	F	T	F
F	T	T	T	F	T
F	F	T	F	T	F

From the table

$\sim p \wedge q \equiv \sim(q \to p)$

3 **(b)**

Clearly, $(p \wedge q) \wedge r \cong p \wedge (q \wedge r)$

4 **(c)**

The symbolic form of given statement is $\sim (p \vee q)$

5 **(a)**

$(p \wedge q) \wedge (\sim (p \vee q))$

$\cong (p \wedge q) \wedge (\sim p \wedge \sim q)$

$\cong q \wedge (p \wedge \sim p) \wedge \sim q$

$\cong q \wedge c \wedge \sim \cong c$

So, statement in option (a) is a contradiction

8 **(b)**

p	q	$\sim p$	$\sim q$	$p \wedge \sim q$	$\sim p \wedge q$	$(p \wedge \sim q) \wedge (\sim p \wedge q)$
T	T	F	F	F	F	F
T	F	F	T	T	F	F
F	T	T	F	F	T	F
F	F	T	T	F	F	F

It is clear from, the table that $(p \wedge \sim q) \wedge (\sim p \wedge q)$is a contradiction.

10 **(d)**

Since p is true and q is false

$\therefore p \rightarrow q$ has truth value F

Statement r has truth value T

$\therefore (p \rightarrow q) \wedge r$ has truth value F. Also, $(p \rightarrow q) \wedge \sim r$ has truth value F

$p \wedge q$ has truth value F and $p \vee r$ has truth value T

$\therefore (p \wedge q) \wedge (p \vee r)$ has truth value F

As $p \wedge r$ has truth value T. Therefore, $q \rightarrow (p \wedge r)$ has truth value T

11 **(b)**

Dual of $(x' \vee y')' = x \wedge y$ is $(x' \wedge y') = x \vee y$

13 **(a)**

We have,

$(\sim p \vee \sim q) \vee (p \vee \sim q) = \sim p \vee (\sim q \vee (p \ \vee \sim q))$

$= \sim p \vee (p \vee \sim q) = (\sim p \vee p) \vee \sim q = t \vee \sim q = t$

14 **(b)**

$\sim (p \vee q) \vee (\sim p \wedge q)$

$\equiv (\sim p \wedge \sim q) \vee (\sim p \wedge q)$

$\equiv \sim p \wedge (\sim q \vee q)$

$\equiv \sim p$

15 **(d)**

p	q	$\sim p$	$\sim q$	$p \vee (\sim q)$	$(\sim p) \wedge q$	$p \vee q$	$\sim (p \vee q)$	$(\sim p) \vee (\sim q)$	$(p \vee q) \vee (\sim p)$
T	T	F	F	T	F	T	F	F	T
F	T	T	F	F	T	T	F	T	T
T	F	F	T	T	F	T	F	T	T
F	F	T	T	T	F	F	T	T	T

It is clear from the table that columns 8 and 9 are not equal, ie, $\sim (p \vee q)$ is not equivalent to$(\sim p) \vee (\sim q)$.

Hence, option (e) is false statement.

16 **(c)**

p	q	$p \leftrightarrow q$	$\sim[p \leftrightarrow q]$
T	T	T	F
T	F	F	T
F	T	F	T
F	F	T	F

It is clear from the table that, it is neither tautology nor contradiction.

19 **(c)**

Consider the following statements:

p : We control the population growth

q : We become prosper

The given statement is $p \rightarrow q$ and its negation is $p \wedge \sim q$

i.e. We control population but we donot become prosper

20 **(c)**

Mathematics is interestring is not a proposition.

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	C	D	B	C	A	C	D	B	A	D
Q.	11	12	13	14	15	16	17	18	19	20
A.	B	D	A	B	D	C	B	C	C	C

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DPP
DAILY PRACTICE PROBLEMS

CLASS : XIth
DATE :

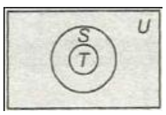
Solutions

SUBJECT : MATHS
DPP NO. :4

Topic :-MATHEMATICAL REASONING

1 **(c)**

All teachers are scholars



2 **(b)**

The negation of the given statement is "he is not rich or not happy".

4 **(a)**

We have,

$\sim \{p \vee (\sim p \vee q)\}$

$\cong\sim \{(p \vee\sim p) \vee q\} \cong\sim (t \vee q) \cong\sim t \cong c$

Also,

$(p \wedge\sim q) \wedge\sim p \cong (p \wedge\sim p \wedge\sim q) \cong c \wedge\sim q \cong c$

So, option (a) is correct

5 **(c)**

$\sim \{q \vee\sim (p \wedge r)\} =\sim q \wedge (p \wedge r)$

6 **(a)**

We have,

$\sim (\sim p) = p$

$\therefore\sim (\sim p) \leftrightarrow p \cong p \leftrightarrow p$

Hence, $\sim (\sim p) \leftrightarrow p$ is a tautology

7 **(a)**

The contrapositive of $p \rightarrow q$ is $\sim q \rightarrow\sim p$

So, the contrapositive of $2x + 3 = 2 \rightarrow x \neq 4$ is

$x = 4 \rightarrow 2x + 3 \neq 9$

8 **(b)**

Let p: It rains, q: I shall go to school

Thus, we have $p \rightarrow q$

Its negation is $\sim (p \rightarrow q) ie, p \wedge\sim q$

ie,It rains and I shall not go to school.

11 **(d)**

We know that $p \rightarrow q$ is false when p is true and q is false. So, $p \rightarrow (q \vee r)$ is false when p is true and $q \vee r$ is false. But, $q \vee r$ is false when q and r both are false

Hence, $p \rightarrow (q \vee r)$ is false when p is true and q and r both are false

12 **(a)**

Given that

p: Ram is smart

q:Ram is intelligent

The symbolic form of "Ram is smart and intelligent." is $(p \wedge q)$

13 **(c)**

Mathematics is interesting is not a logical sentence. It may be intersecting for some persons and may not be interesting for others

$\therefore$ This is not a proposition

16 **(b)**

By definition, the inverse of implication $p \rightarrow q$ is $\sim p \rightarrow \sim q$

18 **(c)**

We know that

$p \rightarrow q \cong \sim p \vee q$ and $q \rightarrow p \cong \sim q \vee p$

$\therefore p \leftrightarrow q \cong (\sim p \vee q) \wedge (\sim q \vee p)$

$\sim (p \leftrightarrow q) \cong \sim (\sim p \vee q) \vee \sim (\sim q \vee p)$

$\sim (p \leftrightarrow q) \cong (p \wedge \sim q) \vee (q \wedge \sim p))$

19 **(d)**

$\sim (\sim p \rightarrow q) \cong \sim (p \vee q) \cong \sim p \wedge \sim q$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	B	D	C	C	B	D	D	A	B	A
Q.	11	12	13	14	15	16	17	18	19	20
A.	C	B	B	A	C	A	A	B	B	A

SESSION : 2025-26

DPP
DAILY PRACTICE PROBLEMS

CLASS : XIth
DATE :

Solutions

SUBJECT : MATHS
DPP NO. :5

Topic :-MATHEMATICAL REASONING

1 **(d)**
We know that $p \to q$ is false when p is true and q is false. So, $p \to (q \vee r)$ is false when p is true and $q \vee r$ is false. But, $q \vee r$ is false when q and r both are false
Hence, $p \to (q \vee r)$ is false when p is true and q and r both are false

2 **(a)**
Given that
p: Ram is smart
q:Ram is intelligent
The symbolic form of "Ram is smart and intelligent." is $(p \wedge q)$

3 **(c)**
Mathematics is interesting is not a logical sentence. It may be intersecting for some persons and may not be interesting for others
$\therefore$ This is not a proposition

6 **(b)**
By definition, the inverse of implication $p \to q$ is $\sim p \to \sim q$

8 **(c)**
We know that
$p \to q \cong \sim p \vee q$ and $q \to p \cong \sim q \vee p$
$\therefore p \leftrightarrow q \cong (\sim p \vee q) \wedge (\sim q \vee p)$
$\sim (p \leftrightarrow q) \cong \sim (\sim p \vee q) \vee \sim (\sim q \vee p)$
$\sim (p \leftrightarrow q) \cong (p \wedge \sim q) \vee (q \wedge \sim p))$

9 **(d)**
$\sim (\sim p \to q) \cong \sim (p \vee q) \cong \sim p \wedge \sim q$

12 **(c)**
We have,
$p \leftrightarrow q \cong \sim p \vee q$
$\therefore (p \leftrightarrow q) \vee (p \wedge \sim q)$
$= (\sim p \vee q) \vee (p \wedge \sim q)$
$= \{(\sim p \vee q) \vee p\} \wedge \{(\sim p \vee q) \vee \sim q)\}$
$= \{(\sim p \vee p) \vee q\} \wedge \{\sim p \vee (q \vee \sim q)\}$

$= (t \vee q) \wedge (\sim p \vee t)$
$= t \wedge t = t$

13 **(a)**

'If a man is not happy, then he is not rich' is written as $\sim p \rightarrow \sim q$.

14 **(c)**

Clearly,
$p \vee \sim p$is always true. So, it is a tautology
We have,
$\sim (\sim p) \leftrightarrow p \cong p \leftrightarrow p$
So, $\sim (\sim p) \leftrightarrow p$ is always true. So, it is a tautology
We know that $p \rightarrow q \cong \sim p \vee q$
$\therefore p \wedge (p \rightarrow q) \cong p \wedge (\sim p \vee q) \cong (p \wedge \sim p) \vee (p \wedge q)$
$\cong c \vee (p \wedge q) \cong p \wedge q$
$\therefore p \wedge (p \rightarrow q) \rightarrow p \cong p \wedge q \rightarrow p$ which is a tautology
So, option (c) is false

16 **(a)**

By De'Morgan's law, we have
$\sim (p \vee q) = \sim p \wedge \sim q$

18 **(c)**

Clearly, statement in option (c) is false. So, it has definite truth value. Hence, it is a proposition

19 **(b)**

Let p: A number is a prime
q: It is odd
Given proposition is $p \rightarrow q$ its inverse is $\sim q \rightarrow \sim q$.
ie, If a number is not prime, then it is not odd.

20 **(c)**

Given, p:Ravi races, q: Ravi wins
$\therefore$The statement of given proposition $\sim (p \vee (\sim q))$
Which is equivalent to $\sim p \wedge q$.
"It is not true that Ravi races or that Ravi does not win."

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	D	A	C	A	C	B	A	C	D	C
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	C	A	C	C	A	C	C	B	C

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DAILY PRACTICE PROBLEMS

CLASS : XIth
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Solutions

SUBJECT : MATHS
DPP NO. :6

Topic :-MATHEMATICAL REASONING

1 **(c)**

Contrapositive of $(p \vee q) \rightarrow r$

is $\sim r \rightarrow \sim (p \vee q) \equiv \sim r \rightarrow (\sim p \wedge \sim q)$

3 **(d)**

The symbolic form of given statement is $p \Leftrightarrow q$

5 **(b)**

$p \Rightarrow q$ is logically equivalent to $\sim q \Rightarrow \sim p$

$\therefore\ (p \Rightarrow q) \Leftrightarrow (\sim q \Rightarrow \sim p)$

Is a tautology but not a contradiction

6 **(d)**

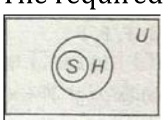
$\sim \big(p \wedge (q \longrightarrow \sim r)\big) = \sim p \vee \sim (q \longrightarrow \sim r)$

$= \sim p \vee (q \wedge \sim (\sim r))$

$= \sim p \vee (q \wedge r)$

7 **(c)**

The required venn diagram of given statement is



9 **(c)**

The truth table that of $p \rightarrow q$ is as follows:

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

10 **(c)**

P : There is rational number $x \in S$ such that $x > 0$

$\sim P$: Every rational number $x \in S$ satisfies $x \leq 0$

11 **(a)**

$\sim (p \vee q) \vee (\sim p \wedge q) \equiv (\sim p \wedge \sim q) \vee (\sim p \wedge q)$

$\equiv \sim p \wedge (\sim q \vee q) \equiv \sim p \wedge t \equiv \sim p$

13 **(a)**

p	q	$p \rightarrow q$	$\sim(p \rightarrow q)$	$\sim q$	$p \wedge (\sim q)$
T	T	T	F	F	F
T	F	F	T	T	T
F	T	T	F	F	F
F	F	T	F	T	F

From the table $\sim(p \rightarrow q) \equiv p \wedge (\sim q)$

$\therefore$ All the values are same.

14 **(d)**

For the given circuit, Boolean polynomial is $(\sim p \wedge q) \vee (p \vee \sim q)$.

16 **(b)**

We have,

$p \rightarrow \sim p \cong \sim p \vee \sim p \cong \sim p$ and $\sim p \rightarrow p \cong p \vee p \cong p$

$\therefore (p \rightarrow \sim p) \wedge (\sim p \rightarrow p) \cong \sim p \wedge p \cong c$

17 **(d)**

$p \Rightarrow (\sim p \vee q)$ is false means p is true and $\sim p \vee q$ is false

$\Rightarrow p$ is true and both $\sim p$ and q are false

$\Rightarrow p$ is true and q is false

19 **(c)**

$\sim (\sim p \longrightarrow q) \equiv \sim p \wedge \sim q$

20 **(d)**

The contrapositive of $p \rightarrow \sim q$ is

$\sim (\sim q) \rightarrow \sim p$ or $q \rightarrow \sim p$

Also, converse of $q \rightarrow \sim p$ is $\sim p \rightarrow q$.

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	C	C	D	D	B	D	C	B	C	C
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	B	A	D	A	B	D	D	C	D

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DAILY PRACTICE PROBLEMS

CLASS : XIth
DATE :

Solutions

SUBJECT : MATHS
DPP NO. :7

Topic :-MATHEMATICAL REASONING

2 **(d)**

$\therefore p$: 4is an even prime number.

q: 6 is a divisor of 12

And r: the HCF of 4 and 6 is 2

$\therefore \ \sim p \vee (q \wedge r)$is true.

3 **(b)**

The switching function for the given network is $(p \wedge q \vee r) \vee t$

4 **(c)**

We have,

$p \leftrightarrow q \cong (p \rightarrow q) \wedge (q \rightarrow p)$

$\cong (\sim p \vee q) \wedge (\sim q \vee p)$

$\therefore \sim (p \leftrightarrow q) \cong \sim (\sim p \vee q) \vee \sim (\sim q \vee p)$

$\cong (p \wedge \sim q) \vee (q \wedge \sim p)$

5 **(b)**

The inverse of $(p \wedge \sim q) \rightarrow r$ is

$\sim (p \wedge \sim q) \rightarrow \sim r$

$\Rightarrow (\sim p \vee q) \rightarrow \sim r$

9 **(a)**

$\because$ Switches x and y' are connected parallel which is denoted by $(x \wedge y')$

Similarly, y and $z'$and z and x' are also connected parallel

Which are denoted by $(y \wedge z')$ and $(z \wedge x')$ respectively

Now, $x \wedge y', y \wedge z'$ and $z \wedge x'$ are connected in series. So, switching function of given network is

$(x \wedge y') \vee (y \wedge z') \vee (z \wedge x')$

10 **(d)**

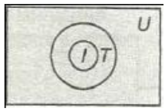
$S(p, q, r) = (\sim p) \vee [\sim (q \wedge r)]$

$= (\sim p) \vee [\sim q \vee \sim r]$

$\Rightarrow S(\sim p, \sim q, \sim r) = p \vee (q \vee r)$

11 **(b)**

Some triangles are not isosceles



16 **(c)**

q	p	$q \rightarrow p$	$p \rightarrow (q \rightarrow p)$	$p \vee q$	$p \rightarrow (p \vee q)$
T	T	T	T	T	T
T	F	F	T	T	T
F	T	T	T	T	T
F	F	T	T	F	T

$\therefore$ Statement $p \rightarrow (q \rightarrow p)$ is equivalent to $p \rightarrow (p \vee q)$.

18 **(a)**

$\because$ p: A man is happy

and q: A man is rich

'If a man is not happy, then he is not rich' is written as $\sim p \rightarrow \sim q$

20 **(a)**

p	q	$p \vee q$	$\sim p$	$(p \vee q) \vee \sim p$
T	T	T	F	T
T	F	T	F	T
F	T	T	T	T
F	F	F	T	T

It is clear that $(p \vee q) \vee \sim p$ is a tautology.

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	A	D	B	C	B	B	A	D	A	D
Q.	11	12	13	14	15	16	17	18	19	20
A.	B	A	A	D	D	C	B	A	C	A

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6.

p	q	~p	$p \leftrightarrow q$	$\sim(p \leftrightarrow q)$	$\sim p \leftrightarrow q$
T	T	F	T	F	F
T	F	F	F	T	T
F	T	T	F	T	T
F	F	T	T	F	F

7. Both statements p and q are true
so $p \Rightarrow q$ and $q \Rightarrow p$
$\therefore$ $p \Leftrightarrow q$

8. When p and q both are true then
$\sim(p \to q)$ and $(\sim p \vee \sim q)$ both are false
i.e. $\sim(p \to q) \leftrightarrow (\sim p \vee \sim q)$ is true
when p and q both are false then
$\sim(p \to q)$ is false and $(\sim p \vee \sim q)$ is true
i.e. $\sim(p \to q) \leftrightarrow (\sim p \vee \sim q)$ is false
Hence $\sim(p \to q) \leftrightarrow (\sim p \vee \sim q)$ is neither tautology nor contradiction.

10. $\because$ $p \to (q \vee r)$ is false
$\Rightarrow$ p is true and $(q \vee r)$ is false
$\Rightarrow$ p is true, q and r both are false
i.e. $p \to (q \vee r)$ is false when truth values of p, q, r are T, F, F resp. otherwise it is true.

11. Let p, q, r be the three statements such that
$p : x = 5$, $q : y = -2$ and $r : x - 2y = 9$
Here given statement is $(p \wedge q) \to r$ and its contrapositive is $\sim r \to \sim(p \wedge q)$
i.e. $\sim r \to (\sim p \vee \sim q)$ i.e. if $x - 2y \neq 9$ then $x \neq 5$
or $y \neq -2$

12. Let $S(p, q) \equiv (p \vee \sim q) \wedge \sim p$
$\Rightarrow$ $S(\sim p, \sim q) \equiv (\sim p \vee q) \wedge p$

Now $\quad S^*(\sim p, \sim q) \equiv (\sim p \wedge q) \vee p$

and $\sim S(p, q) \equiv \sim[(p \vee \sim q) \wedge \sim p] \equiv \sim(p \vee \sim q) \vee p$

$\equiv (\sim p \wedge q) \vee p$

Hence $S^*(\sim p, \sim q) \equiv \sim S(p, q)$

17. $\because \quad (p \wedge q) \vee (q \wedge r)$ is false

$\Rightarrow \quad (p \wedge q)$ and $(q \wedge r)$ both are false

$\Rightarrow$ p and r both are false or q is false.

otherwise $(p \wedge q) \vee (q \wedge r)$ is true

18. The negation of ''Everyone in Germany speaks German'' is - there is at least one person in Germany who does not speak German.

20. $\sim(p \rightarrow (q \wedge r)) \equiv p \wedge \sim(q \wedge r)$

$(\therefore \sim(p \rightarrow q) \equiv p \wedge \sim q)$

$\equiv p \wedge (\sim q \vee \sim r)$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	B	C	D	C	C	A	C	C	C	D
Q.	11	12	13	14	15	16	17	18	19	20
A.	C	B	D	C	B	A	D	B	C	D

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Topic :- MATHEMATICAL REASONING

1. $\because \sim q \to \sim p \equiv \sim(\sim q) \vee \sim p$ $\quad (\because p \to q \equiv \sim p \vee q)$

$\equiv q \vee \sim p$

$\equiv \sim p \vee q$ $\quad$ (by commutative law)

$\equiv p \to q$ $\quad (\because p \to q = \sim p \vee q)$

Hence $\quad p \to q \equiv \sim q \to \sim p$

6. Let p, q, r three statement defined as

p : a number N is divisible by 15

q : number N is divisible by 5

r : number N is divisible by 3

Here given statement is $p \to (q \vee r)$

Here negative of above statement is

$\sim(p \to (q \vee r)) \equiv p \wedge (\sim(q \vee r)$

$\equiv p \wedge (\sim q \wedge \sim r)$

i.e. A number is divisible by 15 and it is not divisible by 5 and 3.

11. $(\sim T \;\; F) \sim T \quad \Rightarrow \quad T$

$\therefore \quad (F \;\; F) \;\; F \quad \Rightarrow \quad T$

$\therefore \quad F \;\; F \quad \Rightarrow \quad T$

$\therefore \quad F \quad \Rightarrow \quad T$

15. $\because \quad (\sim p \vee \sim q) \vee (p \vee \sim q)$

$\equiv \quad (\sim p \vee \sim q) \vee (\sim q \vee p)$ (by commutative law)

$\equiv \quad \sim p \vee [\sim q \vee (\sim q \vee p)]$ (by Associative law)

$\equiv \quad \sim p \vee [(\sim q \vee \sim q) \vee p]$ (by Associative law)

$\equiv \quad \sim p \vee (\sim q \vee p)$ $\quad (\because p \vee p = p)$

$\equiv \quad \sim p \vee (p \vee \sim q)$ $\quad$ (by commutative law)

$\equiv \quad (\sim p \vee p) \vee \sim q$ $\quad$ (by Associative law)

$\equiv \quad t \vee \sim q \equiv t$ $\quad$ t is a tautology

Hence $(\sim p \vee \sim q) \vee (p \vee \sim q)$ is a tautology.

17. $\because$ $(p \wedge q) \rightarrow p$ is false

$\Rightarrow$ $(p \wedge q)$ is true and p is false

which is not possible

so $(p \wedge q) \rightarrow p$ is always true i.e. it is a tautology.

19. $\because$ $[(p \wedge p) \rightarrow q] \rightarrow p \equiv (p \rightarrow q) \rightarrow p$ $(\because p \wedge p \equiv p)$

when p is false and q is true (or false) then

$(p \rightarrow q)$ is true i.e. $(p \rightarrow q) \rightarrow p$ is false

Hence $[(p \wedge p) \rightarrow q] \rightarrow p$ is not a tautology.

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	B	B	A	D	C	D	A	B	C	C
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	A	D	B	A	D	A	A	D	C

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Topic :- MATHEMATICAL REASONING

1. $\because$ $p \to (q \to p)$ is false

$\Rightarrow$ p is true and $(q \to p)$ is false. which is not possible.

So $p \to (q \to p)$ is always true i.e. it is a tautology.

again $p \to (p \vee q)$ is false

p is true and $(p \vee q)$ is false. Which is not possible.

So $p \to (p \vee q)$ is always true i.e. it is a tautology.

Hence $p \to (q \to p) \equiv p \to (p \vee q)$

2. Given $r : \sim p \leftrightarrow q$

statement-I $r \equiv q \vee p$

statement-II $r \equiv (p \leftrightarrow \sim q)$

p	q	~ p	~ q	(~ p ↔ q)	q ∨ p	(p ↔ ~ q)
T	T	F	F	F	T	F
T	F	F	T	T	T	T
F	T	T	F	T	T	T
F	F	T	T	F	F	F

Hence Statement-I is false and Statement-II is true.

3. statement-I : $\sim(p \leftrightarrow \sim q)$ is equivalent to $p \leftrightarrow q$

statement-II : $\sim(p \leftrightarrow \sim q)$ is a tautology.

p	q	~ q	(p ↔ q)	(p ↔ ~ q)	~ (p ↔ ~ q)
T	T	F	T	F	T
T	F	T	F	T	F
F	T	F	F	T	F
F	F	T	T	F	T

Hence statement-1 is true, statement-2 is false.

4. Given and

p = There is a rational number $x \in S$ such that $x > 0$

then $\sim p$: Any rational number $x \in S$ such that x0

i.e. $\sim p$: Every rational number $x \in S$ satisfy $x \leq 0$

5. Given Statement :

$(p \wedge \sim r) \Leftrightarrow q$

Negations of $p \Leftrightarrow q$ are

$\sim (p \Leftrightarrow q), \sim (q \Leftrightarrow p),$

$\sim p \Leftrightarrow q$ and $\sim q \Leftrightarrow p$

Hence negations of given statement

are $\sim(q \Leftrightarrow (p \wedge \sim r))$ and $\sim (p \wedge \sim r) \Leftrightarrow q$

6. $[p \wedge (p \rightarrow q)] \rightarrow q$

$[p \wedge (\sim p \vee q)] \rightarrow q$

$[(p \wedge \sim p) \vee (p \wedge q)] \rightarrow q$

$[c \vee (p \wedge q)] \rightarrow q$

$\Rightarrow \ (p \wedge q) \rightarrow q$

$\Rightarrow \ \sim(p \wedge q) \vee q$

$\Rightarrow \ (\sim p \vee \sim q) \vee q$

$\Rightarrow \ \sim p \vee (q \vee \sim q)$

$\Rightarrow \ \sim p \vee (t) \equiv$ tautology

9. $\sim S \vee (\sim r \wedge S)$

S	r	~r	$\sim r \wedge S$	$\sim S$	$\sim S \vee (\sim r \wedge S)$	$\sim(\sim S \vee (\sim r \wedge S))$
T	T	F	F	F	F	T
T	F	T	T	F	T	F
F	T	F	F	T	T	F
F	F	T	F	T	T	F

10. $(p \wedge \sim q) \vee q \vee (\sim p \wedge q)$

$= [(p \vee q) \wedge (\sim q \vee q)] \vee (\sim p \wedge q)$

$= [(p \vee q) \wedge t] \vee (\sim p \wedge q)$

$= (p \vee q) \vee (\sim p \wedge q)$

$= [(p \vee q \vee \sim p) \wedge (p \vee q \vee q)]$

$= (t \vee q) \wedge (p \vee q) = t \wedge (p \vee q) = p \vee q$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	B	A	A	C	B	D	B	A	B	B
Q.	11	12	13	14	15	16	17	18	19	20
A.	B	D	D	B	A	B	B	D	B	B