Mathematical Reasoning

1. Consider the statement: "For an integer n, if $n^3 - 1$ is even, then n is odd." The contrapositive statement of this statement is:

(a) For an integer n, if n is even, then $n^3 - 1$ is odd.
(b) For an intetger n, if $n^3 - 1$ is not even, then n is not odd.
(c) For an integer n, if n is even, then $n^3 - 1$ is even.
(d) For an integer n, if n is odd, then $n^3 - 1$ is even.

2. Contrapositive of the statement : 'If a function *f* is differentiable at *a*, then it is also continuous at *a*', is :

(a) If a function *f* is continuous at *a*, then it is not differentiable at *a*.
(b) If a function *f* is not continuous at *a*, then it is not differentiable at *a*.
(c) If a function *f* is not continuous at *a*, then it is differentiable at *a*
(d) If a function *f* is continuous at *a*, then it is differentiable at *a*

3. The contrapositive of the statement "If *I* reach the station in time, then *I* will catch the train" is :

(a) If *I* do not reach the station in time, then *I* will catch the train.
(b) If *I* do not reach the station in time, then *I* will not catch the train.
(c) If *I* will catch the train, then *I* reach the station in time.
(d) If *I* will not catch the train, then *I* do not reach the station in time

4. Negation of the statement: $\sqrt{5}$ is an integer of 5 is irrational is:
(a) $\sqrt{5}$ is not an integer or 5 is not irrational
(b) $\sqrt{5}$ is not an integer and 5 is not irrational
(c) $\sqrt{5}$ is irrational or 5 is an integer.
(d) $\sqrt{5}$ is an integer and 5 is irrational

5. Let *A*, *B*, *C* and *D* be four non-empty sets. The contrapositive statement of "If $A \subseteq B$ and $B \subseteq D$, then $A \subseteq C$ " is:

(a) If $A \not\subset C$, then $A \not\subset B$ and $B \not\subset D$
(b) If $A \not\subset C$, then $B \not\subset A$ or $D \not\subset B$
(c) If $A \not\subset C$, then $A \not\subset B$ and $B \not\subset D$
(d) If $A \not\subset C$, then $A \not\subset B$ or $B \not\subset D$

6. The negation of the Boolean expression $p \vee (\sim p \wedge q)$ is equivalent to :

(a) $p \wedge \sim q$
(b) $\sim p \wedge \sim q$
(c) $\sim p \vee \sim q$
(d) $\sim p \vee q$

7. The negation of the Boolean expression $x \leftrightarrow \sim y$ is equivalent to:

(a) $(x \wedge y) \vee (\sim x \wedge \sim y)$
(b) $(x \wedge y) \wedge (\sim x \vee \sim y)$
(c) $(x \wedge y) \vee (\sim x \wedge y)$
(d) $(\sim x \wedge y) \vee (\sim x \wedge \sim y)$

8. Given the following two statements :
(S_1) : $(q \vee p) \rightarrow (p \leftrightarrow \sim q)$ is a tautology.
(S_2) : $\sim q \wedge (\sim p \leftrightarrow q)$ is a fallacy. Then :
(a) both (S_1) and (S_2) are correct
(b) only (S_1) is correct
(c) only (S_2) is correct
(d) both (S_1) and (S_2) are not correct

9. The propositionis $p \rightarrow \sim(p \wedge \sim q)$ equivalent to :

(a) q
(b) $(\sim p) \vee q$
(c) $(\sim p) \wedge q$
(d) $(\sim p) \vee (\sim q)$

10. Let *p, q, r* be three statements such that the truth value of $(p \wedge q) \rightarrow (\sim q \vee r)$ is F. Then the truth values of *p, q, r* are respectively :

(a) T, F, T (b) T, T, T (c) F, T, F (d) T, T, F

11. If $p \to (p \wedge \sim q)$ is false, then the truth values of p and q are respectively:

(a) F, F (b) T, F (c) T, T (d) F, T

12. Which one of the following is a tautology?

(a) $(p \wedge (p \to q)) \to q$ (b) $q \to (p \wedge (p \to q))$ (c) $p \wedge (p \vee q)$ (d) $p \vee (p \wedge q)$

13. Which of the following statements is a tautology?

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

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

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

(d) $\sim(p \vee \sim q) \to p \vee q$

14. The logical statement $(p \Rightarrow q) \wedge (q \Rightarrow \sim p)$ is equivalent to:

(a) p (b) q (c) $\sim p$ (d) $\sim q$

15. The statement $(p \to (q \to p)) \to (p \to (p \vee q))$ is :

(a) equivalent to $(p \wedge q) \vee (\sim q)$

(b) a contradiction

(c) equivalent to $(p \vee q) \wedge (\sim p)$

(d) a tautology

16. The Boolean expression $\sim (p \vee q) \vee (\sim p \wedge q)$ is equivalent to

(a) $\sim q$ (b) $\sim p$ (c) p (d) q

17. If $(p \wedge \sim q) \wedge (p \wedge r) \to \sim p \vee q$ is false, then the truth values of p , q and r are respectively

(a) T,T,T (b) F,F,F (c) T,F,T (d) F,T,F

18. If $p \to (\sim p \vee \sim q)$ is false, then the truth values of p and q are respectively :

(a) F,F (b) F,T (c) T,T (d) T,T

19. The following statements $(p \to q) \to [(\sim p \to q) \to q]$ is

(a) $\sim p \to q$ equivalent to (b) $p \to \sim q$ equivalent to (c) a fallacy

(d) a tautology

20. The proposition $(\sim p) \vee (p \wedge \sim q)$ is equivalent to

(a) $p \wedge \sim q$ (b) $p \vee \sim q$ (c) $p \to \sim q$ (d) $q \to p$

21. Contrapositive of the statement 'If two numbers are not equal , then their square are not equal to; is

(a) If the square of two number are not equal , then the numbers are equal

(b) If the square of two number are equal, then the number are not equal

(c) If the squares of two numbers are equal, then the number are equal.

(d) If the square of two numbers are not equal, then the numbers are not equal.

22. The Boolean expression $(p \wedge \sim q) \vee q \vee (\sim p \wedge q)$ is equivalent to

(a) $\sim p \wedge q$ (b) $p \wedge q$ (c) $p \vee q$ (d) $p \vee \sim q$

23. Consider the following statements:

P : If 7 is an odd number, then 7 is divisible by 2.

Q : If 7 is a prime number, then 7 is an odd number.

If V_1 is the truth value of the contrapositive of P and V_2 is the truth value of contrapositive of Q,

then the ordered pair) (V_1, V_2) equals

(a) (F,F) (b) (F,T) (c) (T,F) (d) (T,T)

24. The contrapositive of the following statements , "If the side of a square doubles, then its area increase four times", is

(a) If the area of a square increases four times, then its side is not doubled.

(b) If the area of a square increases four times, then its side is doubled.

(c) If the area of a square does not increase four times, then its side is not doubled.

(d) If the side of a square is not doubled, then its area does not increase.

25. The negation of $\sim s \vee (\sim r \wedge S)$ is equivalent to

(a) $S \vee (r \vee \sim s)$ (b) $s \wedge r$ (c) $s \wedge \sim r$ (d) $s \wedge (r \wedge \sim s)$

26. The contrapositive of the statement " If it is raining , then I will not come", is

(a) if I will come, then it is not raining

(b) if I will not come, then it is raining

(c) if I will not come, the it is not raining

(d) if I will come, then it is raining

Answer key

1.(a) 2.(b) 3.(d) 4.(b) 5.(d) 6.(b) 7.(a) 8.(d) 9.(b) 10.(d) 11.(c) 12.(a) 13.(d)
14.(c) 15.(d) 16.(b) 17.(c) 18.(c) 19.(d) 20.(c) 21.(c) 22.(c) 23.(b) 240.(c) 25.(b) 26.(a)