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MHT-CET
Triumph Maths
Based on Maharashtra Board Syllabus
STD. XII Sci.

Salient Features

- Exhaustive subtopic wise coverage of MCQs.
- Important formulae provided in each chapter.
- Hints included for relevant questions.
- Various competitive exam questions updated till the latest year.
- Includes solved MCQs from JEE (Main) 2015, 16, 17, MHT CET 2017.
- Evaluation test provided at the end of each chapter.
- Includes Two Model Question Papers.

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Preface

"Std. XII: Sci. Triumph Maths" is a complete and thorough guide to prepare students for a competitive level examination. The book will not only assist students with MCQs of Std. XII, but will also help them to prepare for JEE (Main), CET and various other competitive examinations.

The content of this book is based on the Maharashtra State Board Syllabus. **Formulae** that form a key part for solving MCQs have been provided in each chapter. **Shortcuts** for easy and less tedious solving are also included.

MCQs in each chapter are divided into three sections:

Classical Thinking: consisting of straight forward questions including knowledge based questions.

Critical Thinking: consisting of questions that require some understanding of the concept.

Competitive Thinking: consisting of questions from various competitive examinations like JEE (Main), CET, etc.

Hints have been provided to the MCQs which are broken down to the simplest form possible.

An **Evaluation Test** has been provided at the end of each chapter to assess the level of preparation of the student on a competitive level.

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

Please write to us on : mail@targetpublications.org

Best of luck to all the aspirants!

Yours faithfully
Authors

Edition : Second

01 Mathematical Logic

Subtopics

1.1 Statement, Logical Connectives, Compound Statements and Truth Table

1.2 Statement Pattern, Logical Equivalence, and Algebra of Statements

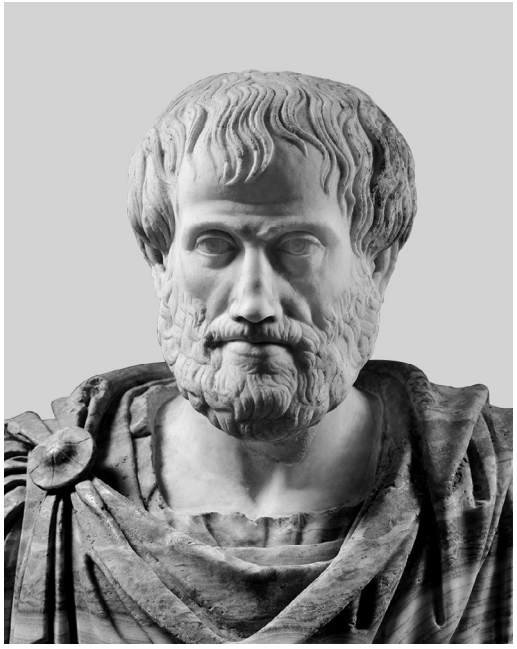
1.3 Tautology, Contradiction, Contingency

1.4 Quantifiers and Quantified Statements, Duality

1.5 Negation of compound statements

1.6 Switching circuit

Aristotle (384 - 322 B.C.)



Aristotle the great philosopher and thinker laid the foundations of study of logic in systematic form. The study of logic helps in increasing one's ability of systematic and logical reasoning and develops the skill of understanding validity of statements.

Chapter at a glance

1. Statement

A statement is declarative sentence which is either true or false, but not both simultaneously.

- Statements are denoted by lower case letters p, q, r, etc.
- The truth value of a statement is denoted by '1' or 'T' for True and '0' or 'F' for False.

Open sentences, imperative sentences, exclamatory sentences and interrogative sentences **are not considered as Statements** in Logic.

2. Logical connectives

Type of compound statement	Connective	Symbol	Example
Conjuction	and	$\wedge$	p and q : $p \wedge q$
Disjunction	or	$\vee$	p or q : $p \vee q$
Negation	not	$\sim$	negation p : $\sim p$ not p : $\sim p$
Conditional or Implication	if….then	$\rightarrow$ or $\Rightarrow$	If p, then q : $p \rightarrow q$
Biconditional or Double implication	if and only if i.e. iff	$\leftrightarrow$ or $\Leftrightarrow$	p iff q : $p \leftrightarrow q$

i. When two or more simple statements are combined using logical connectives, then the statement so formed is called Compound Statement.

ii. Sub-statements are those simple statements which are used in a compound statement.

iii. In the conditional statement $p \rightarrow q$, p is called the antecedent or hypothesis, while q is called the consequent or conclusion.

3. Truth Tables for compound statements:

i. Conjuction, Disjunction, Conditional and Biconditional:

p	q	$p \wedge q$	$p \vee q$	$p \rightarrow q$	$p \leftrightarrow q$
T	T	T	T	T	T
T	F	F	T	F	F
F	T	F	T	T	F
F	F	F	F	T	T

ii. Negation:

p	$\sim p$
T	F
F	T

4. Relation between compound statements and sets in set theory:

i. Negation corresponds to 'complement of a set'.

ii. Disjunction is related to the concept of 'union of two sets'.

iii. Conjunction corresponds to 'intersection of two sets'.

iv. Conditional implies 'subset of a set'.

v. Biconditional corresponds to 'equality of two sets'.

5. Statement Pattern:

When two or more simple statements p, q, r …. are combined using connectives $\wedge$, $\vee$, $\sim$, $\rightarrow$, $\leftrightarrow$ the new statement formed is called a **statement pattern.**

e.g.: $\sim p \wedge q$, $p \wedge (p \wedge q)$, $(q \rightarrow p) \vee r$

6. Converse, Inverse, Contrapositive of a Statement:

If $p \rightarrow q$ is a conditional statement, then its

i. Converse: $q \rightarrow p$

ii. Inverse: $\sim p \rightarrow \sim q$

iii. Contrapositive: $\sim q \rightarrow \sim p$

Classical Thinking

1.1 Statement, Logical Connectives, Compound Statements and Truth Table

1. Which of the following is a statement in logic?
   (A) What a wonderful day!
   (B) Shut up!
   (C) What are you doing?
   (D) Bombay is the capital of India.

2. Which of the following is a statement?
   (A) Open the door.
   (B) Do your homework.
   (C) Switch on the fan.
   (D) Two plus two is four.

3. Which of the following is a statement in logic?
   (A) Go away (B) How beautiful!
   (C) $x > 5$ (D) $2 = 3$

4. The connective in the statement "Earth revolves around the Sun and Moon is a satellite of earth", is
   (A) or (B) Earth
   (C) Sun (D) and

5. p: Sunday is a holiday, q: Ram does not study on holiday.
   The symbolic form of the statement 'Sunday is a holiday and Ram studies on holiday' is
   (A) $p \wedge \sim q$ (B) $p \wedge q$
   (C) $\sim p \wedge \sim q$ (D) $p \vee \sim q$

6. p : There are clouds in the sky and q : it is not raining. The symbolic form is
   (A) $p \rightarrow q$ (B) $p \rightarrow \sim q$
   (C) $p \wedge \sim q$ (D) $\sim p \wedge q$

7. If p: The sun has set, q: The moon has risen, then symbolically the statement 'The sun has not set or the moon has not risen' is written as
   (A) $p \wedge \sim q$ (B) $\sim q \vee p$
   (C) $\sim p \wedge q$ (D) $\sim p \vee \sim q$

8. If p: Rohit is tall, q: Rohit is handsome, then the statement 'Rohit is tall or he is short and handsome' can be written symbolically as
   (A) $p \vee (\sim p \wedge q)$
   (B) $p \wedge (\sim p \vee q)$
   (C) $p \vee (p \wedge \sim q)$
   (D) $\sim p \wedge (\sim p \wedge \sim q)$

9. Assuming the first part of the statement as p, second as q and the third as r, the statement 'Candidates are present, and voters are ready to vote but no ballot papers' in symbolic form is
   (A) $(p \vee q) \wedge \sim r$
   (B) $(p \wedge \sim q) \wedge r$
   (C) $(\sim p \wedge q) \wedge \sim r$
   (D) $(p \wedge q) \wedge \sim r$

10. Write verbally $\sim p \vee q$ where
    p: She is beautiful; q: She is clever
    (A) She is beautiful but not clever
    (B) She is not beautiful or she is clever
    (C) She is not beautiful or she is not clever
    (D) She is beautiful and clever.

11. If p: Ram is lazy, q: Ram fails in the examination, then the verbal form of $\sim p \vee \sim q$ is
    (A) Ram is not lazy and he fails in the examination.
    (B) Ram is not lazy or he does not fail in the examination.
    (C) Ram is lazy or he does not fail in the examination.
    (D) Ram is not lazy and he does not fail in the examination.

12. A compound statement p or q is false only when
    (A) p is false.
    (B) q is false.
    (C) both p and q are false.
    (D) depends on p and q.

13. A compound statement p and q is true only when
    (A) p is true.
    (B) q is true.
    (C) both p and q are true.
    (D) none of p and q is true.

14. For the statements p and q '$p \rightarrow q$' is read as 'if p then q'. Here, the statement q is called
    (A) antecedent.
    (B) consequent.
    (C) logical connective.
    (D) prime component.

15. If p : Prakash passes the exam,
    q : Papa will give him a bicycle.
    Then the statement 'Prakash passing the exam, implies that his papa will give him a bicycle' can be symbolically written as
    (A) $p \rightarrow q$ (B) $p \leftrightarrow q$
    (C) $p \wedge q$ (D) $p \vee q$

16. If d: driver is drunk, a: driver meets with an accident, translate the statement 'If the Driver is not drunk, then he cannot meet with an accident' into symbols
(A) $\sim a \rightarrow \sim d$ (B) $\sim d \rightarrow \sim a$
(C) $\sim d \wedge a$ (D) $a \wedge \sim d$

17. If a: Vijay becomes a doctor,
b: Ajay is an engineer.
Then the statement 'Vijay becomes a doctor if and only if Ajay is an engineer' can be written in symbolic form as
(A) $b \leftrightarrow \sim a$ (B) $a \leftrightarrow b$
(C) $a \rightarrow b$ (D) $b \rightarrow a$

18. A compound statement $p \rightarrow q$ is false only when
(A) p is true and q is false.
(B) p is false but q is true.
(C) atleast one of p or q is false.
(D) both p and q are false.

19. Assuming the first part of each statement as p, second as q and the third as r, the statement 'If A, B, C are three distinct points, then either they are collinear or they form a triangle' in symbolic form is
(A) $p \leftrightarrow (q \vee r)$
(B) $(p \wedge q) \rightarrow r$
(C) $p \rightarrow (q \vee r)$
(D) $p \rightarrow (q \wedge r)$

20. If m: Rimi likes calculus.
n: Rimi opts for engineering branch.
Then the verbal form of $m \rightarrow n$ is
(A) If Rimi opts for engineering branch then she likes calculus.
(B) If Rimi likes calculus then she does not opt for engineering branch.
(C) If Rimi likes calculus then she opts for engineering branch
(D) If Rimi likes engineering branch then she opts for calculus.

21. The inverse of logical statement $p \rightarrow q$ is
(A) $\sim p \rightarrow \sim q$ (B) $p \leftrightarrow q$
(C) $q \rightarrow p$ (D) $q \leftrightarrow p$

22. Contrapositive of $p \rightarrow q$ is
(A) $q \rightarrow p$
(B) $\sim q \rightarrow p$
(C) $\sim q \rightarrow \sim p$
(D) $q \rightarrow \sim p$

23. The statement "If x^2 is not even then x is not even", is the converse of the statement
(A) If x^2 is odd, then x is even
(B) If x is not even, then x^2 is not even
(C) If x is even, then x^2 is even
(D) If x is odd, then x^2 is even

24. The converse of 'If x is zero then we cannot divide by x' is
(A) If we cannot divide by x then x is zero.
(B) If we divide by x then x is non-zero.
(C) If x is non-zero then we can divide by x.
(D) If we cannot divide by x then x is non-zero.

25. The converse of the statement "If $x > y$, then $x + a > y + a$", is
(A) If $x < y$, then $x + a < y + a$
(B) If $x + a > y + a$, then $x > y$
(C) If $x < y$, then $x + a > y + a$
(D) If $x > y$, then $x + a < y + a$

26. The inverse of the statement "If you access the internet, then you have to pay the charges", is
(A) If you do not access the internet, then you do not have to pay the charges.
(B) If you pay the charges, then you accessed the internet.
(C) If you do not pay the charges, then you do not access the internet.
(D) You have to pay the charges if and only if you access the internet.

27. The contrapositive of the statement: "If a child concentrates then he learns" is
(A) If a child does not concentrate he does not learn.
(B) If a child does not learn then he does not concentrate.
(C) If a child practises then he learns.
(D) If a child concentrates, he does not forget.