DIRECTORATE OF EDUCATION
Govt. of NCT, Delhi

SUPPORT MATERIAL
(2019-2020)

Class : IX
MATHEMATICS
(ENGLISH MEDIUM)

Under the Guidance of

Mr. Sandeep Kumar
Secretary (Education)

Mr. Binay Bhushan
Director (Education)

Dr. Saroj Bala Sain
Addl. DE (School & Exam.)

Coordinators

Ms. Savita Drall
DDE (Exam)

Ms. Mukta Soni
Addl. DDE (Exam)

Dr. Raj Kumar
OSD (Exam)

Mr. Krishan Kumar
OSD (Exam)
PREFACE

It gives me immense pleasure to present the Support Material for various subjects. The material prepared for students of classes IX to XII has been conceived and developed by a team comprising of the Subject Experts, Members of the Academic Core Unit and teachers of the Directorate of Education.

The subject wise Support Material is developed for the betterment and enhancement of the academic performance of the students. It will give them an insight into the subject leading to complete understanding. It is hoped that the teachers and students will make optimum use of this material. This will help us achieve academic excellence.

I commend the efforts of the team who have worked with complete dedication to develop this matter well within time. This is another endeavor of the Directorate to give complete support to the learners all over Delhi.
Dear Students,

Directorate of Education is committed to providing qualitative and best education to all its students. The Directorate is continuously engaged in the endeavor to make available the best study material for uplifting the standard of its students and schools.

Every year, the expert faculty of Directorate reviews and updates Support Material. The expert faculty of different subjects incorporates the changes in the material as per the latest amendments made by CBSE to make its students familiar with new approaches and methods so that students do well in the examination.

The book in your hand is the outcome of continuous and consistent efforts of senior teachers of the Directorate. They have prepared and developed this material especially for you. A huge amount of money and time has been spent on it in order to make you updated for annual examination.

Last, but not the least, this is the perfect time for you to build the foundation of your future. I have full faith in you and the capabilities of your teachers. Please make the fullest and best use of this Support Material.

BINAY BHUSHAN
DIRECTOR (EDUCATION)
I am very much pleased to forward the Support Material for classes IX to XII. Every year, the Support Material of most of the subjects is updated/revised as per the most recent changes made by CBSE. The team of subject experts, officers of Exam Branch, members of Core Academic Unit and teachers from various schools of Directorate has made it possible to make available unsurpassed material to students.

Consistence use of Support Material by the students and teachers will make the year long journey seamless and enjoyable. The main purpose to provide the Support Material for the students of government schools of Directorate is not only to help them to avoid purchasing of expensive material available in the market but also to keep them updated and well prepared for exam. The Support Material has always been a ready to use material, which is matchless and most appropriate.

I would like to congratulate all the Team Members for their tireless, unremitting and valuable contributions and wish all the best to teachers and students.

(Dr. Saroj Bala Sain)
Addl.DE (School/Exam)
DIRECTORATE OF EDUCATION
Govt. of NCT, Delhi

SUPPORT MATERIAL
(2019-2020)

Class : IX
MATHEMATICS

NOT FOR SALE

PUBLISHED BY : DELHI BUREAU OF TEXTBOOKS
LIST OF GROUP LEADER AND SUBJECT EXPERTS
FOR PREPARATION / REVIEW OF SUPPORT MATERIAL

Class - IX
Subject : Mathematics

1. Sh. Ashutosh Kumar Aggarwal  
   SBV J.J. Colony Khichripur Village, Delhi-110091

2. Mr. Neeraj Gupta  
   TGT Maths  
   RPVV, Civil Lines, Delhi

3. Mrs. Ritu Tiwari  
   TGT Maths  
   RPVV, Surajmal Vihar, Delhi

4. Mr. Jaspal Singh Negi  
   TGT Maths  
   GBSSS, J&K Block, Dilshad Garden, Delhi

5. Mr. Jai Prakash  
   TGT (Maths)  
   SBV, Jafarbad, Delhi

7. Ms. Aakanksha  
   TGT (Maths)  
   Core Academic Unit
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MATHEMATICS (IX)

The Syllabus in the subject of Mathematics has undergone changes from time to time in accordance with growth of the subject and emerging needs of the society. The present revised syllabus has been designed in accordance with National Curriculum Framework 2005 and as per guidelines given in the Focus Group of Teaching of Mathematics which is to meet the emerging needs of all categories of students. For motivating the teacher to related the topics to real life problems and other subject areas, greater emphasis has been laid on applications of various concepts.

The curriculum at secondary stage primarily aims at enhancing the capacity of students to employ Mathematics in solving day-to-day life problem adn studying the subject as a separate discipline. IT is expected that students should acquired the ability to solve problem using algebraic methods and apply the knowledge of simple trigonometry to solve problem of height and distances. Carrying out experiments with numbers and forms of geometry, framing hypothesis and verifying these with further observations form inherent part of Mathematics learning at this stage. The proposed curriculum includes the study of number system, algebra, geometry, trigonometry, mensuration, mensuration, statistics, graphs and coordinate geometry, etc.

The teaching of Mathematics should be imparted through activities which may involve the use of concrete materials, models, patterns, charts, pictures, posters, games, puzzles and experiments.

Objectives
The broad objectives of teaching of Mathematics at secondary stage are to help the learners to:

- consolidate the Mathematical knowledge and skills acquired at the upper primary stage; acquire knowledge and understanding, particularly by way of motivation and visualization, of basic concepts, terms, principles and symbols and underlying processes and skills; develop mastery of basic algebraic skills;
- develop drawing skills;
- feel the flow of reason while proving a result or solving a problem;
- apply the knowledge and skills acquired to solve problems and wherever possible, by more than one method;
- to develop ability to think, analyze and articulate logically;
- to develop awareness of the need for national integration, protection of environment, observance of small family norms, removal of social barriers, elimination of gender biases;
• to develop necessary skills to work with modern technological devices and mathematical software’s.
• to develop interest in mathematics as a problem-solving tool in various fields for its beautiful structures and patterns, etc.
• to develop reverence and respect towards great Mathematicians for their contributions to the field of Mathematics;
• to develop interest in the subject by participating in related competitions;
• to acquaint students with different aspects of Mathematics used in daily life;
• to develop an interest in students to study Mathematics as a discipline.

**COURSE STRUCTURE CLASS - IX**

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<td><strong>80</strong></td>
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**UNIT I: NUMBER SYSTEMS**

1. REAL NUMBERS (16 Periods)


2. Examples of non-recurring/non-terminating decimals. Existence of non-rational numbers (irrational numbers) such as √2, -0 and their representation on the number line. Explaining that every real number is represented by a unique point on the number line and conversely, viz. every point on the number line represents a unique real number.

3. Definition of nth root of a real number.

4. Rationalization (with precise meaning) of real numbers of the type

\[
\frac{1}{a+b\sqrt{x}} \text{ and } \frac{1}{\sqrt{x} + \sqrt{y}} \quad \text{(and their combinations) where } x \text{ and } y \text{ are natural number and } a \text{ and } b \text{ are integers.}
\]
5. Recall of laws of exponents with integral powers. Rational exponents with positive real bases (to be done by particular cases, allowing learner to arrive at the general laws.)

UNIT II: ALGEBRA

1. POLYNOMIALS (23 Periods)
Definition of a polynomial in one variable, with examples and counter examples. Coefficients of a polynomial, terms of a polynomial and zero polynomial. Degree of a polynomial. Constant, linear, quadratic and cubic polynomials. Monomials, binomials, trinomials. Factors and multiples. Zeros of a polynomial. Motivate and State the Remainder Theorem with examples. Statement and proof of the Factor Theorem. Factorization of \( ax^2 + bx + c \), \( a \neq 0 \) where \( a \), \( b \) and \( c \) are real numbers, and of cubic polynomials using the Factor Theorem.
Recall of algebraic expressions and identities. Verification of identities:
\[
(x + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx
\]
\[
(x \pm y)^3 = x^3 \pm y^3 \pm 3xy(x \pm y)
\]
\[
x^3 \pm y^3 = (x \pm y)(x^2 \pm xy + y^2)
\]
\[
x^3 + y^3 + z^3 = 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)
\]
and their use in factorization of polynomials.

2. LINEAR EQUATIONS IN TWO VARIABLES (14) Periods
Recall of linear equations in one variable. Introduction to the equation in two variables. Focus on linear equations of the type \( ax + by + c = 0 \). Explain that a linear equation in two variables has infinitely many solutions and justify their being written as ordered pairs of real numbers, plotting them and showing that they lie on a line. Graph of linear equations in two variables. Examples, problems from real life, including problems on Ratio and Proportion and with algebraic and graphical solutions being done simultaneously.

UNIT III: COORDINATE GEOMETRY

COORDINATE GEOMETRY (6) Periods
The Cartesian plane, coordinates of a point, names and terms associated with the coordinate plane, notations, plotting points in the plane.
UNIT IV: GEOMETRY

1. INTRODUCTION TO EUCLID'S GEOMETRY (Not for assessment) (6 Periods)

History - Geometry in India and Euclid's geometry. Euclid's method of formalizing observed phenomenon into rigorous Mathematics with definitions, common/obvious notions, axioms/postulates and theorems. The five postulates of Euclid. Equivalent versions of the fifth postulate. Showing the relationship between axiom and theorem, for example:

(Axiom) 1. Given two distinct points, there exists one and only one line through them.

(Theorem) 2. (Prove) Two distinct lines cannot have more than one point in common.

2. LINES AND ANGLES (13 Periods)

1. (Motivate) If a ray stands on a line, then the sum of the two adjacent angles so formed is 180° and the converse.

2. (Prove) If two lines intersect, vertically opposite angles are equal.

3. (Motivate) Results on corresponding angles, alternate angles, interior angles when a transversal intersects two parallel lines.

4. (Motivate) Lines which are parallel to a given line are parallel.

5. (Prove) The sum of the angles of a triangle is 180°.

6. (Motivate) If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the two interior opposite angles.

3. TRIANGLES (20 Periods)

1. (Motivate) Two triangles are congruent if any two sides and the included angle of one triangle is equal to any two sides and the included angle of the other triangle (SAS Congruence).

2. (Prove) Two triangles are congruent if any two angles and the included side of one triangle is equal to any two angles and the included side of the other triangle (ASA Congruence).

3. (Motivate) Two triangles are congruent if the three sides of one triangle are equal to three sides of the other triangle (SSS Congruence).

4. (Motivate) Two right triangles are congruent if the hypotenuse and a side of one triangle are equal (respectively) to the hypotenuse and a side of the other triangle. (RHS Congruence)
5. (Prove) The angles opposite to equal sides of a triangle are equal.
6. (Motivate) The sides opposite to equal angles of a triangle are equal.
7. (Motivate) Triangle inequalities and relation between 'angle and facing side' inequalities in triangles.

4. **QUADRILATERALS**
   (10) Periods
   1. (Prove) The diagonal divides a parallelogram into two congruent triangles.
   2. (Motivate) In a parallelogram opposite sides are equal, and conversely.
   3. (Motivate) In a parallelogram opposite angles are equal, and conversely.
   4. (Motivate) A quadrilateral is a parallelogram if a pair of its opposite sides is parallel and equal.
   5. (Motivate) In a parallelogram, the diagonals bisect each other and conversely.
   6. (Motivate) In a triangle, the line segment joining the mid points of any two sides is parallel to the third side and in half of it and (motivate) its converse.

5. **AREA**
   (7) Periods
   Review concept of area, recall area of a rectangle.
   1. (Prove) Parallelograms on the same base and between the same parallels have equal area.
   2. (Motivate) Triangles on the same base (or equal bases) and between the same parallels are equal in area.

6. **CIRCLES**
   (15) Periods
   Through examples, arrive at definition of circle and related concepts-radius, circumference, diameter, chord, arc, secant, sector, segment, subtended angle.
   1. (Prove) Equal chords of a circle subtend equal angles at the center and (motivate) its converse.
   2. (Motivate) The perpendicular from the center of a circle to a chord bisects the chord and conversely, the line drawn through the center of a circle to bisect a chord is perpendicular to the chord.
   3. (Motivate) There is one and only one circle passing through three given non-collinear points.
   4. (Motivate) Equal chords of a circle (or of congruent circles) are equidistant from the center (or their respective centers) and conversely.
5. (Prove) The angle subtended by an arc at the center is double the angle subtended by it at any point on the remaining part of the circle.
6. (Motivate) Angles in the same segment of a circle are equal.
7. (Motivate) If a line segment joining two points subtends equal angle at two other points lying on the same side of the line containing the segment, the four points lie on a circle.
8. (Motivate) The sum of either of the pair of the opposite angles of a cyclic quadrilateral is $180^\circ$ and its converse

7. CONSTRUCTIONS (10) Periods
   1. Construction of bisectors of line segments and angles of measure $60^\circ$, $90^\circ$, $45^\circ$ etc., equilateral triangles.
   2. Construction of a triangle given its base, sum/difference of the other two sides and one base angle.
   3. Construction of a triangle of given perimeter and base angles.

UNIT V: MENSURATION
1. AREAS (4) Periods
   Area of a triangle using Heron's formula (without proof) and its application in finding the area of a quadrilateral.

2. SURFACE AREAS AND VOLUMES (12) Periods
   Periods Surface areas and volumes of cubes, cuboids, spheres (including hemispheres) and right circular cylinders/cones.

UNIT VI: STATISTICS \& PROBABILITY
1. STATISTICS (13) Periods
   Introduction to Statistics: Collection of data, presentation of data — tabular form, ungrouped / grouped, bar graphs, histograms (with varying base lengths), frequency polygons. Mean, median and mode of ungrouped data.

2. PROBABILITY (9) Periods
   History, Repeated experiments and observed frequency approach to probability. Focus is on empirical probability. (A large amount of time to be devoted to groupand to individual activities to motivate the concept; the experiments to be drawn from real-life situations, and from examples used in the chapter on statistics).
QUESTION PAPER DESIGN  
CLASS-IX AND X (2019-20)  
Subject : Mathematic

Time : 3 Hrs.  
Maximum Marks : 80

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<th>Sr. No.</th>
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<th>Very Short Answer objective type (VSA) (1 Mark)</th>
<th>Short Answer objective type (SA) (2 Mark)</th>
<th>Short Answer - II (SA) (3 Mark)</th>
<th>Long Answer - (LA) (4 Mark)</th>
<th>Total Marks</th>
<th>% Weightage (approx.)</th>
</tr>
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<td>Remembering : Exhibit memory of previously learned material by recalling facts, terms, basic concepts and answers.</td>
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<td>02</td>
<td>02</td>
<td>01</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>Understanding : Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas</td>
<td>06</td>
<td>01</td>
<td>01</td>
<td>03</td>
<td>23</td>
<td>29</td>
</tr>
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<td>3.</td>
<td>Applying : Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.</td>
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<td>02</td>
<td>02</td>
<td>01</td>
<td>19</td>
<td>24</td>
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<td>4.</td>
<td>Analyzing and Evaluating : Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations. Evaluation: Present and defend opinions by making Judgements about information, validity of ideas, or quality of work based on a set of criteria. Creating : Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.</td>
<td>03</td>
<td>01</td>
<td>03</td>
<td>01</td>
<td>18</td>
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<td>20x1=20</td>
<td>6x2=12</td>
<td>8x3=24</td>
<td>6x4=24</td>
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<td>Portfolio</td>
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Class IX - Mathematics
CHAPTER-1
NUMBER SYSTEMS
MIND MAP

Rational Number

Irrational Number

Real Number

Number line

Every point on the line represents real numbers

Natural Numbers (N)

Whole Numbers (W)

Integers (Z)

Cannot be written in the form p/q, p, q are integers q ≠ 0

Rational Numbers form p/q, p, q are integers q ≠ 0

Laws of exponents

\[
\begin{array}{c|c|c|c}
\text{Term} & \sqrt{a} b & \sqrt{a} - b & \sqrt{a} + b \\
\hline
\frac{1}{\sqrt{a}} & \frac{1}{\sqrt{a+b}} & \frac{1}{\sqrt{a-b}} & \frac{1}{\sqrt{a+b}} \\
\end{array}
\]

Rational Station Factor
CHAPTER-1
NUMBER SYSTEMS

KEY POINTS

• 1, 2, 3, .......... are natural numbers which are represented by N.
• 0, 1, 2, 3, .......... are whole numbers which are represented by W.
• .......... −3, −2, −1, 0, 1, 2, 3, .......... are Integers which are represented by Z or I.
• A number is a rational number if
  (a) it can be represented in the form of \( \frac{p}{q} \), where \( p \) and \( q \) are integers and \( q \neq 0 \).
  or
  (b) its decimal expansion is terminating \( (\text{e.g. } \frac{2}{5} = 0.4) \)
  or
  (c) its decimal expansion is non-terminating recurring (repeating)
    \( (\text{e.g. } 0.1234 = 0.1234234......) \)
• A number is irrational number if
  (a) it can not be represented in the form of \( \frac{p}{q} \), where \( p \) and \( q \) are integers and \( q \neq 0 \).
  or
  (b) its decimal expansion is non-terminating non-recurring \( (\text{e.g. } 0.1010010001......) \)
• All rational and irrational numbers collectively form real numbers.
• There are infinite rational numbers between any two rational numbers.
• There is a unique real number corresponding to every point on the number line. Also, corresponding to each real number, there is a unique point on the number line.
• Rationalisation of a denominator means to change the Irrational denominator to rational form.
• To rationalise the denominator of \( \frac{1}{\sqrt{a} - b} \), We multiply this by \( \frac{\sqrt{a} + b}{\sqrt{a} - b} \), where \( a \) is a natural number and \( b \) is an integer.
Laws of Exponents: Let $a > 0$ be a real number and $m$ and $n$ are rational numbers, then

1) $a^m a^n = a^{m+n}$
2) $a^m \div a^n = a^{m-n}$
3) $(a^m)^n = a^{mn}$
4) $a^m \cdot b^n = (ab)^m$
5) $a^0 = 1$
6) $a^{-m} = \frac{1}{a^m}$

For positive real number $a$ and $b$, the following Identities hold

1) $\sqrt{a} \cdot \sqrt{b} = \sqrt{ab}$
2) $\sqrt{a} + \sqrt{b} = \frac{a}{\sqrt{b}}$
3) $(\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b}) = a - b$
4) $(\sqrt{a} + \sqrt{b})^2 = a + 2\sqrt{ab} + b$
5) $(a + \sqrt{b})(a - \sqrt{b}) = a^2 - b$

All natural numbers, whole numbers and integers are rational

**Prime Numbers**: All natural numbers that have exactly two factors (i.e., 1 and itself) are called prime numbers. E.g., 2, 3, 5, 7, 11, 13, 17, 19, 23, … etc.

**Composite Numbers**: Those natural numbers which have more than two factors are known as composite numbers. E.g., 4, 6, 8, 10, 12, …

1 is neither prime nor composite.

**Types of Numbers**

![Diagram of Types of Numbers]

**Real Numbers**

- **Rational Numbers**
  - Terminating Decimal Expansion
  - Non Terminating Recurring Decimal Expansion
  - $q = 2^m \times 5^n$
  - $\left(\frac{2}{5} = 0.4\right)$
  - $\left(\frac{10}{3} = 3.33... = 3\overline{3}\right)$

- **Irrational Numbers**
  - Non-Terminating Non-Recurring Decimal Expansion
  - $\sqrt{2} = 1.414...$
Real Numbers

Rational Numbers
Eg: \( \left\{ -5, \frac{-7}{3}, 0, \frac{5}{6} \right\} \)

Irrational Numbers
Eg: \( \left\{ \sqrt{2}, \sqrt{3}, \sqrt{5}, \pi \right\} \)

Integers
( ... -3, -2, -1, 0, 1, 2, 3 ... )

Fractions
\( \left\{ \frac{1}{2}, \frac{5}{3}, \frac{7}{5} \right\} \)

Negative Integers
( ... -3, -2, -1 )

Whole Numbers (0, 1, 2, 3...)

Zero (0)

Natural Numbers (1, 2, 3, ....)

Even Numbers
(2, 4, 6, 8 ....)

Odd Numbers
(1, 3, 5, 7, 9...)

Prime Number
(2)

Composite Numbers
(4, 6, 8, 10 ...)

Prime Numbers
(3, 5, 7, 11 ....)

Composite Numbers
(9, 15 ...)

\* \( n\sqrt{a} = a^{\frac{1}{n}} \)
where 'a' is a positive real number and n is a positive integer.

\[ \frac{m}{a^n} = \left( \sqrt[n]{a} \right)^m = \sqrt[n]{a^m} \]

where 'a' is a positive real number, m and n are co-prime integers, and n > 0.
PART - A

1. If \( x = 2 \) and \( y = 4 \), then \( \left( \frac{x}{y} \right)^{x-y} + \left( \frac{y}{x} \right)^{y-x} = \) ________
   a) 4  b) 8  c) 12  d) 2

2. Which of the following is the greatest?
   a) \( 4^2 \)  b) \( (16)^{3/2} \)  c) \( \left( \frac{1}{64} \right)^{-1/3} \)  d) \( (256)^{-1/4} \)

3. \( \frac{(32)^{0.2} + (81)^{0.25}}{(256)^{0.5} - (121)^{0.5}} = \) ________
   a) 2  b) 5  c) 1  d) 11

4. \( \frac{3}{7} \) line between ________
   a) \( \frac{4}{9}, \frac{5}{9} \)  b) \( \frac{43}{99}, \frac{4}{9} \)
   c) \( \frac{42}{99}, \frac{4}{9} \)  d) \( \frac{41}{99}, \frac{41}{9} \)

5. The number \( 0.318564318564318564 \ldots \) is
   a) a natural number  b) an integer  c) a rational number  d) an irrational number

6. The number \( 0.7 \) in the form \( \frac{p}{q} \), where \( p \) and \( q \) are integers and \( q \neq 0 \), is
   a) \( \frac{77}{100} \)  b) \( \frac{7}{10} \)
   c) \( \frac{7}{9} \)  d) \( \frac{7}{100} \)

7. The value of \( 0.23 + 0.22 \) is
   a) 0.45  b) 0.45  c) \( \frac{45}{99} \)  d) both (B) and (C)
8. The value of \([3 - 4 (3 - 4)^4]^3\), is
   a) 1          b) -1
   c) 0          d) 7
9. The cube root of 125 divided by square root of 25, is
   a) 5          b) 1
   c) 1/5        d) None of these
10. If \(y^2 = 625\) then \(y\) is
     a) a rational number          b) an irrational number
     c) neither rational nor irrational  d) a natural number
11. \(\sqrt[5]{81^{25}} = \) ________
    a) 1/81          b) 81
    c) 243          d) 343
12. The value of \(x\), if \(5^{x-3} \cdot 3^{2x-8} = 225\), is
    a) 2          b) 3
    c) 5          d) 7
13. If \(a = 2 + \sqrt{3}\), then the value of \(\frac{1}{a}\) is
    a) \(2 + \sqrt{3}\)          b) \(2 - \sqrt{3}\)
    c) \(\sqrt{3} - 2\)          d) 1
14. The smallest natural number is
    a) -1          b) 0
    c) 1          d) 2
15. Which of the following is not a rational number?
    a) \(\sqrt{2}\)          b) \(\sqrt{4}\)
    c) \(\sqrt{9}\)          d) \(\sqrt{25}\)
16. Choose the wrong statement:
    a) Every natural number is a whole number.
    b) Every integer is a rational number.
    c) Every rational number is an integer.
    d) Every rational number is a real number.
17. The decimal expansion of the number $\sqrt{3}$ is
   a) a finite decimal  
   b) 1.732
   c) non-terminating recurring  
   d) non-terminating non-recurring

18. Between two rational numbers
   a) there is no rational number.
   b) there is exactly one rational number.
   c) there are infinitely many rational numbers.
   d) there are only rational numbers and no irrational number.

19. Which of the following is an irrational number?
   a) $\frac{4}{\sqrt{9}}$  
   b) $\frac{\sqrt{12}}{\sqrt{3}}$
   c) $\sqrt{7}$  
   d) $\sqrt{81}$

20. Every rational number is
   a) a natural number  
   b) an integer
   c) a real number  
   d) a whole number

21. $\sqrt{6} \times \sqrt{8}$ is equal to
   a) $3\sqrt{4}$  
   b) $4\sqrt{3}$
   c) $\sqrt{14}$  
   d) $6\sqrt{8}$

22. After rationalising the denominator of $\frac{3\sqrt{2}}{3\sqrt{2} - 2\sqrt{2}}$, we get the denominator as
   a) 13  
   b) 5
   c) 19  
   d) 35

23. Which of the following is equal to 'a'?
   a) $a^{\frac{10}{5}} - a^{\frac{4}{5}}$  
   b) $\frac{12}{\sqrt[3]{(a^4)}}$
   c) $(\sqrt[3]{a^2})^{\frac{2}{3}}$  
   d) $a^{\frac{12}{7}} \times a^{\frac{7}{12}}$
24. The product of any two irrational numbers is
   a) always an irrational number.
   b) always a rational number.
   c) always an integer.
   d) sometimes rational, sometimes irrational.

25. A rational number between \( \sqrt{2} \) and \( \sqrt{3} \) is
   a) \( \frac{\sqrt{2} + \sqrt{3}}{2} \)
   b) \( \frac{\sqrt{2} \times \sqrt{3}}{2} \)
   c) 1.5
   d) 1.8

**Fill in the blanks**

26. The sum of a rational and an irrational number is always __________ number.

27. The difference of a rational and an irrational number is always ______ number.

28. The decimal expansion of every rational number is either __________ or non-terminating __________.

29. The decimal expansion of every irrational number is always __________.

30. Every number whose decimal expansion is non-terminating non-recurring is __________ number.

31. Between two distinct rational numbers there lie __________ rational numbers.

32. Between two distinct rational numbers there lie __________ irrational numbers.

33. Between two distinct irrational numbers there lie __________ rational numbers.

34. The reciprocal of every (non-zero) rational number is a __________ number.

**State whether the following statements are true or false.**

35. Every integer is a whole number.

36. Every integer can be written in the form \( \frac{p}{q} \), where \( p, q \) are integers, \( q \neq 0 \).
37. Every real number is an irrational number.
38. There are infinitely many integers between any two integers.
39. The square of an irrational number is always a rational number.
40. Reciprocal of every rational number is a rational number.

41. Write first five whole numbers in \( \frac{p}{q} \) form, where \( p \) and \( q \) are integers and \( q \neq 0 \)
42. Find decimal expansion of \( \frac{17}{8}, \frac{3}{15}, \frac{2}{7}, \frac{50}{3} \).
43. Find four rational numbers between \( \frac{2}{9} \) and \( \frac{3}{7} \).
44. Find decimal form of \( \sqrt{23} \) and \( \sqrt{24} \) upto 3 decimal places.
45. Find two Irrational numbers between \( \sqrt{23} \) and \( \sqrt{24} \).
46. Find one Irrational and one rational number between 2 and \( \sqrt{5} \).
47. Write two numbers whose decimal expansions are terminating.
48. What can be the maximum number of digits in the repeating block of digits in the decimal expansion of \( \frac{5}{7} \) ?
49. Write two numbers whose decimal expansions are non-terminating non-repeating (non-recurring).
50. Find the value of \( (256)^{0.16} \times (256)^{0.09} \)
52. Represent \( -\frac{7}{5} \) on the number line.
53. Represent following on number line
   i) \( \sqrt{5} \)  ii) \( \sqrt{3} \)  iii) \( \sqrt{2} \)
54. Insert two Irrational numbers between \( \frac{2}{3} \) and \( \frac{3}{2} \)
55. Simplify: \( \frac{\sqrt{5} + \sqrt{3}}{\sqrt{80} + \sqrt{48} - \sqrt{45} - \sqrt{27}} \)
56. Find the value of \( [1^3 + 2^3 + 3^3 + 8^2]^{-0.2} \)
57. Find the value of \( x \) if \( x^{1/2} = (36)^{0.5} \)
58. Find the value of \( x \) if \( (\sqrt{3})^x = 3^7 \)
59. If $2^{5x} \div 2^x = \sqrt[3]{32}$. Then find the value of $x$.

60. Evaluate $a^{x-y} \cdot a^{y-z} \cdot a^{z-x}$.

61. Simplify $\frac{2}{5} \cdot \frac{2}{5}$.

62. Which of the following rational numbers will have a terminating decimal expansion or a non-terminating repeating (recurring) decimal expansion?

(i) $\frac{135}{50}$  
(ii) $\frac{4}{11}$  
(iii) $\frac{8}{7}$  
(iv) $6\frac{3}{8}$

(v) $\frac{55}{9}$  
(vi) $\frac{5^2 \times 3^3}{2 \times 5^3 \times 27}$  
(vii) $\frac{51}{60}$

63. Classify the following numbers as terminating decimal or non-terminating recurring decimal or non-terminating non-recurring decimal:

(i) 0.1666...  
(ii) 0.250  
(iii) 1.01001000100001....

(iv) 0.27696  
(v) 2.142857142857....  
(vi) $0\overline{3}$

(vii) 0.2359872785...  
(viii) 0.484848848...  
(ix) 2.502500250002.....

(x) 4.123456789

Also classify these given numbers as Rational and Irrational numbers.

64. Classify the following numbers as rational or Irrational number:

(i) $\sqrt{27}$  
(ii) $\sqrt{36}$  
(iii) $\sqrt{5} \times \sqrt{125}$  
(iv) $2\sqrt{3}$

(v) $\frac{7\sqrt{7}}{\sqrt{343}}$  
(vi) $2 + \sqrt{21}$  
(vii) $5 + 2\sqrt{23} - (\sqrt{25} + \sqrt{92})$

(viii) $\frac{22}{7}$  
(ix) $\pi$  
(x) $\frac{3}{27}$

65. Express the following numbers in the form $\frac{p}{q}$, where $p$ and $q$ are integers and $q \neq 0$.

(i) 0.0875  
(ii) 2.123456789  
(iii) 0.181818.....
(iv) $0.4\overline{37}$  (v) $3.6\overline{51}$

66. Do as directed:

(i) Add: $\sqrt{125} + 2\sqrt{27}$ and $-5\sqrt{5} - \sqrt{3}$

(ii) Add: $\sqrt{7} - \sqrt{11}$ and $\sqrt{5} - \sqrt{11} + \sqrt{13}$

(iii) Multiply: $2\sqrt{2}$ by $5\sqrt{2}$.

(iv) Multiply: $(-3 + \sqrt{5})$ by 3.

(v) Divide: $7\sqrt{5}$ by $-14\sqrt{125}$

(vi) Divide: $2\sqrt{216} - 3\sqrt{27}$ by 3.

Part (C)

67. Simplify:

(i) $(2\sqrt{2} + 3\sqrt{3})(2\sqrt{2} - 3\sqrt{3})$

(ii) $(2\sqrt{8} - 3\sqrt{2})^2$

(iii) $(\sqrt{7} + \sqrt{6})^2$

(iv) $(6 - \sqrt{2})(2 + \sqrt{3})$

68. Evaluate:

(i) $\frac{2^{38} + 2^{37} + 2^{36}}{2^{39} + 2^{38} + 2^{37}}$

(ii) $\left[\left(\frac{1}{64}\right)^\frac{1}{6}\right]^2$

69. Find the value of a if $\frac{6}{3\sqrt{2} - 2\sqrt{3}} = 3\sqrt{2} - a\sqrt{3}$.

70. Simplify: $\left[5\left(\sqrt[3]{8} + \sqrt[3]{27}\right)^3\right]^\frac{1}{4}$

71. Simplify: $\frac{(25)^{3/2} \times (243)^{3/6}}{(16)^{5/4} \times (8)^{4/3}}$

72. If $5^{x-1} - (25)^{-1} = 2500$, then find the value of x.

Part (D)

73. Express $0.6 + 0.\overline{7} + 0.4\overline{7}$ in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$. 

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Class IX - Mathematics

19
74. Rationalise the denominator of \( \frac{1}{\sqrt{3} + \sqrt{5} + \sqrt{7}} \)

75. Find \( a \) and \( b \) if \( \frac{7 + 3\sqrt{5}}{2 + \sqrt{5}} - \frac{7 - 3\sqrt{5}}{2 - \sqrt{5}} = a + b\sqrt{5} \)

76. If \( x = (3 - 2\sqrt{2}) \), show that \( \left( \sqrt{x} - \frac{1}{\sqrt{x}} \right) = \pm 2 \)

77. If \( xyz = 1 \), then simplify
\[
\left(1 + x + y^{-1}\right)^{-1} \times \left(1 + y + z^{-1}\right)^{-1} \times \left(1 + z + x^{-1}\right)^{-1}
\]

78. Find the value of \( x \) if

(i) \( 25^{2x-3} = 5^{2x+3} \)

(ii) \( (4)^{2x-1} - (16)^{x-1} = 384 \)

80. Simplify :
\[
\frac{a}{b^a+b^{c-a}} + \frac{1}{1+x^{a-b}+x^{c-b}} + \frac{1}{1+x^{a-c}+x^{b-c}}
\]

81. Simplify :
\[
\left( \frac{x^a}{x^{-b}} \right)^{a-b} \times \left( \frac{x^b}{x^{-c}} \right)^{b-c} \times \left( \frac{x^c}{x^{-a}} \right)^{c-a}
\]

82. Show that :
\[
\frac{1}{(3 - \sqrt{8})} - \frac{1}{(\sqrt{8} - \sqrt{7})} + \frac{1}{(\sqrt{7} - \sqrt{6})} - \frac{1}{(\sqrt{6} - \sqrt{5})} + \frac{1}{(\sqrt{5} - 2)} = 5
\]

83. If \( a = \frac{\sqrt{7} - \sqrt{6}}{\sqrt{7} + \sqrt{6}} \) and \( b = \frac{\sqrt{7} + \sqrt{6}}{\sqrt{7} - \sqrt{6}} \), then find the value of \( a^2 + b^2 + ab \).

84. Simplify :
\[
\frac{2\sqrt{6}}{\sqrt{2} + \sqrt{3}} + \frac{6\sqrt{2}}{\sqrt{6} + \sqrt{3}} - \frac{8\sqrt{3}}{\sqrt{6} + \sqrt{2}}
\]

85. If \( x = 9 - 4\sqrt{5} \), then find

(i) \( x + \frac{1}{x} \)  (ii) \( x - \frac{1}{x} \)  (iii) \( x^2 + \frac{1}{x^2} \)  (iv) \( x^2 - \frac{1}{x^2} \)

(v) \( x^3 + \frac{1}{x^3} \)  (vi) \( x^3 - \frac{1}{x^3} \)  (vii) \( \sqrt{x} + \frac{1}{\sqrt{x}} \)  (viii) \( \sqrt{x} - \frac{1}{\sqrt{x}} \)
(ix) \( x^4 + \frac{1}{x^4} \)  
(x) \( x^6 + \frac{1}{x^8} \)  
(xi) \( x + \frac{14}{x} \)

86. If \( a = 1 + \sqrt{7} \), find the value of \( \frac{-6}{a} \)

87. If \( p = 5 - 2\sqrt{6} \), find \( p^2 + \frac{1}{p^2} \)

88. Express 0.3178 in the form of \( \frac{p}{q} \) where \( p \) and \( q \) are integers and \( q \neq 0 \).

89. If \( \sqrt{2} = 1.414 \), then find the value of \( \sqrt{8} + \sqrt{50} + \sqrt{72} + \sqrt{98} \)

90. Find the value of

\[
\frac{4}{(216)^{\frac{2}{3}}} + \frac{1}{(256)^{\frac{3}{4}}} + \frac{2}{(243)^{\frac{1}{5}}}
\]
CHAPTER-1
NUMBER SYSTEMS
ANSWERS

1. b) 8

2. b) \((16)^{3/2}\)

3. c) 1

4. c) \(\frac{42}{99}, \frac{4}{9}\)

5. c) a rational number

6. c) \(\frac{7}{9}\)

7. d) Both (B) and (C)

8. b) \(-1\)

9. b) 1

10. a) a rational number

11. c) 243

12. c) 5

13. b) \(2 - \sqrt{3}\)

14. c) 1

15. a) \(\sqrt{2}\)
16. c) Every rational number is an integer
17. d) Non-terminating non-recurring
18. c) There are infinitely many rational numbers
19. c) \sqrt{7}
20. c) a real number
21. b) \sqrt[3]{3}
22. c) 19
23. c) \left(\sqrt{9}\right)^{\frac{2}{3}}
24. d) Sometimes rational, sometimes irrational
25. c) 1.5
26. an irrational
27. an irrational
28. Terminating, recurring
29. non-terminating non-recurring
30. an irrational
31. infinitely many
32. infinitely many
33. infinitely many
34. rational
35. False
36. True
37. False
38. False
39. False
40. False
41) \[ \frac{0}{1}, \frac{1}{1}, \frac{2}{1}, \frac{3}{1}, \frac{4}{1} \]

42) \[ \frac{17}{8} = 2.125, \quad \frac{3}{15} = 0.2, \quad \frac{2}{7} = 0.285714, \quad \frac{50}{3} = 16.\overline{6} \]

43) \[ \frac{15}{63}, \frac{16}{63}, \frac{17}{63}, \frac{18}{63}, \quad \text{(other answers are possible).} \]

44) \[ \sqrt{23} = 4.795, \quad \sqrt{24} = 4.898 \]

45) \[ 4.8010010001 \ldots, \quad 4.8020020002 \ldots, \quad \text{(other answers are possible)} \]

46) \[ 2.1, 2.010010001 \ldots, \quad \text{(other answers are possible).} \]

48) \[ 6 \]

50) \[ 4 \]

51) \[ 2016.1010010001 \ldots; \quad 2016.2020020002 \ldots; \quad \text{(other answers are possible)} \]

54) \[ 0.909009000 \ldots; \quad 1.10100100010000 \ldots \quad \text{(other answers are possible)} \]

55) \[ 1 

56) \[ \frac{1}{10^5} \]

57) \[ 36 \]

58) \[ 14 \]

59) \[ x = \frac{1}{4} \]

60) \[ 1 \]

61) \[ (60)^{\frac{1}{5}} \]

62) \[ \begin{array}{ll}
(i) & \text{Terminating Decimal} \\
(ii) & \text{Non Terminating Repeating Decimal} \\
(iii) & \text{Non-Terminating Repeating Decimal} \\
(iv) & \text{Terminating Decimal} \\
(v) & \text{Non-Terminating Repeating Decimal} \\
(vi) & \text{Terminating Decimal} \\
(vii) & \text{Terminating Decimal} \\
\end{array} \]
63) (i) Non-Terminating Repeating Decimal (Rational).
    (ii) Terminating Decimal (Rational).
    (iii) Non-Terminating Non-Repeating Decimal (Irrational).
    (iv) Terminating Decimal (Rational)
    (v) Non-Terminating Repeating Decimal (Rational)
    (vi) Non-Terminating Repeating Decimal (Rational)
    (vii) Non-Terminating Non-Repeating Decimal (Irrational)
    (viii) Non-Terminating Non-Repeating Decimal (Irrational)
    (ix) Non-Terminating Non-Repeating Decimal (Irrational)
    (x) Non-Terminating Repeating Decimal (Rational).

64. (i) Irrational  (ii) Rational  (iii) Rational  (iv) Irrational
    (v) Rational    (vi) Irrational  (vii) Rational  (viii) Rational
    (ix) Irrational (x) Rational

65. (i) \[ \frac{7}{80} \]  (ii) \[ \frac{2123456789}{1000000000} \]  (iii) \[ \frac{2}{11} \]
    (iv) \[ \frac{433}{990} \]  (v) \[ \frac{1643}{450} \]

66. (i) \[ 5\sqrt{3} \]  (ii) \[ \sqrt{5} - 2\sqrt{11} + \sqrt{7} + \sqrt{13} \]  (iii) 20
    (iv) \[ -9 + 3\sqrt{5} \]  (v) \[ -\frac{1}{10} \]  (vi) \[ 4\sqrt{6} - 3\sqrt{3} \]

67. (i) \[ -19 \]  (ii) 2  (iii) \[ 13 + 2\sqrt{42} \]
    (iv) \[ 12 + 6\sqrt{3} - 2\sqrt{2} - \sqrt{6} \]

68. (i) \[ \frac{1}{2} \]  (ii) 2

69. \[ a = -2 \]  70. 5  71. \[ \frac{3375}{512} \]

72. \[ x = 3 \]  73. \[ \frac{167}{90} \]
74. \(\frac{1}{59}(9\sqrt{3} + 5\sqrt{5} + \sqrt{7} - 2\sqrt{105})\)

75. \(a = 0, b = 2\)

77. \(\frac{1}{(1 + y + xy)(1 + z + yz)(1 + x + zx)}\)

78. (i) \(\frac{9}{2}\)  
   (ii) \(\frac{11}{4}\)

79. 4  
80. 1  
81. 1

83. \(a^2 + b^2 + ab = 675\)

84. 0

85. (i) 18  
   (ii) \(-8\sqrt{5}\)  
   (iii) 322  
   (iv) \(-144\sqrt{5}\)  
   (v) 5778  
   (vi) \(-2584\sqrt{5}\)  
   (vii) \(2\sqrt{5}\)  
   (viii) 4  
   (ix) 103682  
   (x) 33385282  
   (xi) \(8\sqrt{3} - 14\sqrt{2}\)

86. 1-\(\sqrt{7}\)  
87. 98  
88. \(\frac{635}{1998}\)

89. 28.28  
90. 214
Practice Test

NUMBER SYSTEMS

Time : 50 Min.

1. If \( \frac{4}{a} = \frac{a^2}{16} \), then check whether \( a \) is rational or irrational number. (1)

2. Find two irrational numbers between \( \sqrt{2} \) and \( \sqrt{3} \). (1)

3. Simplify:
\[
4\sqrt{3} + 3\sqrt{48} - \frac{5}{2}\sqrt{\frac{4}{3}}
\] (2)

4. If \( \sqrt{3} = 1.732 \), find the value of \( \frac{2}{\sqrt{3} - 1} \). (2)

5. Find the value of \( x \) and \( y \)
\[
\frac{\sqrt{11} - \sqrt{7}}{\sqrt{11} + \sqrt{7}} = a - b\sqrt{77}
\] (3)

6. Represent \( 2 + \sqrt{3} \) on the number line. (3)

7. Simplify:
\[
\frac{16 \times 2^{a+1} - 4 \times 2^{a}}{16 \times 2^{a+2} - 2 \times 2^{a+2}}
\] (4)

8. Express the following in the form \( \frac{p}{q} \) where \( p \) and \( q \) are integers and \( q \neq 0 \)
\( 0.\overline{4} + 0.1\overline{8} \) (4)
CHAPTER-2
POLYNOMIALS
MIND MAP

Monomial
Binomial
Trinomial
Polynomial

On the basis of terms

Linear
Quadratic
Cubic
Biquadratic

On the basis of degrees

Types of Polynomial

Coefficients
Terms
Definition

Zeroes

Remainder Theorm

Factor Theorm

Identities
CHAPTER-2
POLYNOMIALS

KEY POINTS

1. A Polynomial \( p(x) \) in one variable \( x \) is an algebraic expression in \( x \) of the form \( p(x) = a_n x^n + a_{n-1} x^{n-1} + a_{n-2} x^{n-2} + \ldots + a_2 x^2 + a_1 x + a_0 \), where
   (i) \( a_0, a_1, a_2 \ldots a_n \) are constants and \( a_n \neq 0 \)
   (ii) \( a_0, a_1, a_2 \ldots a_n \) are respectively the coefficients of \( x^0, x^1, x^2, \ldots, x^n \)
   (iii) Each of \( a_n x^n, a_{n-1} x^{n-1}, a_{n-2} x^{n-2}, \ldots, a_2 x^2, a_1 x, a \) are called terms of the polynomial.
   (iv) \( n \) is called the degree of the polynomial where \( n \) is a non-negative integer.

2. **Degree of the Polynomial**: Highest power of \( x \) in the algebraic expression is called the degree of the polynomial.

3. **Different types of polynomials**:
   Generally, we divide the polynomials in the following categories:
   (i) **Based on degrees**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Polynomial</th>
<th>General form</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 1</td>
<td>Linear</td>
<td>( ax + b, )</td>
<td>( x + 1, 2x \text{ etc.} )</td>
</tr>
<tr>
<td>(b) 2</td>
<td>Quadratic</td>
<td>( ax^2 + bx + c, )</td>
<td>( 4x^2 + 5x + \frac{2}{3} \text{ etc.} )</td>
</tr>
<tr>
<td>(c) 3</td>
<td>Cubic</td>
<td>( ax^3 + bx^2 + cx + d, )</td>
<td>( x^3 - 3x^2 + 5 \text{ etc.} )</td>
</tr>
<tr>
<td>(d) 4</td>
<td>Biquadratic</td>
<td>( ax^4 + bx^3 + cx^2 + dx + e, )</td>
<td>( x^4 - 16 \text{ etc.} )</td>
</tr>
</tbody>
</table>

   \( a, b, c, d, e \) are real constants and \( a \neq 0 \).

   **Note**: A polynomial of degree five or more than five does not have any particular name. Such a polynomial is usually called a polynomial of degree five or six or ... etc.

(ii) **Based on Number of Terms**:

<table>
<thead>
<tr>
<th>No. of Terms</th>
<th>Polynomial</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 1</td>
<td>Monomial</td>
<td>( 5, \frac{1}{3} x, \frac{1}{3} y \text{ etc.} )</td>
</tr>
<tr>
<td>(b) 2</td>
<td>Binomial</td>
<td>( \sqrt{3} + 6x, x - 5y, x^2 + 2 \text{ etc.} )</td>
</tr>
<tr>
<td>(c) 3</td>
<td>Trinomial</td>
<td>( \sqrt{2} x^2 + 4x + 2, 5y^4 + 2y + 6 \text{ etc.} )</td>
</tr>
</tbody>
</table>
Note: A polynomial having four or more than four terms does not have particular name. These are simply called polynomials.

(iii) Zero degree polynomial or non-zero constant polynomial.
Any non-zero number (constant) is regarded as polynomial of degree zero or zero degree polynomial. i.e., \( p(x) = a \) where \( a \neq 0 \) is a zero degree polynomial, since we can write \( p(x) = a \),
as
\[
p(x) = ax^0
\]
e.g.,
\[
5 = 5x^0, \quad \frac{\sqrt{7}}{2} = \frac{\sqrt{7}}{2} x^0
\]

(iv) Zero Polynomial: A polynomial whose all coefficients are zero is called as zero polynomial i.e., \( p(x) = 0 \). The degree of zero polynomial is not defined or we can not determine the degree of zero polynomial.

4. For a polynomial \( p(x) \) if \( p(a) = 0 \) where \( a \) is a real number we say that 'a' is a zero of the polynomial.

5. If \( p(x) \) is any polynomial of degree greater than or equal to 1 and \( p(x) \) is divided by a linear polynomial \( x - a \), then the remainder is \( p(a) \). This is called remainder theorem.

6. If \( p(x) \) is a polynomial of degree \( \geq 1 \) and 'a' is any real number then
   (i) \( x - a \) is a factor of \( p(x) \), if \( p(a) = 0 \) and
   (ii) \( p(a) = 0 \) if \( x - a \) is a factor of \( p(x) \).
   This is called factor theorem.

7. A polynomial of degree 'n' can have at most n zeroes.

   • Some algebraic identities :-
     (i) \( (x+y)^2 = x^2 + 2xy + y^2 \)
     (ii) \( (x-y)^2 = x^2 - 2xy + y^2 \)
     (iii) \( x^2 - y^2 = (x+y)(x-y) \)
     (iv) \( (x+a)(x+b) = x^2 + (a+b)x + ab \)
     (v) \( (x+y+z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx \)
(vi) \((x+y)^3 = x^3 + y^3 + 3xy (x+y) = x^3 + y^3 + 3xy^2\)

(vii) \((x-y)^3 = x^3 - y^3 - 3xy (x-y) = x^3 - y^3 - 3x^2y + 3xy^2\)

(viii) \(x^3 + y^3 = (x+y)(x^2 - xy + y^2)\)

(ix) \(x^2-y^2 = (x-y)(x^2 + xy + y^2)\)

(x) \(x^3 + y^3 + z^3 - 3xyz = (x+y+z)(x^2+y^2+z^2-xy-yz-zx)\)

\[= \frac{1}{2} (x+y+z) \left\{ (x-y)^2 + (y-z)^2 + (z-x)^2 \right\} \]

(xi) If \(x+y+z = 0\), then \(x^3 + y^3 + z^3 = 3xyz\)
POLYNOMIALS

1. Find \( ax^n + bx^q + c \) to be polynomial p & q are :
   a) Rational Numbers
   b) Natural Numbers
   c) Real Numbers
   d) Whole Numbers

2. Which of the following is/are polynomial(s) :
   a) \( \sqrt{7}x + 5 \)
   b) \( \sqrt{7}x + 5 \)
   c) \( \frac{\sqrt{7}x + 5}{\sqrt{7}x - 5} \)
   d) \( \frac{5x^{5/2} + 3x^{3/2}}{x} \)

3. Choose the correct option for a polynomial :
   i) \( 3x+2 \)
   ii) \( 7x+1 = 0 \)
   iii) \( 5x^4 + 3x^2 + 1 = 0 \)
   iv) \( x^3 + 3x^2 + 1 \)
   a) i) & ii)
   b) i) & iii)
   c) ii) & iv)
   d) i) & iv)

4. The terms of the polynomial \( x^3 - 4x^2 - 3x + 2 \) are :
   a) 1, -4, -3, 2
   b) \( x^3 - 4x^2 - 3x + 2 \)
   c) \( +x^3, -4x^2, -3x, 2 \)
   d) \( x^3, 4x^2, 3x, 2 \)

5. Coefficient of \( x^2 \) in \((x^2-1)(x-2)\) is :
   a) 2
   b) -2
   c) -1
   d) +1

6. The degree of the polynomial \( \sqrt{5} \) is :
   a) \( \frac{1}{2} \)
   b) 0
   c) 1
   d) -1

7. If \( \deg(f(x)) = 5 \) & \( \deg(g(x)) = 4 \) then \( \deg[f(x) - g(x)] \) is.
   a) 5
   b) 4
   c) 1
   d) 9

8. Degree of cubic polynomial with two terms is –
   a) 0
   b) 1
   c) 2
   d) 3
9. Degree of zero polynomial is:
   a) 0  
   b) 1  
   c) 2  
   d) Not defined

10. Degree of non zero constant polynomial is –
   a) 0  
   b) 1  
   c) −1  
   d) Not defined

11. The zero (s) of the polynomial \(x^2−8\) is (are) –
   a) 8  
   b) \(2\sqrt{2}\)  
   c) \(2\sqrt{2}, -2\sqrt{2}\)  
   d) \(\sqrt{8}\)

12. The zero (s) of the polynomial \(z^2−2z\) is (are) –
   a) 0  
   b) 2z  
   c) 2  
   d) 0, 2

13. If \((px+q)\) is a factor of the polynomial \(h(x)\) then which one is true:
   a) \(h\left(\frac{-p}{q}\right) = 0\)  
   b) \(h\left(\frac{p}{q}\right) = 0\)  
   c) \(h\left(\frac{q}{p}\right) = 0\)  
   d) \(h\left(\frac{-q}{p}\right) = 0\)

14. Let \(h(x)\) be a polynomial such that \(h\left(-\frac{1}{3}\right) = 0\), then one of the factors of \(h(x)\) is –
   a) \(3x−1\)  
   b) \(3x+1\)  
   c) \(x−3\)  
   d) \(x+3\)

15. If \(y+2m\) is a factor of \(y^5 − 4m^2y^3 + 2y + 2m + 3\) then value of \(m\) is –
   a) \(\frac{2}{3}\)  
   b) \(\frac{3}{2}\)  
   c) 1  
   d) \(-\frac{3}{2}\)

16. If \(\left(\frac{1}{16}p^2−q\right) = \left(\frac{1}{4}p−11\right)\left(\frac{1}{4}p+11\right)\) then \(q\) is –
   a) 11  
   b) 1  
   c) 121  
   d) \(\frac{11}{4}\)
17. If $3x = a + b + c$ then $(x-a)^3 + (x-b)^3 + (x-c)^3 -3(x-a)(x-b)(x-c)$ is
   a) $a+b+c$                  b) 0
   c) 1                          d) $3(x-a)(x-b)(x-c)$

18. If $p + q + r = 9$ then $(3-p)^3 + (3-q)^3 + (3-r)^3$ is :–
   a) $3(3-p)(3-q)(3-r)$                  b) 0
   c) 1                          d) $-3(3-p)(3-q)(3-r)$

19. If $(x-1)(x-2)(x+c) = x^3 + ax^2 + bc + 5 \times 2 \times 1$ then $c$ will be
   a) 1                  b) 2
   c) 5                          d) $-5$

20. If $(x+2)(x-5) = x^2 + (a + b) x + a \times b$ then value of $(a+b)$ is
   a) 3                  b) $-3$
   c) 7                          d) $-10$

**Fill in the blanks:**–

21. $49^3-30^3+ (.........)^3 = 3 \times 49 \times 30 \times 19$

22. The polynomial containing two non zero terms is called .........

23. The polynomial containing exactly two non zero, zeroes has .........
   degree ...........

24. If $l(x) = 4x+1$ then $l(-6) - l(-5)$ is ...........

25. If $p(x) = x^3 - 2x^2 + x + 1$ then $p(0) \times p(-1) =$ .................

26. If $q(x) = x^2 - 3x + 2$ then $p(1) + p(-1) - p(0)$ is ...........

27. If side of a square is $(x+2y-z)$ units then area of the square is .........

28. If $x^2 + mx - 30 = (x-5)(x+6)$ then $m$ is ...........

29. A quadratic polynomial can be written as the product of ............ linear polynomials.

30. If the factors of $5x^2 - 18x + 9$ are $(ax+b)$, $(x+b)$ then the values of $a$ & $b$
   are ............. & ............. respectively.

31. In the polynomial $x^3 - 5x$, the expressions $x^4$ & $-5x$ are called ........... of
   the polynomial
32. When a polynomial $q(x)$ is divided by $(x-2)$ & the remainder $q(2) = 0$ then $(x-2)$ is a ............... of the polynomial.

33. Write True or False:

i) Every polynomial is also an equation.

ii) Every polynomial is binomial.

iii) A binomial may have degree 5.

iv) If 2 is a zero of a polynomial $q(x)$ then 2 is also a zero of $2\times q(x)$.

v) If $(x-a)$ is a factor of polynomial $p(x)$ then $a$ is a zero of $a\times p(x)$.

vi) $x=3$ is a zero of the polynomial $x^3-3x+x-3$.

vii) 2, 1 and $-1$ all are zeroes of $x^2-x-2$.

viii) $(x+1)$ is a factor of $x^n+1$ only if n is odd positive integer.

ix) When $(p^2-p-29)$ is divided by $(p-6)$ the remainder is 1.

x) The remainder theorem is true only when the divisor of the polynomial is linear polynomial.

34. Column I                                      Column II

i) Degree of the polynomial                       a) $(100-3)^2$
   $0.x^4 + 4x^3 - 2x + 3$

ii) Factors of $(x+y)^2-(x^2+y^2)$                  b) 0

iii) $97^2$ can be solved as                        c) 3

iv) Zero (s) of $(x-2)^2-(x+2)^2$                  d) 3, x, y, (x+y)

35. Column I                                      Column II

i) $103 \times 103$                                 a) 0

ii) If $\frac{x}{y} + \frac{y}{x} = 2$ then value of  b) 1
    $(x-y)^2$ is

iii) Number of zeros of $px + q$                   c) $-1$

iv) the value of $K$ when $(-x^{140} - 2x^{151} + K)$  d) $(100+3)^3$
    is divided by $(x+1)$
36. Check whether \( q(x) \) is a multiple of \( r(x) \) or not. 
Where \( q(x) = 2x^3 - 11x^2 - 4x + 5 \), \( r(x) = 2x + 1 \)
37. Show that \((x-5)\) is a factor of \( x^3 - 3x^2 - 4x - 30 \).
38. Evaluate by using suitable identity : \((997)^3\)
39. Find the zeroes of the polynomial \( p(x) = x (x-2) (x+3) \)
40. Find the quotient when \( 3x^2 - 7x - 6 \) is divided by \( (x-3) \)
41. Factories \( 8x^2 + \sqrt{27} y^3 \).
42. If \( p(x) = x + 9 \), then find \( p(x) + p(-x) \)
43. Find the product without multiplying directly \( 106 \times 94 \).
44. Expand using suitable identity \((2x-3y+z)^2\)
45. Find the value of \((351)^2 - (350)^2\).

**PART (C)**

46. Factories : \( 64a^2 + 96ab + 36b^2 \)
47. Factories : \( x^2 + 6x^2 + 11x + 6 \)
48. If \( x^2 + y^2 = 49 \) and \( x - y = 3 \), then find the value of \( x^3 - y^3 \).
49. Simplify : \( (5a-2b) (25a^2 + 10ab + 4b^2) - (2a + 5b)(4a^2 - 10ab + 25b^2) \)
50. Find the sum of remainders when \( x^3 - 3x^2 + 4x - 4 \) is divided by \( (x-1) \) and \( (x+2) \).
51. Find the product \( \left( p - \frac{1}{p} \right) \left( p + \frac{1}{p} \right) \left( p^2 + \frac{1}{p^2} \right) \left( p^4 + \frac{1}{p^4} \right) \)
52. Factories : \( 7\sqrt{2} k^2 - 10k - 4\sqrt{2} \).
53. Simplify : \((3x-4y)^3 - (3x+4y)^3\)
54. Use appropriate identity, expand \((2a)^3 + b^3 + (3c)^3 - 18abc\).
55. Simplify : \((x+y+z)^2 - (x-y-z)^2\).
56. Factories : \( 125x^2 + 8y^2 + z^2 - 30xyz \).
57. \( x+2 \) is a factor of polynomial \( ax^3 + bx^2 + x - 2 \) and the remainder 4 is obtained on dividing this polynomial by \( (x-2) \). Find the value of \( a \) and \( b \).
58. If the polynomial \( ax^3 + 4x^2 + 3x-4 \ & x^3 - 4x + a \) leave the same remainder when divided by \( (x-3) \). Find \( a \)
59. If \( \left( \frac{9}{10} \right)^3 - \left( \frac{2}{5} \right)^3 - \left( \frac{1}{2} \right)^3 = \frac{x}{50} \), find \( x \)
60. If \((x-3)\) and \(x - \frac{1}{3}\) are factors of the polynomial \(px^2 + 3x + r\), show that \(p = r\).

61. i) Using identity, find the value of \((-7)^3 + (5)^3 + (2)^3\).
   ii) Find dimensions of cube whose volume is given by the expression \(4x^2 + 14x + 6\).

62. Give possible expression for the length and breadth of each of the following rectangles if.
   i) Area = \((x^2 + 5\sqrt{5}x + 30)\) sq. unit.
   ii) Area = \((24x^2 - 26x - 8)\) sq. unit.

63. A literacy campaign was organised by Class IX girl students under NSS. Students made \((x-5)\) rows and \((3x-4)\) columns for the rally. Write the total number of students in the form of a polynomial.

64. Under tree plantation programme students of Class IX planted total \((3x^2 - 4x - 4)\) trees in school.
   If total number of students is the class are \((x - 2)\) then find out number of trees planted by each students. (Assuming each student planted equal number of trees).

65. If \(a + b + c = 0\), find the value of
\[
\frac{(b+c)^2}{bc} + \frac{(c+a)^2}{ca} + \frac{(a+b)^2}{ab}
\]

66. Simplify:
\[
\frac{(a^2-b^2)^3 + (b^2-c^2)^3 + (c^2-a^2)^3}{(a-b)^3 + (b-c)^3 + (c-a)^3}
\]

67. Factories:
\(2a-b-c)^3 + (2b-c-a)^3 + (2c-a-b)^3\)

68. If the polynomial \(4x^2 - 16x + ax + 7\) is exactly divisible by \(x - 1\), then find the value of \(a\). Hence factorise the polynomial.

69. If \(p, q, \) and \(r\) are all non zero and \(p+q+r = 0\), prove that
\[
\frac{p^2}{qr} + \frac{q^2}{rp} + \frac{r^2}{pq} = 3
\]

70. Factories: \(9x^3 - 27x^2 - 100x + 300\)
71. If \((x+4)\) is a factor of the polynomial \(x^3 - x^2 - 14x + 24\), find the other factors.

72. If \(\frac{x}{y} + \frac{y}{x} = -1\) where \(x \neq 0, y \neq 0\) then find the value of \(x^3 - y^3\).

73. Simplify: \[
\frac{155 \times 155 + 155 \times 55 + 55 \times 55}{155 \times 155 \times 155 - 55 \times 55 \times 55}
\]
CHAPTER-2
POLYNOMIALS
ANSWERS

1. d) Whole Number
2. b) \( \sqrt{7} x + 5 \)
3. d) (i) & (iv)
4. c) \( x^3, -4x^2, -3x, 2 \)
5. b) \(-2\)
6. b) 0
7. a) 5
8. d) 3
9. d) Not defined
10. a) 0
11. c) \( \pm 2\sqrt{2} \)
12. d) 0, 2
13. \( h\left(\frac{-q}{p}\right) = 0 \)
14. b) \( 3x + 1 \)
15. b) \( 3/2 \)
16. c) 121
17. b) 0
18. a) \( 3(3-p) (3-q) (3-r) \)
19. c) 5
20. b) \(-3\)
21. 19
22. Binomial
23. 2
23. 2
24. −4
25. −5
26. 4
27. \((x + 2y - z)^2 = x^2 + 4y^2 + z^2 + 4xy - 4yz - 2xz\)
28. 1
29. Two
30. 5 and 3
31. Terms
32. Factor
33. i) False
   ii) False
   iii) True
   iv) True
   v) True
   vi) False
   vii) False
   viii) True
   ix) True
   x) True
34. i) c
   ii) d
   iii) a
   iv) b
35. i) d
   ii) a
   iii) b
   iv) c
36. 110
37. Hint Put $x = 5$
38. $991026973$
39. $0, 2, -3$
40. $(3x+2)$
41. $(2x + \sqrt{3}y) (4x^2 - 2\sqrt{3}xy + 3y^2)$
42. $18$
43. Hint: $(100+6)(100-6) = 9964$
44. $4x^2 + 9y^2 + z^2 - 12xy - 6yz + 4xz$
45. $701$
46. $(8a + 6b)^2$
47. $(x+1)(x+2)(x+3)$
48. $207$
49. $117a^3 - 133b^3$
50. $-34$

51. $p^8 - \frac{1}{p^8}$

52. $(K - \sqrt{2})(7\sqrt{2}K + 4)$
53. $-8y(16y^2 + 27x^3)$ or $-128y^3 - 216x^3y$
54. $-$
55. $4xy + 4zx$
56. $(5x + 2y + z) (25y^2 + 4y^2 + z^2 - 10xy - 2yz - 5zx)$
57. $a = 0, b = 2$
58. $a = -1$ Hint $p(3) = q (3)$
59. $x = 27$ (Use $a+b+c = 0, a^3 + b^3 + c^3 = 3abc$)
60. $-$
61. i) $-210$
   ii) $2 ; (x + 3) ; (2x + 1)$
62. i) \((x + 2\sqrt{5})(x + 3\sqrt{5})\)  
   ii) \((4x + 1), (6x - 8)\)
63. \(3x^2 - 19x + 20\)
64. \((3x + 2)\)
65. \(3\)
66. \((a+b)(b+c)(c+b)\)
67. \(3(2a-b-c)(2b-c-a)(2c-a-b)\)
68. \(a = 5, (x-1)(2x+1)(2x-7)\)
70. \((3x+10)(x-3) (3x-10)\)
71. \((x-3)(x-2)\)
72. \(0\)
73. \(0.01\)
1. Is \((x^2)^\frac{1}{2} + 2\sqrt{5}\) a polynomial? (1)

2. Show that \(x = 1\) is a zero of the polynomial \(3x^3 - 4x^2 + 8x - 7\). (1)

3. Find the zeroes of the polynomial \(x^2 - 4x + 3\) (2)

4. If \(x + y + z = 6, xy + yz + zx = 11\). Find the value of \(x^2 + y^2 + z^2\). (2)

5. If \(3x - 4\) is a factor of the polynomial \(p(x) = 2x^3 - 11x^2 + kx - 20\), find the value of \(k\) (3)

6. Factorise: \(a^2 + b^2 + 2(ab + bc + ca)\) (3)

7. If \(a + b + c = 0\), then find the value of \(\frac{a^2}{bc} + \frac{b^2}{ca} + \frac{c^2}{ab}\) (4)

8. Factorise \(x^3 - 23x^2 + 142x - 120\) by using factor theorem. (4)
Coordinate Axes: The position of a point in a plane is determined with reference to two fixed mutually perpendicular lines, called coordinate axes.

The horizontal line xox' is called x-axis.
The vertical line yoy' is called y-axis.
The intersection point of these two lines is called origin. It is represented by O.

Coordinates: Location of a point P in cartesian system, written in the form of ordered pair say P(a, b) as shown in figure above.

a is the length of perpendicular of P (a, b) from y-axis and is called abscissa of P.
• b is the length of perpendicular of P (a, b) from x-axis and is called ordinate of P.
• Location of a point P(a, b) on graph with sign convention – where a and b are such that –

<table>
<thead>
<tr>
<th>Value of Point</th>
<th>Sign of Point</th>
<th>Location of Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) a = 0, b = 0</td>
<td>–</td>
<td>origin</td>
</tr>
<tr>
<td>ii) a &gt; 0, b &gt; 0</td>
<td>(+, +)</td>
<td>IInd Quadrant</td>
</tr>
<tr>
<td>iii) a &lt; 0, b &gt; 0</td>
<td>(−, +)</td>
<td>IInd Quadrant</td>
</tr>
<tr>
<td>iv) a &lt; 0, b &lt; 0</td>
<td>(−, −)</td>
<td>IInd Quadrant</td>
</tr>
<tr>
<td>v) a &gt; 0, b &lt; 0</td>
<td>(+, −)</td>
<td>IVth Quadrant</td>
</tr>
</tbody>
</table>

Note: If a point lie on x-axis or y-axis it does not lie in any quadrant.

• Coordinates of a point on x-axis are of the form (x, 0)
• Coordinates of a point on y-axis are of the form (0, y)
PART (A)

1. The abscissa of a point is the distance of the point from
   a) x-axis                    b) y-axis
   c) origin                   d) None of these

2. The y-coordinate of a point is the distance of that point from
   a) x-axis                    b) y-axis
   c) origin                   d) None of these

3. If both the coordinates of a point are negative then that point will lie in
   a) First quadrant           b) Second quadrant
   c) Third quadrant           d) Fourth quadrant

4. If abscissa of a point is zero then that point will lie
   a) on x-axis                 b) on y-axis
   c) at origin                 d) in 1st quadrant

5. If x>0 and y<0, then the point (x, −y) lies in ____________.
   a) I quadrant                b) II quadrant
   c) III quadrant              d) IV quadrant

6. Point (a, 0) lies
   a) on x-axis                 b) on y-axis
   c) in third quadrant         d) in fourth quadrant

7. Signs of abscissa and ordinate of a point in the fourth quadrant are respectively.
   a) +, +                       b) −, −
   c) −, +                       d) +, −

8. Ordinate of a point is positive is
   a) I and IV quadrants        b) I quadrant only
   b) I and II quadrants        d) I and III quadrants

9. The point which lies on y-axis at a distance of 10 units in the negative direction of y-axis is
   a) (10, 0)                    b) (0, 10)
   c) (−10, 0)                   d) (0, −10)
10. The point whose abscissa and ordinate have different signs will lie in
   a) I and II quadrants  b) I and III quadrants
   b) II and III quadrants  d) II and IV quadrant

11. Which of the point P(0, 3), Q(1, 0), R(0, –1), S(–5, 0), T(1, 2) do not lie
    one x-axis?
   a) P and R only  b) Q and S only
   c) P, R and T  d) Q, S and T

12. If the coordinates of the points are P(–2, 3), and Q (–3, 5), then
    (abscissa of P) – (abscissa of Q)
   a) –5  b) 1
   c) –1  d) –2

13. Point (1, 1), (1, –1), (–1, 1), (–1, –1)
   a) lie in I quadrant  b) lie in III quadrant
   c) lie in I and III quadrants  d) do not lie in the same quadrant

14. The point of intersection of the coordinate axes is
   a) Abscissa  b) Ordinate
   c) Quadrant  d) Origin

15. The abscissa and ordinate of the origin are
   a) 1, 0  b) 1, 1
   c) 0, 1  d) 0, 0

16. The measure of the angle between the coordinate axes is
   a) 0°  b) 90°
   c) 180°  d) 270°

17. The perpendicular distance of the point p(–4, –3) from x-axis is
   a) –4  b) –3
   c) 4  d) 3

18. The perpendicular distance of the point p(–7, 2) from y-axis is
   a) –7  b) 7
   c) 2  d) None of these
19. The distance of the point \(p(3, 4)\) from the origin is
   a) 3  
   b) 4  
   c) 7  
   d) 5

20. Which of the points \(A(-5, 0), B(0, -3), C(3, 0), D(0, 4)\) are closer to the origin?
   a) A  
   b) B  
   c) D  
   d) Points B and C both

**Fill in the blanks:**

21. The coordinate axes divide the plane into four parts which are called ____________.

22. If the coordinates of a point are \((-2, 5)\), then its ordinate is ___________ and its abscissa is ___________.

23. The point \((200, -111)\) lies in the ____________ quadrant.

24. The abscissa of any point on the y-axis is ___________.

25. The ordinate of any point on the x-axis is ___________.

26. The points \((0, 0), (0, 4), \) and \((4, 0)\) form a/an ___________ triangle.

27. If \((x, y)\) represents a point and \(xy > 0\), then the point may lie in ___________ or ___________ quadrant.

28. The points with coordinates \((3, -1)\) and \((-1, 3)\) are at ___________ (same/different) positions of the coordinate plane.

29. If the ordinate of point is 7 and abscissa is -5, then its coordinates are ___________.

30. The point whose abscissa is 5 and which lie on \(x\)-axis is ___________.

State which of the statements are true & which are false.

31. \(x\)-coordinate of a point is its distance from the \(x\)-axis.

32. The co-ordinates of a point describe the point in the place uniquely.

33. The points with coordinates \((3, 4)\) and \((4, 3)\) are at same position of the plane.

34. \(Y\)-coordinate of a point is also called abscissa.
35. The coordinates of a point, which lies on negative x-axis at a distance of 6 units from y-axis, are (-6, 0).

36. In which quadrant do the given points lie.
   i) (3, -2)   ii) (17, -30)   iii) (-2, 5)
   iv) (-50, -20)   v) (10, 100)   iv) (-81, 80)

37. On which axis do the given points lie:
   i) (11, 0)   ii) (-11, 0)   ii) (0, 14)
   iv) (0, -100)

38. The abscissa and ordinate of a point A are -3 and -5 respectively then write down the coordinate of A.

39. Is P(7, 0) and Q (0, 7) represent the same point?

40. In which quadrant x coordinate is negative?

41. Name the figure formed when we plot the points (0, 0), (4, 4) and (0, 4) on a graph paper.

42. In which quadrant, does the point A (x, y) with values x>0 and y>0 exists.

43. Write the coordinates os the fourth vertex of a square when three of its vertices are given by (1, 2) (5, 2) (5, -2).

44. If abscissa of point A is positive & ordinate is negative then in which quadrant do A lie?

45. Write the coordinates of a point whose perpendicular distance from x-axis is 5 units & perpendicular distance from y-axis is 3 & it lies in II quadrant.

46. Draw the Cartesian plane on a graph paper and plot the given points.
   i) A(3, 5)   ii) B(-7/2, 0)   ii) C(2,-6)
   iii) D(-6, -4)   v) E(0, -5/2)   vi) F(8, 0)
47. Write the coordinates of each of points in the given figure.

\[ A, B, C, P, Q, R \]

48. Point P (4, 3) is in the first quadrant. Find the coordinate of the point Q, opposite to P in fourth quadrant.

49. Find the distance of point (8, 3) from x axis & y axis.

50. Write the name of the figure formed by joining the points A (−3, 0), B (0, 3) and C (3, 0) in the cartesian plane.

51. Write the coordinates of the point that lies on y-axis and is at a distance of 2 units in upward direction.

52. If the mirror image of a point \((x, y)\) about x-axis is \((x, −y)\) then write the mirror image of the point S (−5, 7) about x-axis is ________.
53. Find the distance of the point P (4, 2) from origin.

54. Write the mirror image of (4, −3) about y-axis.

PART – C

55. Draw a line segment on a graph paper whose end points lies in first quadrant and third quadrant. Write the coordinates of its end points and mid point of line segment.

56. Plot the points A (2, 4) & B (2, −5) whose x-coordinates are same. Is this line AB parallel to any of the axes. If yes, to which axis is it parallel?

57. Plot the points P (2, −3) & Q (−5, −3) whose ordinates are same. To which axis the line P Q is parallel?

58. Plot the points A (7, 6) & B (7, −6) on graph paper. Join them & answer the following:
   (i) Write the coordinate of the point where line AB cuts the x-axis?
   (ii) To which axis, line AB is parallel?

59. Draw a triangle ABC on graph paper having the coordinates of its vertices as A (−2, 0), B (4, 0) and C (1, 5). Also find the area of triangle.

60. If we plot the points P(5, 0), Q (5, 5), R(−5, 5) and S (−5, 0), which figure will we get? Name the axis of symmetry of this figure?

61. Find the coordinates of a point which is equidistant from the two points (−4, 0) and (4, 0). How many of such points are possible satisfying the condition?

62. Draw a quadrilateral with vertices A (4, 3), B(−4, 3), C(−4, −3) and D(4, −3). Draw its diagonals and write the coordinates of the point where the diagonals cut each other?

63. A rectangular field is of length 10 units & breadth 8 units. One of its vertex lie on the origin. The longer side is along x-axis and one of its vertices lie in first quadrant. Find all the vertices.

64. Plot the point B (5, 3), E(5, 1), S(0, 1) and T(0, 3) and answer the following:
   i) Join the points and name the figure obtained.
   ii) Find the area of figure.
CHAPTER-3
COORDINATE GEOMETRY
ANSWERS

1. b) y-axis
2. a) x-axis
3. c) third quadrant
4. b) on y-axis
5. a) I quadrant
6. a) on x-axis
7. d) +, −
8. c) I and II quadrants
9. d) (0, −10)
10. d) II and IV quadrants
11. c) P, R and T
12. b) 1
13. d) do not lie in the same quadrant
14. d) Origin
15. d) (0, 0)
16. b) 90°
17. d) 3
18. b) 7
19. d) 5
20. d) Points B and C both quadrants
21. quadrants
22. 5, −2
23. IV
24. 0
25. 0
26. right angled isosceles
27. I, III
28. different
29. (−5, 7)
30. (5, 0)
31. False
32. True
33. False
34. False
35. True
36. i) IV quadrant
   ii) IV quadrant
   iii) II quadrant
   vi) III quadrant
37. i) x-axis
   ii) x-axis
   iii) y-axis
38. (−3, −5)
39. No
40. II and III quadrant
41. Right angled Triangle

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42. Ist Quadrant
43. (1, –2)
44. IV
45. (–3, 5)
47. A(3, –7), B(–3, –3)  
    C(4, 9), P(6, 0)  
    Q(–10, 7), R(9, –4)
48. (4, –3)
49. 3 units, 8 units
50. Triangle or isosceles  
    Triangles
51. (0, 2)
52. (–5, –7)
53. \(\sqrt{20}\) units
54. (–4, –3)
56. Yes, y-axis
57. x-axis
58. i) (7, 0)  
    ii) Parallel to y-axis
59. 15 square units
60. Rectangle, y-axis
61. Any point on y-axis, infinite
62. At origin (0, 0)
63. (0, 0), (10, 0), (10, 8), (0, 8)
64. i) Rectangle  
    ii) 10 sq. units
Practice Test

COORDINATE GEOMETRY

Time: 50 Min.

1. In which quadrant, the point \((x, y)\) will lie? (Where \(x\) is a positive and \(y\) is a negative number). (1)

2. Write the \(y\)-coordinate of a point which lies on \(x\)-axis. (1)

3. Find the value of \(x\) and \(y\) if:
   
   (a) \((x - 4, 7) = (4, 7)\)
   
   (b) \((1, 2y - 3) = (1, 7)\)

4. What is the distance of a point \((7, 6)\) from \(x\)-axis and \(y\)-axis? (2)

5. Plot the following points in a Cartesian plane. (3)
   
   \((-3, 5), (-2, 0), (-4, 0)\)

6. Write the equations of lines \(l\) and \(m\) as shown in the figure. (3)
   
   Also name the line which is represented by \(x = 0\).

7. Plot the points \(O(0, 0), A(4, 0)\) and \(C(0, 6)\). Find the coordinates of the fourth point \(B\) such that \(OABC\) forms a rectangle. (4)

8. The base \(AB\) of two equilateral triangles \(ABC\) and \(ABD\) with side \(2a\), lies along the \(x\)-axis such that the mid point of \(AB\) is at the origin. Find the coordinates of two vertices \(C\) and \(D\) of the triangles. (4)
CHAPTER-4
Linear Equations In Two Variables

MIND MAP

Linear Equations

Equations of the form $ax + by + c = 0$

$x, y$ are variables
$a, b, c$ are constants

Solution

Two

One

Graphical Representation

Initial

Title

Section

Page

Total Pages

Book Title

Publisher
CHAPTER-4
LINEAR EQUATIONS IN TWO VARIABLES
KEY POINTS

- **Linear equation in one variable** – An equation which can be put in the form \( ax + b = 0 \), \( a \neq 0 \) and \( a, b \) are real numbers is called a linear equation in one variable.

- **Linear equation in two variables** – Any equation which can be put in the form \( ax + by + c = 0 \), where \( a, b, \) and \( c \) are real numbers and \( a, b \neq 0 \), is called a linear equation in two variables.

Linear equation in one variable has a unique solution

\[ ax + b = 0 \quad \Rightarrow \quad x = -\frac{b}{a} \]

- Linear equation in two variables has infinitely many solutions.
- The graph of every linear equation in two variables is a straight line.
- Every point on the line satisfies the equation of the line.
- Every solution of the equation is a point on the line. Thus, a linear equation in two variables is represented geometrically by a line whose points make up the collection of solutions of the equation.

Graph:

* The pair of values of \( x \) and \( y \) which satisfies the given equation is called solution of the linear equation in two variables.

**Example**: \( x + y = 4 \)

Solutions of equation \( x + y = 4 \) are 

\((0, 4)\) \((1, 3)\) \((2, 2)\) \((4, 0)\)

and many more
PART-A

1. Which of the following is not a linear equation?
   a) \(3x + 3 = 5x + 2\)  
   b) \(x^2 + 5 = 3x - 5\)  
   c) \(\frac{7}{3}x - 5 = 4x - 3\)  
   c) \((x+2)^2 = x^2 - 8\)

2. Which of the following is not a linear equation in two variables?
   a) \(2x + 3y = 5\)  
   b) \(3x + 2y = 6\)  
   c) \(ax^2 + by = c\)  
   d) \(ax + by = c\)

3. A linear equation in two variables has maximum
   a) Only one solution  
   b) Two solution  
   c) Infinite solution  
   d) None of these

4. The graph of \(ax + by + c = 0\) is
   a) a straight line parallel to x-axis  
   b) a straight line parallel to y-axis  
   c) a general straight line  
   d) Name of these

5. If \(x = 1, y = 1\) is a solution of equation \(9ax + 12ay = 63\), then the value of \(a\) is
   a) 3  
   b) 0  
   c) -3  
   d) 4

6. The equation of x-axis is
   a) \(x = k\)  
   b) \(x = 0\)  
   c) \(y = k\)  
   d) \(y = 0\)

7. Any point on the line \(y = x\) is of the form
   a) \((a, 0)\)  
   b) \((0, a)\)  
   c) \((a, a)\)  
   d) \((a, -a)\)

8. \(x = 0\) represents the equation of
   a) x-axis  
   b) y-axis  
   c) a line parallel to x-axis  
   d) a line parallel to y-axis

9. \(x = 2, y = 3\) is a solution of the linear equation
a) \(2x + y = 8\)  
 b) \(x + 2y = 8\)  
 c) \(x + y = 8\)  
 d) \(-x + y = 8\)  

10. The graph of \(2x + 3y = 6\) is a line which meets the y-axis at the point?  
 a) \((2,0)\)  
 b) \((3,0)\)  
 c) \((0,2)\)  
 d) \((0,3)\)

11. How many linear equations in x and y can be formed by \(x = 18\) and \(y = 4\)?  
 a) only one  
 b) two  
 c) three  
 d) infinitely many

12. The point of the form \((-a, a)\) always lie on  
 a) \(x = a\)  
 b) \(y = -a\)  
 c) \(y = x\)  
 d) \(x + y = 0\)

13. The graph of \(y = x\) passes through the point?  
 a) \(\left(\frac{5}{2}, -\frac{5}{2}\right)\)  
 b) \(\left(0, \frac{5}{2}\right)\)  
 c) \((1,1)\)  
 d) \(\left(-\frac{1}{2}, \frac{1}{2}\right)\)

14. Graph of \(x = 5\) is a line  
 a) Parallel to x-axis  
 b) Parallel to y-axis  
 c) Passes through origin  
 d) Lying on x-axis

15. Any solution of the linear equation \(5x + 0y + 7 = 0\) in two variables is of the form  
 a) \(\left(0, -\frac{7}{5}\right)\)  
 b) \(\left(-\frac{7}{5}, 0\right)\)  
 c) \(\left(-\frac{7}{5}, k\right)\)  
 d) \(\left(k, -\frac{7}{5}\right)\)

16. Any point on the x-axis is of the form  
 a) \((x, y)\)  
 b) \((0, y)\)  
 c) \((0, x)\)  
 d) \((x, 0)\)
17. Solution of the equation 3x - y = 3 is
   a) (0, -3)       b) (2, 3)
   c) (3, 6)       d) All of these

18. The coefficient of the variable y in linear equation 5 (2x-y) + 3x + 4y - 7 = 0 is
   a) -1       b) -9
   c) 13       d) 9

19. If a linear equation has solutions (-1,1), (0, 0), (2, -2), then its equation is
   a) y - x = 0       b) x + y = 0
   c) -2x + y = 0    d) -x + 2y = 0

20. The point (a, -a) does not lie on the graph of
   a) x = a       b) y = -a
   c) y = x       d) x + y = 0

21. Which of the following equations represents a line parallel to x-axis ?
   a) 2x + 3 = 0       b) 2y + 2 = 0
   c) 2x + 3y = 0    d) 2x - 3y = 0

22. Which of the following equations represents a line parallel to y-axis ?
   a) 2x = 3y       b) 2y = 4
   c) 2x = 4        d) 2x - 3y = 9

23. If (a, -2) lies on the graph of 3x - y = 10, then the value of a is
   a) 4       b) \( \frac{8}{3} \)
   c) 0       d) 1

24. The equation 2x + 9 = 0 on number line is represented by :
   a) a line       b) a point
   c) Infinitely many lines    d) Infinitely many points

25. The distance between the graphs of the equations x = -4 and x = 1 is
   a) 1       b) 5
   c) 3       d) None of these
26. The distance between the graphs of the equations \( y = -2 \) and \( y = -5 \)
   a) \( 7 \)          b) \( 3 \)
   c) \( -7 \)         d) None

27. If \((2k-1, k)\) is a solution of the equation \(10x - 9y = 12\), then \(k = \)______
   a) \( 1 \)          b) \( 2 \)
   c) \( 3 \)          d) \( 4 \)

28. Which of the following equations passes through the origin?
   a) \( x + y = 2 \)  b) \( x - y = 2 \)
   c) \( 2x - 3y = 0 \) d) None of these

29. If the equation \(3y = 7\) is expressed as \(ax + by + c = 0\) then which of the following is correct?
   a) \( a = 0, b = 7, c = 3 \)  b) \( a = 3, b = 0, c = -7 \)
   c) \( a = 0, b = 3, c = -7 \) d) \( a = 3, b = -7, c = 0 \)

30. On expressing \(x\) in terms of \(y\) for the linear equation \(\frac{2}{3}x + 4y = -7\)
    Which of the following is correct?
    a) \( y = \frac{-21 - 12x}{2} \)  b) \( x = \frac{-21 - 12y}{2} \)
    c) \( y = -7 + \frac{2}{3}x \)  d) \( x = -7 + 4y \)

**Fill in the blanks:**

31. The equation of a line parallel to \(x\)-axis is \(____=a\) where \(a\) is any non-zero real number.

32. The equation of a line parallel to \(y\)-axis is \(____=a\), where \(a\) is any non-zero number.

33. The graph of every linear equation in two variables is a \(____\)

34. An equation of the form \(ax + b = 0\), where \(a, b\) are real numbers and \(a \neq 0\), in the variable \(x\) geometrically represents \(____\)

35. The coefficient of \(x\) in the linear equation \(2(x + y) - x = 7\) is \(____\)
    State whether the following statements are true or false.

36. The linear equation \(7x + 9y = 8\) has a unique.

37. All the points \((2,0), (-3,0), (4, 2)\) lie on the \(x\)-axis

38. The line parallel to \(y\)-axis at a distance of 5 units to the left of \(y\)-axis is given by the equation \(x = -5\).

39. The graph of every linear equation in two variables need not be a line.

40. The graph of the linear equation \(x+2y = 5\) passes through the point \((0, 5)\)
41. Express the linear equation $\sqrt{2}x - 4 = 5y$ in the form of $ax + by + c = 0$ and thus indicate the values of $a$, $b$ and $c$.

42. Express $x$ in terms of $y$ for the equation $3x + 4y = 7$

43. Express $y$ in the terms of $x$.
   
   $3y + 5x = 9$

44. Point $(9, 0)$ lie on which axis?

45. Find a solution of $x + y = 5$ which lies on $y$-axis

46. Express the equation $5y = 9$ as linear equation in two variables.

47. Write the linear equation which is parallel to $x$-axis and is at a distance of 2 units from the origin in upward direction.

48. Check whether $(1, -2)$ is a solution of $2x - y = 6$.

49. Check whether $x = 2$ & $y = -2$ is a solution of $2x - y = 6$.

50. How many solutions are there for equation $y = 5x + 2$.

51. Find the value of $K$, if $x = -1$ & $y = 1$ is a solution of equation $Kx - 2y = 0$.

52. If the graph of equation $2x + Ky = 10$ intersects $x$-axis at point $(5, 0)$ find the value of $K$.

53. The graph of the linear equation $4x = 6$ is parallel to which axis?

54. At what point the graph of $2x - y = 6$, cuts $x$-axis?

55. On which side of $y$-axis, $x + 3 = 0$ lies

56. On which side of $y$-axis, $x + 3 = 0$ lies?

PART-B

57. Find any two solutions of equation

   $2x + y = x + 5$.

58. Find the value of $P$ if $x = 2$, $y = 3$ is a solution of equation $5x + 3Py = 4a$

59. If the points $A(3, 5)$ and $B(1, 4)$ lies on the graph of line $ax + by = 7$, find the value of $a$. 
60. Write the coordinates of the point where the graph of the equation $5x + 2y = 10$ intersect both the axes.

61. Write the equations of two lines passing through $(3, 10)$.

62. The cost of coloured paper is $7\ more$ than $\frac{1}{3}$ of the cost of white paper. Write this statement in linear equation in two variables.

63. Draw the graph of equation $x + y = 5$.

64. From the choices given below, choose the equation whose graph is given in figure –
   (i) $x + 2y = 5$
   (ii) $x - 2y = 5$
   (iii) $y + 2x = 5$

65. The graph of linear equation $2x - y = 6$ will pass through which quadrant(s).

66. How many solution of the equation $3x - 2 = x - 3$ are there on the
   (i) Number line
   (ii) Cartesian plane.

67. Find the points where the graph of $x + y = 4$ meets line which is
   (i) parallel to x-axis at 3 units from origin in positive direction of y-axis.
   (ii) parallel to y-axis at 2 units on left of origin.

PART-C

68. If the points A $(4, 6)$ and B $(1, 3)$ lie on the graph of $ax + by = 8$ then find the value of $a$ and $b$.

69. Find the value of $'a'$ if $(1, -1)$ is the solution of the equation $2x + ay = 5$. Find two more solutions of the equation.
70. Find two solutions of the equation $4x + 5y = 28$. Check whether (-2,10) is solution of the given equation.

71. Write the equation of line passing through (3, -3) & (6, -6).

72. If $x = 3k - 2$, $y=2k$ is a solution of equation $4x - 7y + 12 =0$, then find the value of K.

73. If $(m-2, 2m+1)$ lies on equation $2x + 3y - 10 = 0$, find m.

74. $F = (9/5)C + 32$.

   (i) If the temperature is 35°C, what is the temperature in Fahrenheit?

   (ii) If the temperature is 30°C, what is the temperature in Fahrenheit?

75. Draw the graph of the linear equation $2x+3y=6$. Find out the coordinates of the points where the line intersects at x axis and y-axis.

76. Draw the graph for the linear equations

   $3x + 4y = 12$. If $x = 8$, find the value of $y$ with the help of graph.

77. Draw the graph of $y = x & 2y = -5x$ on the same graph.

78. Give the geometrical representation of $5x + 7 = 0$ as equation.

   (i) in one variable

   (ii) in two variables

79. Draw the graph of the linear equations $2y - x = 7$. With the help of graph check whether $x = 3$ and $y = 2$ is the solution of the equation?

   **Part – D**

80. Write $3y = 8x$ in the form of $ax+by+c=0$. Write $x$ in terms of $y$. Find any two solutions of the equation. How many solutions you can find out?
81. Rohan and Ramita of Class IX decided to collect ₹ 25 for class cleanliness. Write it in linear equations in two variables. Also draw the graph.

82. Sarika distributes chocolates on the occasion of children's Day. She gives 5 chocolates to each child and 20 chocolates to adults. If number of children is represented by 'x' and total distributed chocolates as 'y'.
   (i) Write it in the form of linear equation in two variables.
   (ii) If she distributed 145 chocolates in total, find number of children?

83. Priyanka and Arti decided to donate ₹ 1600 for the Army widows. Let Priyanka's share as 'x' and Arti share as 'y'.
   (a) Form a linear equation in two variables.
   (b) If Priyanka donates thrice the amount donated by Arti, then find out the amount donated by both.

84. Riya participates in Diwali Mela with her friends for the charity to centre of handicapped children. They donate ₹ 3600 to the centre from the amount earned in Mela. If each girl donates ₹ 150 and each boy donates ₹ 200.
   (a) Form the linear equation in two variables.
   (b) If number of girls are 8, find number of boys.

85. Aftab is driving a car with uniform speed of 60 km/hr. Assuming total distance to be y km & time taken as x hours, form a linear equation. Draw the graph. From the graph read the following:
   (i) distance travelled in 90 minutes.
   (ii) Time taken to cover a distance of 150 km.

86. The parking charges of a car in a private parking is ₹ 20 for the first hour and ₹10 for subsequent hours. Taking total parking charges to be y & total parking time as x hours form a linear equation. Write it in standard form ₹ hence find, a, b & c. Draw the graph also.

87. We know that C = 2πr, taking π = 22/7, circumference as y units, radius as x units, form a linear equation. Draw the graph. Check whether the graph passes through (0, 0). From the graph read the circumference when radius is 2.8 units.
CHAPTER-4
LINEAR EQUATIONS IN TWO VARIABLES

ANSWER

1. b) \( x^2 + 5 = 3x - 5 \)
2. c) \( ax^2 + by = c \)
3. c) Infinite solution
4. c) a general straight line
5. a) 3
6. d) \( y = 0 \)
7. c) (a, a)
8. b) y-axis
9. b) \( x + 2y = 8 \)
10. c) (0,2)
11. d) infinitely many
12. d) \( x + y = 0 \)
13. c) (1,1)
14. b) Parallel to y - axis
15. c) \( \left( -\frac{7}{5}, k \right) \)
16. d) (x, o)
17. d) All of these
18. a) -1
19. b) \( x + y = 0 \)
20. c) \( y = x \)
21. b) \( 2y + 2 = 0 \)
22. c) \( 2x = 4 \)
23. b) \( \frac{8}{3} \)
24. b) a point
25. b) 5
26. b) 3
27. b) 2
28. c) \( 2x - 3y = 0 \)
29. c) \( a = 0, b = 3, c = -7 \)
30. b) \( x = \frac{-21 - 12y}{2} \)
31. y
32. x
33. straight Line
34. a Point on number line
35. 1
36. False
37. False
38. True
39. False
40. False
41. \( \sqrt{2}x - 5y - 4 = 0 \),
   Where \( a = \sqrt{2}, b = -5, c = -4 \)
42. \( x = \frac{7 - 4y}{3} \)
43. \( y = \frac{9 - 5x}{3} \)
44. x-axis
45. (0, 5)
46. 0.x + 5.y = 9
47. \( y = 2 \)
48. No
49. Yes
50. Infinitely many solutions
51. \( k = -2 \)
52. \( k = 1 \)
53. Parallel to \( y \)-axis.
54. \( (3, 0) \)
55. \( y = mx \)
56. On left side
57. \( (1, 4) (0, 5) \) (or any other two possible solutions)
58. \( p = \frac{4a - 10}{9} \)
59. \( a = -1 \)
60. \( (0, 5) \) and \( (2, 0) \)
61. \( 3x - y + 1 = 0 \) (or any other possible solution)
   \[ 12x + 7y = 106. \]
62. \( 3x - y = 21 \) (Let the cost of coloured paper be \( \text{₹} x \), cost of white paper by \( \text{₹} y \)).
63. \( x - 2y = 5 \)
64. I, II, III
65. (i) One Solution (ii) Infinitely many
66. (i) \( (3, 1) \) (ii) \( (6, -2) \)
67. \( a = -4, b = 4 \)
68. \( a = -3 \) (any two solutions)
69. \( (2, 4), (7, 0) \), No
70. \( x + y = 0 \)
72. \( k = 2 \)
73. \( m = 11/8 \)
74. \( 95^\circ \text{F}, 86^\circ \text{F} \)
75. \((3, 0), (0, 2)\)
76. \( y = 3 \)
79. No
80. \( 8x - 3y + 0 = 0 \)
    \[ a = 8, b = -3, c = 0 \]
    Infinitely many solutions.
81. \( x + y = 25 \)
82. (i) \( 5x + 20 = y \)
    (ii) 25
83. (i) \( x + y = 1600 \)
    (ii) Priyanka = ₹1200, Arti = ₹400
84. (i) \( 150x + 200y = 3600 \), (ii) Number of boys = 12
85. \( y = 60 \)
    (i) 90 km
    (ii) 2½ hours
86. \( y = 20 + 10x \)
    Standard from \( 10x - y + 20 = 0 \)
    \[ a = 10, b = -1, c = 20 \]
PRACTICE TEST
LINEAR EQUATIONS IN TWO VARIABLES

Time : 50 Min.

1. The graph of linear equation $2y = 5$ is parallel to which axis? (1)

2. Write the linear equation the graph of which is parallel to y-axis and is at a distance 3 units on left from the origin. (1)

3. If the point (5, 2) lies on the graph of the linear equation $kx + 5y = 10 \ k$, Find $k$. (2)

4. Write two linear equations the graph of which passes through $(2, -3)$. (2)

5. Write the linear equation $x + \sqrt{3}y = 4$ in the form of $ax + by + c = 0$ & hence write the values of $a, b \ & \ c$. Write $x$ in terms of $y$. (3)

6. Find the solutions of linear equation $2x + y = 4$ which represents a point on
   (i) x-axis, (ii) y-axis.
   (iii) parallel to x-axis at a distance 3 units from origin. (3)

7. Give the geometrical representation of $2x + 5 = 0$ as a linear-equation in
   (a) one variable (b) two variables. (4)

8. In a Residential Society, Rain water is stored in underground water tank. The water is stored at the rate of 30 cubic cm per second. If water stored is $y$ cubic cm in $x$ second, write a linear equation in two variables. Draw its graph. (4)

From the graph read the following:
   (i) Total water stored in 3 seconds.
   (ii) In how many seconds water stored is 120 cm$^3$?
CHAPTER-5
INTRODUCTION TO EUCLID'S GEOMETRY

KEY POINTS

• **Introduction**: Euclidean geometry, which is taught today is named after Euclid - he is known as "the father of geometry". Euclid also studied and contributed in other areas of mathematics, including number theory and astronomy.

• **Axiom or Postulates**: Axiom or Postulates are the assumptions which are obvious universal truths. They are not proved.

• **Theorems**: Theorems are statements which are proved using definitions, axioms, previously proved statements and deductive reasoning.

SOME OF EUCLID'S AXIOMS

1. Things which are equal to the same thing are equal to one another.
2. If equals are added to equals the whole are equal.
3. If equals are subtracted from equals the remainders are equal.
4. Things which coincide with one another are equal to one another.
5. The whole is greater than the part.
6. Things which are double of the same things are equal to one another.
7. Things which are halves of the same things are equal to one another.

EUCLID'S POSTULATES AND DEFINITIONS

• **Postulates 1**: A straight line may be drawn from any one point to any other points.

• **Postulate 2**: A terminated line can be produced indefinitely.

• **Postulate 3**: A circle can be drawn with any centre and any radius.

• **Postulate 4**: All right angles are equal to one-another.

• **Postulate 5**: If a straight line falling on two straight lines makes the interior angles on the same side of it taken together less than two right
angles, then two straight lines if produced indefinitely, meet on that side on which the sum of angles is less than two right angles.

DEFINITIONS

1. A **Point** is that which has no part.

2. A **line** is breadth less length.

3. The ends of a line are points.

4. A **straight line** is a line which lies evenly with the points on it self.

5. A **surface** is that which contain length and breadth only.

6. The **edges** of a surface are lines.

7. A **plane surface** is a surface which lies evenly with the straight lines on it self.

8. Two distinct lines can not have more than one point in common.
Part – A

1. Write the number of dimensions, that a surface contain.
2. A proof is required for _______ (Postulate, Axioms, Theorem).
3. The number of line segments determined by three collinear points is _______ (Two, three, only one).
4. Euclid stated that if Equals are subtracted from Equal then the remainders are equal in the form of _________ (an axiom, a definition, a postulate).
5. In given figure AD = BC then AC and BD are equal or not?

6. How many lines can pass through a single point?
7. State Euclid’s first postulate.
8. Write Euclid’s fifth postulate.
9. If \( a + b = 15 \) and \( a + b + c = 15 + c \)
   which axiom of Euclid does the statement illustrate?
10. If A, B and C are three points on a line and B is between A and C then prove that \( AC - BC = AB \).

Part – B

11. If \( x + y = 10 \) and \( x = z \) then show that \( z + y = 10 \)
12. In given figure \( AX = AY, AB = AC \)
   Show that : \( BX = CY \)

13. In given figure \( \angle ABC = \angle ACB \) and \( \angle 3 = \angle 4 \)
    Show that \( \angle 1 = \angle 2 \)
14. In the given figure of $AD = CB$
then prove that $AC = BD$

15. Solve the equation $x - 10 = 15$, State which axiom do you use here.

16. If a point $C$ lies between two points $A$ and $B$ such that $AC = BC$ then prove that

$$AC = \frac{1}{2} AB$$

17. In the given figure

$$AM = \frac{1}{2} AB$$

$$AN = \frac{1}{2} AC$$

show that $AB = AC$

18. In the given figure $AC = DC$, $CB = CE$
then show that $AB = DE$

19. Prove that every line segment has one and only one mid point.

20. State true or false
(a) only one line can pass through a single point.
(b) There are infinitely many number of lines which passes through the two distinct point.
(c) Euclid belongs to Greece.

Part – C

21. In the given figure $\angle 1 = \angle 2$ and $\angle 2 = \angle 3$
then show that $\angle 1 = \angle 3$
22. In the given figure $AB = BC$, $M$ is the mid point of $AB$ and $N$ is the mid point of $BC$. Show that $AM = NC$

![Diagram of triangle with midpoints]

23. In the given figure $\angle 1 = \angle 3$ and $\angle 2 = \angle 4$

then show that $\angle BAD = \angle BCD$

![Diagram of quadrilateral with angle labels]

24. An equilateral triangle is a polygon made up of three line segments out of which two line segments are equal to the third one and all the angles are $60^\circ$ each.

Can you justify that all sides and all angles are equal in equilateral triangle?

25. RAM and Shyam are two students of Class IX. They give equal donation to a blind school in the month of March. In April each student double their donation.

(a) compare their donation in April.

(b) which mathematical concept have been covered in this question?

26. Monika and Vasu have the same weight if they both gain weight by 2kg. How will their new weights be compared?

(a) What mathematical concept have been covered in this question?
CHAPTER-5
INTRODUCTION TO EUCLID'S GEOMETRY

ANSWERS

1. Two
2. Theorem
3. Only One
4. Axiom
5. Equal
6. Infinite
9. Second axiom
15. Second Axiom
20. (a) false
(b) false
(c) true
25. (a) Donation amount is same in April
(b) Euclid's axiom
26. (a) Euclid's axiom
PRACTICE TEST

Introduction To Euclid's Geometry

Choose the correct option:

1. Through two points:
   (a) A unique line can be drawn
   (b) No line can be drawn
   (c) More than one line can be drawn

2. Through a fixed point:
   (a) A unique line can be drawn
   (b) No line can be drawn
   (c) More than one line can be drawn

3. Number of line segments required to form a closed figure:
   (a) 2  (b) 3  (c) 4

4. Two lines having a common point is called:
   (a) Parallel lines  (b) Intersecting lines
   (c) Coincident lines

5. Euclid arranged all known work in the field of mathematics in his treatise called:
   (a) Elements  (b) Axioms  (c) Postulates

6. The thing which are double the same thing are:
   (a) Halves of the same thing  (b) Double of the same thing
   (c) Equals

7. Axioms are assumed:
   (a) Universal truth specific of geometry
   (b) Universal truths in all branches of mathematics
   (c) Definitions

8. A mathematics statement whose truth has been logically established is called:
   (a) An Axiom  (b) A Postulate
   (c) A Theorem
CHAPTER-6
LINES AND ANGLES

KEY POINTS

• Line is a collection of points which has only length neither breadth nor thickness.

• **Line Segment**: A part or portion of a line with two end points.

• **Ray**: A part of a line with one end point.

• **Collinear points**: Three or more points lying on the same line.

• **Angle**: An angle is formed when two rays originate from the same end point. The rays making an angle are called the arms and the end point is the vertex.

• **Acute angle**: An angle measure between $0^\circ$ and $90^\circ$

• **Right angle**: Angle exactly equal to $90^\circ$

• **Obtuse angle**: An angle greater than $90^\circ$ but less than $180^\circ$

• **Straight angle**: An angle exactly equal to $180^\circ$

• **Reflex Angle**: An angle greater than $180^\circ$ but less than $360^\circ$

• **Complimentary Angles**: A pair of angles whose sum is $90^\circ$

• **Supplementary angle**: A pair of angles whose sum is $180^\circ$

• **Complete Angle**: An angle whose measure is $360^\circ$.

• **Adjacent angles**: Two angles are adjacent if
  
  (i) They have a common vertex.

  (ii) a common arm

  (iii) Their non common arms are on opposite sides of common arm.

• **Linear pair of angle**: A pair of adjacent angles whose sum is $180^\circ$

\[ \angle AOB \& \angle COB \text{ are forming linear pair.} \]
• **Vertically opposite angles**: Angles formed by two intersecting lines on opposite side of the point of intersection.

\[ \angle x = \angle z \]
\[ \angle y = \angle w \]

• **Intersecting lines**: Two lines are said to be intersecting when the perpendicular distance between the two lines is not same every where. They meet at one point.

• **Non Intersecting lines**: Two lines are said to be non-intersecting lines when the perpendicular distance between them is same every where. They do not meet. If these lines are in the same plane these are known as **Parallel lines**.

• **Transversal line**: In the given figure \( l \parallel m \) and \( t \) is transversal then

(a) Vertically opposite angle

\[ \angle 1 = \angle 3 \]
\[ \angle 2 = \angle 4 \]
\[ \angle 5 = \angle 7 \]
\[ \angle 6 = \angle 8 \]

(b) Corresponding angle

\[ \angle 1 = \angle 5 \]
\[ \angle 2 = \angle 6 \]
\[ \angle 3 = \angle 7 \]
\[ \angle 4 = \angle 8 \]

(c) Alternate Interior angle

\[ \angle 3 = \angle 5 \]
\[ \angle 4 = \angle 6 \]

\[ \angle 3 + \angle 6 = 180^\circ \] Angles on the same sides of a transversal are supplementary.

\[ \angle 4 + \angle 5 = 180^\circ \]

\[ \angle 3, \angle 6 \] and \[ \angle 4, \angle 5 \] are called co-interior angles or allied angles or consecutive interior angles.

• Sum of all interior angles of a triangle is \( 180^\circ \).

• Two lines which are parallel to the third line are also parallel to each other.
LINES & ANGLES

Part-A

1. An angle which is greater than 180° & less than 360° is-
   a) Obtuse Angle          b) Straight Angle
   c) Reflex Angle          d) Complete Angle

2. If three or more points does not lie on the same straight line the points are called –
   a) Concurrent points      b) Collinear Points
   c) Non Collinear Points   d) Adjacent Point

3. Reflex angle of 110° is -
   a) 70°                    b) 90°
   c) 250°                   d) 190°

4. If an angle is equal its complement, then the angle is –
   a) 90°                    b) 0°
   c) 48°                    d) 45

5. If the figure POQ is a straight line. The three adjacent angles are consecutive numbers, the measure of these angles is –
   a) 50°, 60°, 70°          b) 59°, 60°, 61°
   c) 58°, 60°, 62°          d) All are correct

6. In the figure, twice of x is 30° less than y, then the values of x & y are respectively, given OB & OA are opposite rays.
   a) 130°, 50°              b) 50°, 130°
   c) 100°, 80°              d) 75°, 105
7. One of the angles of a pair of supplementary angles is 2° more than its supplement, the angles are:
   a) 90°, 90°  
   b) 88°, 92°  
   c) 89°, 91°  
   d) All are correct

8. In the figure $AB \& CD$ are two straight lines intersecting at $O$, $OP$ is a ray. What is the measure of $\angle AOD$?
   a) 40°  
   b) 100°  
   c) 140°  
   d) 128°  

9. If the difference between two supplementary angles is 40 then the angles are:
   a) 40°, 140°  
   b) 80°, 100°  
   c) 110°, 70°  
   d) 65°, 115°  

10. The angles which is four times more than its complement is
    a) 120°  
    b) 144°  
    c) 150°  
    d) 100°  

11. An exterior angle of a triangle is 100° & its two interior opposite angles are equal. Measure of there equal angles are—
    a) 40°  
    b) 50°  
    c) 80°  
    d) 90°  

12. The value of $x$ in the figure is
    a) 230°  
    b) 100°  
    c) 120°  
    d) 115°
13. Which of the following options is correct:
   A pair of adjacent angles have.
   (i) Common vertex
   (ii) Common Arm.
   (iii) Non Common arms are an opposite sides of common arms
   (iv) Non Common arms are on the same side of common arms.
   a) (i) & (ii) are sufficient
   b) (i), (ii) & (iii) are sufficient
   c) (i), (ii) & (iv) are sufficient
   d) All are sufficient

14. Angles $x \& y$ forms a linear pair and $x + 2y = 30^\circ$, the value of $y$ is
   a) $70^\circ$
   b) $110^\circ$
   c) $210^\circ$
   d) $60^\circ$

15. The degree measure of $x \& y$ respectively in the figure are –
   a) $80^\circ, 100^\circ$
   b) $100^\circ, 80^\circ$
   c) $80^\circ, 80^\circ$
   d) $100^\circ, 100^\circ$

16. In the figure $AB, CD & EF$ are three Straight lines intersecting at $O$.
    The measure of $\angle AOF$ is –
   a) $98^\circ$
   b) $152^\circ$
   c) $54^\circ$
   d) $82^\circ$

17. If $\angle ABC + \angle DEF = 180^\circ$, name the pair of angles $\angle ABC \& \angle DEF$
   a) Adjacent Angles
   b) Complementary Angles
   c) Supplementary Angle
   d) V.O.A

18. In the figure, $AB || CD$, What is $x+y$.
    a) $40^\circ$
    b) $60^\circ$
    c) $100^\circ$
    d) $80^\circ$
19. From the Figure, choose the correct option.
   (i) $\angle 1 \& \angle 8$ are alternate angles
   (ii) $\angle 1 \& \angle 7$ are alternate angles
   (iii) $\angle 3 \& \angle 5$ are alternate angles
   (iv) $\angle 4 \& \angle 8$ are corresponding angles
   (v) $\angle 2 \& \angle 6$ are not corresponding angles.
   (vi) $\angle 3 \& \angle 8$ are interior angles on the same side of the transversal.
   a) (i), (iii), (iv), (v) are correct  b) (i), (ii), (iii) are correct
   c) (ii), (iii), (iv), (vi) are correct  d) (ii), (iii), (iv), (v) are correct.

20. If two parallel lines are intersected by a transversal, then the interior angles on the same side of the transversal are –
   a) equal  b) adjacent
   c) Supplementary  d) Complementary

21. In the figure, measure of $x$ is –
   a) $65^\circ$  b) $55^\circ$
   c) $100^\circ$  d) $80^\circ$

22. In the figure, $l \parallel m \& l \parallel n$ then $x$ is –
   a) $90^\circ$  b) $45^\circ$
   c) $30^\circ$  d) $60^\circ$

23. In the figure, if $l \parallel m$ what is $x$.
   a) $30^\circ$  b) $70^\circ$
   c) $43^\circ$  d) $37^\circ$
24. In the figure, \( AB \parallel CD, \ EG \ & \ FG \) are Bi Sectors of \( \angle BEF \ & \ \angle DFE \) respectively, the \( m \angle FGE \) is –
   a) 45°    b) 90°    c) 60°    d) 100°

25. In the figure, \( l \parallel m \) such that \( \angle A = 110° \ & \ \angle B = 130° \) then \( m \angle ACB \) is
   a) 50°    b) 60°    c) 70°    d) 120°

26. The ratio of two interior angles on the same side of the transversal is 2 : 3, the measure of difference of both the angles is –
   a) 36°    b) 180°    c) 72°    d) 108°

27. In the figure, \( l \parallel m \parallel n \) and \( AB \parallel CD \), then \( \angle BCD \) is –
   a) 120°    b) 145°    c) 85°    d) 60°

28. In the figure \( l \parallel m \), then \( y = \) 
   a) 145°    b) 120°    c) 60°    d) 35°

29. An exterior angle is drawn to a triangle, which is acute, then on the basis of angles what type of triangle is this –
   a) Acute angled    b) Obtuse angled
   c) Right angled    d) Scalene
30. In the figure what is the measure of $\angle A =$
   a) 80°  b) 60°  c) 40°  d) 140°

31. In the figure, if $AB = AC$ the measure of $\angle A$ is
   a) 55°  b) 75°  c) 70°  d) 110°

32. In the figure, measure of $x$ is
   a) 100°  b) 140°  c) 60°  d) 20°

33. In the figure, measure of $\angle B$ is
   a) 90°  b) 20°  c) 110°  d) 70°

34. If one of the angles of a triangle is 120°, then the angle between the interior bisectors of the other two angles is
   a) 90°  b) 30°  c) 150°  d) 60°

35. If one of the angles of a triangle is 62, then the angle between the exterior bisectors of the other two angles is
   a) 31°  b) 59°  c) 121°  d) 118°

36. If $a \ & b$ forms a pair of adjacent angles then which figures proves it.
   a)  
   b)  
   c)  
   d)  

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Class IX - Mathematics
Fill in the blanks:

37. Two lines perpendicular to the same line are _______ to each other.
38. Two lines parallel to the same line are _______ to each other.
39. If one angle of a linear pair is acute, then its other angle will be _______.
40. If the sum of two adjacent angles is 180°, then the _______ arms of the two angles are opposite rays.
41. If OB & OA are opposite rays, in the figure then the value of x+y is _______.

42. If the figure AB is a straight line, then the valuer of a+b is _______.

43. If (30–x)° is supplement of (125+2x)° then x is _______.
44. If one of the angles of formed by two intersecting lines is a right angle then the lines are _______ to each other.
45. In the figure, if AB || CD then measure of p is _______.

46. Exterior angle of a triangle is always _______ than either of its interior opposite angles.
PART-B

47. In the adjoining figure $PQ \parallel RS$ find $x$ and $y$.

48. Contributing money. 5 friends bought pizza. They want to divide it equally among themselves. But one of them was given double piece, as he was very hungry. Find the angle of the piece of pizza each one received.

49. $BO$ and $CO$ are external bisector of $\angle B$ and $\angle C$ of $\triangle ABC$. Intersecting at O. If $\angle A = 60^\circ$, $\angle ABC = 70^\circ$, Find $\angle BOC$.

50. In the above question 18, if internal bisector of $\angle B$ and $\angle C$ intersect at $P$, prove that $\angle PBO = 90^\circ$ and $\angle BOC + \angle BPC = 180^\circ$

51. In the given figure if $\parallel m$ and $'t'$ is the transversal find $x$.

52. In the figure,

If $p: q = 11: 19$, $AB \parallel CE$, then find the values of $p$, $q$ and $r$.

53. Prove that vertically opposite angles are equal.

54. In the figure, $CD$ is the angle bisector of $\angle ECB$, $\angle B = \angle ACE$. Prove that $\angle ADC = \angle ACD$. 
55. In the figure, choose the pair of lines which are parallel. Give reasons also.

56. The angles of a triangle are \((x - 40^\circ), (x-20^\circ), (\frac{x}{2} - 10^\circ)\)
Find the value of \(x\) & then find the angles of the triangle.

57. In the figure, if \(\angle AED = \angle BDC + \angle BAE\) then show that \(AB \parallel CD\)

58. In the given figure if \(AB \parallel DC\) and \(\angle BDC = 30^\circ, \angle BAD = 80^\circ\) find \(\angle x, \angle y, \angle z\).

59. If one of the angle of two intersecting lines is right angle then prove that other three angles will also be right angles.

60. \(AB\) and \(CD\) are intersecting lines. \(OD\) is bisector of \(\angle BOY\). Find \(x\).
61. If \( p \parallel q \parallel r \), find \( x \), \( y \), \( z \) from given figure.

62. In the given figure find \( \angle DCB \) if \( AE \parallel CD \).

63. In the given figure \( l \parallel m \) and \( n \) is the transversal, find \( x \).

64. For what value of \( x \), \( l \parallel m \).

65. From the figure find reflex angle \( \angle BOD \) if \( AB \parallel CD \).
66. If the angles of a triangle are in the ratio $5 : 3 : 7$ then show that the triangle is acute angled triangle.

67. Two lines are respectively perpendicular to two parallel lines show that they are parallel to each other.

68. As shown in the figure find $x$ & $y$ if $\angle ACB = 100^\circ$, $\angle ADE = 120^\circ$.

69. In the given figure $\angle DOB = 85^\circ$, $\angle COA = 85^\circ$, $\angle BOA = 40^\circ$, find $\angle COB$ and $\angle DOC$.

70. Prove that the bisectors of the angles of a linear pair are at right angle.

71. If two complementary angles are such that two times the measure of one is equal to three times the measure of the other. Find the measure of larger angle.

72. Prove that the sum of all exterior angles of a triangle is $360^\circ$.

73. If the bisectors of $\angle Q$ and $\angle R$ of a triangle $\triangle PQR$ meet at point $S$, then prove that

$$\angle QSR = 90^\circ + \frac{1}{2} \angle P$$

74. Show that if sum of the two angles of a triangle is equal to the third angle then the triangle is right angled triangle.

Part – D

75. If a transversal intersects two parallel lines prove that internal bisectors of the angle on the same side of a transversal meet at right angles.
76. In the given figure PQ, RS are two mirrors placed parallel to each other. An incident ray AB strikes the mirror PQ at B; the reflected ray moves along the path BC again strikes the mirror RS at C and reflects back along CD.

Prove that \( AB \parallel CD \). 

77. In the figure AE is the bisector of \( \angle A \), AD \( \perp BC \). Show that 
\[
2 (\angle ADE - \angle EAC) = \angle B + \angle C
\]

78. Prove that quadrilateral formed by the intersection of bisectors of interior angles made by a transversal on two parallel lines is a rectangle.

79. In the given figure \( \ell \parallel m \) where \( \ell \) and \( m \) are the bisectors of corresponding angles \( \angle ATQ \) and \( \angle TUS \) respectively. Prove that \( PQ \parallel RS \).

80. POQ is a straight line RO \( \perp PQ \), SO is a ray from O then prove that
\[
\angle ROS = \frac{1}{2} (\angle QOS - \angle POS)
\]
81. (i) If $AB \parallel CD$ find $x$

82. In $\triangle PQR$, sides $PQ$ and $PR$ are extended to $S$ and $T$ respectively. $OQ$ and $OR$ are bisector of $\angle QRS$ and $\angle QRT$ meeting at $O$. Show that $2\angle QOR = \angle PQR + \angle QRP$
Chapter-6
LINES & ANGLES

ANSWERS

1. (c) Reflex Angle
2. (c) Non Collinear Points
3. (d) 250°
4. (d) 45°
5. (b) 59°, 60°, 61°
6. (b) 50°, 130°
7. (c) 89°, 91°
8. (c) 140°
9. (c) 110°, 70°
10. (c) 150°
11. (b) 50°
12. (d) 115°
13. (b) (i), (ii) & (iii) are sufficient
14. (a) 70°
15. (b) 100°, 80°
16. (d) 82°
17. (c) Supplementary Angles
18. (c) 100°
19. (c) (ii), (iii), (iv), (iv) are correct
20. (c) Supplementary
21. (b) 55°
22. (c) 30°
23. (a) 30°
24. (b) 90°
25. (b) 60°
26. (a) 36°
27. (b) 145°
28. (d) 35°
29. (b) Obtuse Angled Triangle.
30. (c) 40°
31. (c) 70°
32. (b) $140^\circ$
33. (a) $90^\circ$
34. (a) $90^\circ$
35. (b) $59^\circ$
36. (b)

37. Parallel
38. Parallel
39. Obtuse
40. Non Common
41. $180^\circ$
42. $90^\circ$
43. $25^\circ$
44. Perpendicular
45. $93^\circ$
46. Greater
47. $x = 55^\circ, y = 40^\circ$
48. 4 Friends $= 60^\circ, 1$ friend $60^\circ \times 2 = 120^\circ$
49. $60^\circ$
50. $125^\circ$
51. $33^\circ, 57^\circ, 65^\circ$
52. $\|\| m$
53. $x = 100^\circ, 60^\circ, 80^\circ, 40^\circ$
54. $x = 30^\circ, y = 70^\circ, z = 110^\circ$
55. $x = 15^\circ$
56. $x = 55^\circ, y = 125^\circ, z = 35^\circ$
57. $30^\circ$
58. $60^\circ$
59. $270^\circ$
60. $285^\circ$
61. $80^\circ, 40^\circ$
62. $45^\circ, 40^\circ$
63. $54^\circ$
64. $17.5^\circ$
65. $40^\circ$
1. If $\angle ABC = 142^\circ$, find reflex $\angle ABC$. (1)

2. Two angles form a linear pair. If one of the angle is acute, what is the type of other angle? (1)

3. Find $x$ in the given figure:  

4. If two parallel lines intersected by a transversal, then name the pair of angles formed that are equal. (2)

5. In a $\triangle ABC$, $\angle A + \angle B = 125^\circ$ and $\angle B + \angle C = 150^\circ$. Find all the angles of $\triangle ABC$. (3)

6. $l$ and $m$ are the intersecting lines in the given figure. Find $x$, $y$ and $z$. (3)

7. If two parallel lines are intersected by a transversal, then prove that the bisectors of the interior angles on both sides of transversal form a rectangle. (4)

8. $ABC$ is a triangle in which $DE \parallel BC$. Find $\angle A$. (4)
CHAPTER-7
TRIANGLES
KEY POINTS

- Two figures having the same shape and size are called congruent figures.
- Two plane figures are congruent, if each one when superimposed on the other, covers the other exactly.
- Two line segments are congruent, if they are of equal lengths.
- Two angles of equal measures are congruent.
- Two circles of the same radii are congruent.
- Two squares of the same sides are congruent.
- Two rectangles are congruent, if they have the same length and breadth.
- If two triangles ABC and DEF are congruent under the correspondence A ↔ D, B ↔ E and C ↔ F, then symbolically, it is expressed as ΔABC ≅ ΔDEF.
- There are four congruent conditions for triangles.
  
  (a) **Side-Angle-Side (SAS) congruent rule**: Two triangles are congruent, if two sides and the included angle of the one triangle are respectively equal to the two sides and the included angle of the other triangle.
  
  (b) **Angle-Side-Angle (ASA) congruence rule**: Two triangles are congruent, if two angles and the included side of the one triangle are respectively equal to the two angles and the included side of the other triangle.
  
  (c) **Side-Side-Side (SSS) congruence rule**: Two triangles are congruent, if the three sides of one triangle are respectively equal to the three sides of the other triangle.
  
  (d) **Right angle-Hypotenuse-Side (RHS) congruence rule**: Two right triangles are congruent, if the hypotenuse and one side of one triangle are respectively equal to the hypotenuse and one side of another triangle.
• Angles opposite to equal sides of a triangle are equal.
• Sides opposite to equal angles of a triangle are equal.
• In a triangle, angle opposite to the longer side is larger (greater)
• In a triangle, side opposite to the larger (greater) angle is longer.
• Sum of any two sides of a triangle is greater than the third side.
• Difference of any two sides of a triangles is less than the third side.

PART-A

1. Which of the following is not a criterion for congruency of triangles?
   a) SSS  b) RHS
   c) AAA  d) SAS

2. If $AB \equiv CD$ then
   a) $AB < CD$  b) $AB + CD = 0$
   c) $AB = CD$  d) $AB > CD$

3. If $\triangle ABC \equiv \triangle DEF$ then.
   a) $AC = DE$  b) $BC = DF$
   c) $FE = CB$  d) $AB = DF$

4. If one angle of a triangle is equal to the sum of the other two angles, then the triangle is
   a) an equilateral triangle  b) an isosceles triangles
   c) an obtuse triangle   d) a right triangle

5. If $AB = QR, BC = PR$ and $CA = PQ$, then
   a) $\triangle ABC \equiv \triangle PQR$  b) $\triangle CBA \equiv \triangle PRQ$
   c) $\triangle BAC \equiv \triangle RPQ$  d) $\triangle PQR \equiv \triangle BCA$

6. In $\triangle ABC$ and $\triangle DFE$, $AB = FD$, $\angle A = \angle D$. The two triangles will be congruent by SAS axiom if
   a) $BC = EF$  b) $AC = DE$
   c) $AC = EF$  d) $BC = DE$

7. If $\triangle ABC \equiv \triangle FDE$, $AB = 5$ cm, $\angle B = 40^\circ$, $A = 80^\circ$. Then which of the following is correct?
   a) $DF = 5$ cm, $\angle F = 60^\circ$  b) $DF = 5$ cm, $\angle E = 60^\circ$
   c) $DF = 5$ cm, $\angle C = 60^\circ$  d) Both (B) and (C)

8. In $\triangle ABC$, $AB = AC$, $\angle B = 40^\circ$. Then $\angle C$ is equal to
   a) $50^\circ$  b) $40^\circ$
   c) $80^\circ$  d) $140^\circ$
9. In \( \triangle ABC \), \( AB = BC \), \( \angle B = 40^\circ \), Then \( \angle A \) is equal to
   a) 70°  
   b) 40°  
   c) 140°  
   d) 100°  

10. In right \( \triangle ABC \), \( AB = BC \). Then \( \angle A \) is equal to
    a) 45°  
    b) 90°  
    c) 60°  
    d) None of these  

11. In \( \triangle PQR \), \( \angle R = \angle P \), \( QR = 4 \text{ cm} \) and \( PR = 5 \text{ cm} \). Then \( PQ = \) ______
    a) 4cm  
    b) 5cm  
    c) 1 cm  
    d) 9cm  

12. If \( a \), \( b \), \( c \) are the lengths of the sides of a triangle, then
    a) \( a - b > c \)  
    b) \( a + b < c \)  
    c) \( c = a + b \)  
    d) \( c < a + b \)  

13. It is not possible to construct a triangle when the lengths of its sides are
    a) 3 cm, 4 cm, 5 cm  
    b) 3 cm, 5 cm, 5 cm  
    c) 5.3 cm, 2.2 cm, 3.1 cm  
    d) 9.3 cm, 5.2 cm, 7.4 cm  

14. In \( \triangle ABC \), \( \angle B = 90^\circ \) then
    a) \( AC = AB \)  
    b) \( AC < AB \)  
    c) \( AC < BC \)  
    d) \( AC > AB \)  

15. If \( \triangle ABC \) is obtuse angled at \( C \), then
    a) \( AB > BC \)  
    b) \( AB = BC \)  
    c) \( AB < BC \)  
    d) \( AC > AB \)  

16. In \( \triangle PQR \), if \( \angle R > \angle Q \), then
    a) \( QR > PR \)  
    b) \( PQ > PR \)  
    c) \( PQ < PR \)  
    d) \( QR < PR \)  

17. In \( \triangle ABC \) and \( \triangle PQR \). If \( AB = QP \), \( \angle B = \angle P \), \( BC = PR \) then which one of the following congruence conditions applies :
    a) SAS  
    b) ASA  
    c) SSS  
    d) RHS  

18. In \( \triangle ABC \) and \( \triangle DEF \), if \( \angle A = \angle F \), \( \angle B = \angle D \) and \( AB = FD \), then which one of the following congruence conditions applies :
    a) SAS  
    b) ASA  
    c) SSS  
    d) RHS  

19.  

<Diagram of triangles A and D with given measurements>  

99  

Class IX - Mathematics
In the given figure, the value of \( x \) is

a) 4 b) 32
c) 20 d) 180

20. If \( \triangle PQR \cong \triangle LMN \) than NL =

a) PQ b) QR
c) RP d) None of these

21. If \( \triangle CAB \cong \triangle MLK \) then \( \angle K = \)

a) \( \angle A \) b) \( \angle B \)
c) \( \angle C \) d) None of these

22. In \( \triangle ABC \), \( \angle C \) is the greatest angle, then

a) AC > AB b) AB > AC
c) AB > BC d) Both (b) and (c)

23. For \( \triangle ABC \), which of the following is incorrect?

a) (BC – AB) < AC b) (AC – BC) < AB
c) (AC – AB) < BC d) None of these

24. If \( \triangle ABC \cong \triangle ACB \), then

a) AB = AC b) AB = BC
c) AC = BC d) None of these

25. In the given figure \( AC \) is bisector of \( \angle BAD \), \( AB = 3 \) cm, \( AC = 5 \)cm, then \( AD = \)

a) 2 cm b) 5 cm
c) 3 cm d) 8 cm

---

Fill in the blanks:

26. Two figures are congruent if they have the ________ shape and same __________

27. Two circles are congruent if they have __________ radii.

28. Two equilateral triangles are congruent if they have ________ sides.

29. Two square are congruent if they have ________ sides.

30. The sum of any two sides of a triangle is __________ than the third side.
31. The difference of any two sides of a triangle is ________ than the third side.

32. In a right triangle, the hypotenuse is the _________ side.

33. If two angles of a triangle are unequal, then the smaller angle has the _________ side opposite to it.

34. If two sides of a triangle are unequal, then the larger side has _________ angle opposite to it.

35. In a triangle, sides opposite to equal angles are ________________

**State which of the following statements are true and false.**

36. In a triangle, the greatest angle has the longest side opposite to it.

37. Two triangles are congruent if three angles of one triangle are equal to three angles of the other triangle.

38. In a triangle, the shortest side has the smallest angle opposite to it.

39. It is necessary to write the correspondence of vertices correctly for writing congruence of triangles in symbolic form.

40. If all the line segments that can be drawn from a point to a line not containing it, the perpendicular line segment is the shortest one.

41. If \( \triangle ABC \cong \triangle DEF \) then
   
   (i) \( AB = \) ________  
   (ii) \( BC = \) ________  
   (iii) \( CA = \) ________  
   (iv) \( \angle E = \) ________  
   (v) \( \angle EDF = \) ________  
   (vi) \( \angle BCA = \) ________

42. Circle \( O_1 \cong \) Circle \( O_2 \). If radius of circle \( O_1 = 6 \) cm then diameter of circle \( O_2 \) is ________.

43. In the given figure, if \( a = b = c \) then \( \angle AOC \cong \) ________

[Diagram of angles and lines]
44. Which is the longest side of the triangles given in the figure?

![Diagram of a triangle with angles 85°, 53°, and 42°]

45. Which is the largest angle in the \( \triangle PQR \)?

![Diagram of a triangle with sides 5 cm, 6 cm, and 5.5 cm]

46. Which two triangles are congruent in the given figure. Write them in symbolic form.

![Diagram with intersecting lines]

**Part – B**

47. Match the columns:

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) 6 cm</td>
<td>(a) SAS congruence</td>
</tr>
<tr>
<td>8 cm</td>
<td>7 cm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 cm</td>
<td>7 cm</td>
</tr>
<tr>
<td>8 cm</td>
<td>6 cm</td>
</tr>
</tbody>
</table>

---

Class IX - Mathematics
48. Match the columns:

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) [ \overline{AB} \cong \overline{PQ} ]</td>
<td>[ x = ? ] (a) 2 cm</td>
</tr>
<tr>
<td>(ii) [ \overline{OX} \cong \overline{2\ cm} ]</td>
<td>[ x = ? ] (b) 5 cm</td>
</tr>
<tr>
<td>(iii) [ \overline{AB} \cong \overline{PQ} ]</td>
<td>[ x = ? ] (c) 10 cm</td>
</tr>
<tr>
<td>(iv) [ \triangle ABC \cong \triangle PRQ ]</td>
<td>[ x = ? ] (d) 4 cm</td>
</tr>
<tr>
<td>(v) [ \overline{SR} \cong \overline{AD} ]</td>
<td>[ x = ? ] (e) 11 cm</td>
</tr>
</tbody>
</table>
49. In the given figure, if \( AB = CD, AD = BC \) then prove that \( \triangle ADC \cong \triangle CBA \)

![Diagram of \( \triangle ADC \) and \( \triangle CBA \)]

50. If \( \triangle ABC \) is an isosceles triangle such that \( AB = AC \), then prove that altitude \( AD \) from \( A \) on \( BC \) bisects it.

51. Which criteria of congruence of triangles is satisfied in the given figure.

![Diagram of \( \triangle ABC \) with sides 3 cm and 4.7 cm, and \( \angle B = 60^\circ \)]

52. In a \( \triangle PQR \), \( \angle P = 110^\circ \), \( PQ = PR \). Find \( \angle Q \) and \( \angle R \).

53. In the given figure \( AB = AC \) and \( \angle ACD = 125^\circ \). Find \( \angle A \)

![Diagram of \( \triangle ABC \) with \( \angle A = 125^\circ \)]

54. In \( \triangle ABC \), if \( \angle A = 55^\circ \), \( \angle B = 75^\circ \) then find out the smallest and longest side of the triangle.

55. In the given figure, \( AC \) bisects \( \angle A \) and \( \angle C \). If \( AD = 5 \text{ cm} \) find \( AB \).

![Diagram of \( \triangle ABC \) with \( AD = 5 \text{ cm} \)]
56. The vertex angle of an isosceles triangle is 80°. Find out the measure of base angles.

Part – C

57. In the given figure, Q is a point on the side SR of \( \triangle PSR \) such that \( PQ = PR \) Prove that \( PS > PQ \).

58. \( ABC \) is a triangle and \( D \) is the mid-point of \( BC \). The Perpendicular from \( D \) to \( AB \) and \( AC \) are equal. Prove that triangle is isosceles.

59. Prove that angles opposite to the equal sides of an isosceles triangle are equal.

60. In the given figure, \( AC > AB \) and \( AD \) bisects \( \angle BAC \)
Prove that \( \angle ADC > ADB \).

61. \( S \) is any point in the interior of a \( \triangle PQR \). Prove that \( SQ + SR < PQ + PR \).

62. In the given figure, if \( AD = BD = CD \), Find \( \angle BAC \)
63. In the given figure, if \( AB = BC \) and \( \angle A = \angle C \) then find the value of \( x \).

64. In the given figure \( \angle ABC = \angle BAC \), D and E are points on BC and AC respectively such that DB = AE. If AD and BE intersect at O then prove that \( OA = OB \).

65. In the given figure, if \( AB = AC \), \( \angle BAD = \angle CAE \) then prove that \( \triangle ADE \) is an isosceles triangle.

66. In \( \triangle DEF \), \( \angle E = 2\angle F \) DM is the angle bisector of \( \angle EDF \) that intersects EF at M. If DM = MF, then prove that \( \angle EDF = 72^\circ \).

67. Prove that the angles of an equilateral triangle are \( 60^\circ \) each.

68. In the given figure, \( \angle a > \angle b \), show that \( \angle ATM < \angle AMT \).
Part-D

69. AF, BD and CE altitudes of ΔABC are equal. Prove that ABC is an equilateral triangle.

70. Prove that two triangles are congruent if two angles and the included side of one triangle are equal to the two angles and the included side of the other triangle.

71. O is any point in the interior of a ΔABC. Prove that (OA + OB + OC) > \( \frac{1}{2} (AB + BC + CA) \)

72. Prove that the perimeter of a triangle is greater than the sum of its three altitudes.

73. Two sides AB, BC and median AM of one ΔABC are respectively equal to sides PQ, QR, and median PN of ΔPQR. Show that.
   (i) ΔABM ≅ Δ PQN
   (ii) ΔABC ≅ Δ PQR

74. In the given figure, PQR is a triangle in which altitudes QS and RT to sides PR and PQ are equal. show that.
   (i) ΔPQS ≅ Δ PRT
   (ii) PQR is an isosceles triangle

75. In the given figure, AB = AD, \( \angle 1 = \angle 2 \) and \( \angle 3 = \angle 4 \). Prove that AP = AQ.
76. In the given figure, ABC is a right angled triangle, right angled at C, M is the mid-point of hypotenuse AB. C is joined to M and produced to a point D such that DM = CM. D is joined to B. Prove that \[ CM = \frac{1}{2} AB \]

77. Prove that the sum of any two sides of a triangle is greater than its third side.

78. Vandana wishes to literate the poor children of the nearby slum area. She makes flash cards for them as shown in the given figure.

(i) \[ \triangle ABC \]

(ii) \[ \triangle DEF \]

(iii) \[ \triangle RPQ \]

(a) Which two flash cards are congruent?

(b) Which criteria of congruency is satisfied here?

(c) Write the third side of both the triangles which are equal by CPCT.

79. Prove that the sum of any two sides of a triangle is greater than twice the median drawn to the third side.

80. In the given figure, \( AB = CD \), \( CE = BF \) and \( \angle ACE = \angle DBF \). Prove that

(i) \( \triangle ACE \cong \triangle DBF \)

(ii) \( AE = DF \)
CHAPTER-7

TRIANGLES

ANSWERS

1. c) AAA
2. c) AB = CD
3. c) FE = CB
4. d) a right triangle
5. b) Δ CBA ≅ Δ PRQ
6. b) AC = DE
7. d) Both (B) and (C)
8. b) 40°
9. a) 70°
10. a) 45°
11. a) 4cm
12. d) c < a + b
13. c) 5.3 cm, 2.2 cm, 3.1 cm
14. d) AC > AB
15. a) AB > BC
16. b) PQ > PR
17. a) SAS
18. b) ASA
19. c) 20
20. c) RP
21. b) ∠B
22. d) Both (b) and (d)
23. d) None of these
24. a) AB = AC
25. c) 3 cm
26. Same, Size
27. equal
28. equal
29. equal
30. greater
31. less
32. largest
33. smaller
34. greater
35. equal
36. True
37. False
38. True
39. True
40. True
41. (i) DE
   (ii) EF
   (iii) FD
   (iv) \(\angle B\)
   (v) \(\angle BAC\)
   (vi) \(\angle EFD\)
42. 12cm
43. \(\angle BOD\)
44. BC
45. \(\angle Q\)
46. \(\triangle LOM \cong \triangle QOP\)
47. (i) (b)
   (ii) (a)
   (iii) (d)
   (iv) (c)
48. (i) (c)
   (ii) (a)
   (iii) (e)
   (iv) (b)
   (v) (d)
51. SAS
52. \(\angle Q = \angle R = 35^\circ\)
53. \(\angle A = 70^\circ\)
54. Smallest Side = AB
   Longest Side = AC
55. AB = 5cm
56. 50°, 50°
57. \(\angle BAC = 90^\circ\)
58. 75°
59. (a) (i) and (iii)
   (b) \(\triangle ABC \cong \triangle QRP\) (SAS Congruency)
   (c) BC = PR
PRACTICE TEST

Time : 50 Min. Triangles M.M. 20

1. Find the measure of each exterior angle of an equilateral triangle. (1)

2. Which of the following is not a criterion for congruence of triangles? (1)
   
   (a) SSA  (b) SAS  
   (c) ASA  (d) SSS

3. In a \( \triangle ABC \), if \( AB = AC \) and \( \angle A = 70^\circ \). Find \( \angle B \) and \( \angle C \). (2)

4. The vertical angle of an isosceles triangle is 100°. Find its base angles. (2)

5. In the given figure, \( ABC \) is a triangle in which \( AB = AC \), side \( BA \) is produced to \( D \) such that \( AB = AD \). Prove that \( \angle BCD = 90^\circ \). (3)

6. In the given figure, if \( AB = BC \) and \( \angle A = \angle C \). Then find the value of \( x \). (3)

7. In the given figure, \( C \) is the midpoint of \( AB \), if \( \angle DCA = \angle ECB \) and \( \angle DBC = \angle EAC \), Prove that \( DC = EC \) and \( BD = AE \). (4)

8. In the given figure \( ABC \) is a right angled triangle, right angled at \( C \). \( M \) is the midpoint of hypotenuse is joined to \( M \) and produced to a point \( D \) such that \( DM = CM \). \( D \) is joined to \( B \).
Show that \( CM = \frac{1}{2} AB \). (4)
CHAPTER-8

QUADRILATERAL

MIND MAPPING

Trapezium

QUADRILATERAL

PARALLELOGRAM

RHOMBUS

RECTANGLE

SQUARE
CHAPTER-8
QUADRILATERAL

KEY POINTS

1. Quadrilateral: A closed figure bounded by four line segments. In a quadrilateral are

   i) Two pairs of opposite sides (no common point)
      e.g. AB & CD, BC & AD
   ii) Two pairs of opposite angles ∠A & ∠C and ∠B & ∠D.
   (iii) Four pairs of adjacent sides AB & BC, BC & CD, CD & AD and AD & AB (one common point)
   (iv) Four pairs of adjacent angles ∠A & ∠B, ∠B & ∠C, ∠C & ∠D, ∠D & ∠A.
   (v) Line segment joining opposite vertices called diagonal of quadrilateral. e.g., AC & BD.
   (vi) Sum of the angles of a quadrilateral is 360°, ∠A + ∠B + ∠C + ∠D = 360°.

2. Parallelogram: A quadrilateral is a parallelogram if.
   • Opposite sides are equal or
   • Opposite angles are equal or
   • Diagonals bisects each other or
   • One pair of opposite sides is equal and parallel
3. A diagonal of a parallelogram divides it into two congruent triangles. Examples of parallelogram:

Square
Rhombus
Rectangle

4. Theorem: A line segment joining the mid points of the two sides of a triangle is parallel to the third side and is half of it. If D & E are mid points then DE \parallel BC and DE = \frac{1}{2} BC.

5. Converse of mid point theorem.
   The line drawn through the mid point of one side of a triangle, parallel to another side bisects the third side.

PART-"A"

1. Three angles of a quadrilateral are 75°, 90°, 75° the fourth angle is
   a) 90° b) 95°
   c) 105° d) 120°

2. ABCD is a rhombus such that \angle ACB = 40° the \angle ABD is
   a) 40° b) 45°
   c) 50° d) 60°

3. The bisector of the angles of a parallelogram enclose a
   a) Parallelogram b) Square
   c) Rhombus d) Rectangle

4. The figure obtained by joining the midpoints of the sides of quadrilateral taken in order is a
   a) Square b) Parallelogram
   c) Rectangle d) Rhombus
5. The diagonals $AC$ and $BD$ of a parallelogram $ABCD$ intersect each other at point “O” If $\angle DAC = 32^\circ$ and $\angle AOB = 70^\circ$ then $\angle DBC$ is equal to:
   a) $24^\circ$  
   b) $86^\circ$  
   c) $38^\circ$  
   d) $32^\circ$

6. The angles of a quadrilateral are in the ratio $3 : 4 : 5 : 6$. The respective angles of the quadrilateral are
   a) $60^\circ, 80^\circ, 100^\circ, 120^\circ$
   b) $120^\circ, 100^\circ, 80^\circ, 60^\circ$
   c) $120^\circ, 60^\circ, 80^\circ, 100^\circ$
   d) $80^\circ, 120^\circ, 100^\circ, 60^\circ$

7. Line segment joining the mid points of two sides of a triangle is parallel to the third side and _____________ of it.
   a) Trisect  
   b) Bisect  
   c) Half  
   d) One Fourth

8. If two consecutive sides of a rhombus are represented by $3x - 6$ and $x + 14$ then the perimeter of the rhombus is
   a) 10  
   b) 24  
   c) 70  
   d) 96

9. Points A, B, C and D are midpoints of the sides of square PQRS. If the area of PQRS is 36 Sqcm, the area of ABCD is ________ Sqcm
   a) $9\sqrt{2}$  
   b) $18\sqrt{2}$  
   c) 9  
   d) 18

10. The perimeter of a rhombus is 60cm. If the length of its longer diagonal measures 24cm, the length of the shorter diagonal is ________ cm.
    a) 20  
    b) 18  
    c) 15  
    d) 9

11. Which statement is true about all parallelogram
    a) The diagonals are congruent.
    b) The area is the product of two adjacent sides
    c) The opposite angles are congruent
    d) The diagonals are perpendicular to each other.
12. In the given figure \(ABCD\) is a rectangle \(m \angle ADE = 30^\circ\) and \(m \angle CFE = 150^\circ\). What is \(m \angle DEF\)
   a) 90° 
   b) 75° 
   c) 110° 
   d) 85°

13. Given four points \(A, B, C, D\) such that three points \(ABC\) are collinear. By joining these points in order to get a closed figure, we get.
   a) A Straight Line 
   b) A Triangle 
   c) A Quadrilateral 
   d) None of these

14. Consecutive angles of parallelogram are
   a) Equal 
   b) Complimentary 
   c) Supplementary 
   d) None of these

15. In parallelogram \(ABCD\), bisectors of angles \(A\) and \(B\) intersect each other at “O” the value of angle \(AOB\) is.
   a) 90° 
   b) 30° 
   c) 60° 
   d) 120°

16. If an angle of a parallelogram is two-third of its adjacent angle the smallest angle of the parallelogram is
   a) 108° 
   b) 54° 
   c) 81° 
   d) 72°

17. A parallelogram must be a rectangle if its diagonals
   a) Bisect each other 
   b) Are congruent 
   c) Are Perpendicular to each other 
   d) None of these

18. In the given figure \(PQRS\) is a rhombus, then the value of \(x\) is
   a) 40° 
   b) 50° 
   c) 60° 
   d) 80°
19. If in a rectangle $ABCD$, diagonal $AC$ bisect $\angle A$ as well as $\angle C$ then $ABCD$ is a
   a) Parallelogram   b) Square
   c) Rhombus   d) Trapezium

20. Two adjacent angles in a parallelogram are in the ratio $2 : 4$. The values of angles are
   a) $80^\circ, 100^\circ$   b) $40^\circ, 140^\circ$
   c) $60^\circ, 120^\circ$   d) $70^\circ, 140^\circ$

21. Which of the following statements are True (T) and which are false (F)?
   a) In a parallelogram, the diagonals are equal ( )
   b) In all the angles of a quadrilateral are equal it is a parallelogram ( )
   c) The diagonals of parallelogram bisect each other ( )
   d) The diagonals of rhombus are equal ( )
   e) All the angles of parallelogram are acute angles ( )
   f) In a trapezium both pair of opposite sides are parallel ( )

22. In a rhombus $ABCD$, if $\angle A = 60^\circ$ find $\angle B$, $\angle C$ & $\angle D$.

23. The angles of a quadrilateral are in the ratio $1:2:4:5$. Find the measure of each angle.

24. If in a rhombus $LMNP$, $\angle LNM = 40^\circ$ then what is the measure of $\angle LPM$?

25. In a parallelogram if all the four angles are in the ratio $1:1:1:1$ then, what type of parallelogram is this?

26. In the figure, $AB \parallel CD$, what will be the measure of $\angle ADC$?

27. In the figure, if $D$ & $E$ are respectively the mid points of $AB$ & $AC$, what will be the length of $ED$?
28. PQRS is a rhombus with $\angle QPS = 50^\circ$. Find $\angle RQS$.

29. In the figure, ABCD is a parallelogram find value of $(x + y)$.

30. In the figure line $\ell \parallel m$ and $p \parallel q$, $\angle BCD = 108^\circ$ find all four angles of quadrilateral ABCD.

31. If two adjacent angles of a parallelogram ABCD are in the ratio 5:4, find all the angles of the parallelogram.

**Part – B**

32. Prove that the sum of all the four angles of a quadrilateral is 360:

33. Show that opposite angles of a parallelogram are equal.

34. In a parallelogram ABCD $\angle B=110^\circ$ determine the measure of $\angle A$ and $\angle D$.

35. In the figure if PQRS is a parallelogram, then find the value of $x$ & $y$.

36. The diagonals of a parallelogram ABCD intersect at O. A line through O intersects AB at X & DC at Y. Prove that $OX=OY$. 
37. In a parallelogram ABCD diagonals AC and BD intersect at O and AC = 7.4 cm. and BD = 6.2 cm. Find the length of AO and BO.

38. Two opposite angles of a parallelogram are (5x-3) and (4x+12). Find the measure of each angle of the parallelogram.

39. Diagonals of a quadrilateral ABCD bisect each other if ∠A=35° determine ∠B.

40. The perimeter of a parallelogram is 30cm. If longer side is 9.5 cm then find the length of shorter side.

41. In a parallelogram ABCD diagonals AC and BD intersects at O and AC=12.6 cm and BD = 9.4 cm. Find the measures of OC and OD.

42. ABCD is a rhombus in which DO = 3x & AO = 4x, find perimeter of quadrilateral ABCD.

43. The angles of a quadrilateral are (x+20), (x–20), (2x+5), (2x–5). Find the value of x.

Part – C

44. In the figure P is the mid point of side BC of a parallelogram ABCD such that ∠BAP = ∠DAP prove that AD = 2CD.

45. In the adjoining figure if PQRS is a parallelogram where ∠PQR = 100 and ∠SPR = 40. Find ∠PRQ and ∠SRQ.

46. Prove that the line segment joining the mid points of two sides of a triangle is parallel to the third side.
47. In the given figure L, M, and N are mid point of the sides PQ, PR and QR respectively of \( \triangle PQR \). If PQ = 4.4cm, QR = 5.6 cm and PR = 4.8cm then find the perimeter of \( \triangle LMN \).

![Diagram of \( \triangle LMN \)]

48. A quadrilateral is a parallelogram if one pair of opposite sides are equal and parallel. Prove it.

49. If the diagonals of a quadrilateral bisect each other then quadrilateral is a parallelograms. Prove it.

50. In a parallelograms PQRS, M and N are points on PQ and RS such that PM = RN. Prove that MS II NQ.

51. In a parallelogram ABCD, AP and CQ are drawn perpendiculars from vertices A and C on diagonal BD. Prove that \( \triangle APB \cong \triangle CQD \).

52. The diagonals of a rectangle ABCD meet at O. If \( \angle BOC = 50^\circ \) then find \( \angle ODA \).

![Diagram of rectangle ABCD]

53. In the given figure AD and BE are the medians of \( \triangle ABC \) and BE || DF prove that CF = 1/4 AC.

![Diagram of \( \triangle ABC \) with medians]
Part – D

54. In the figure LMNO, is a trapezium in which LM is parallel to side ON and P is the mid point of side LO. If Q is a point on the side MN such that segment PQ is parallel to side ON Prove that Q is the mid point of MN and PQ = 1/2 (LM + ON).

55. In the figure, \( \triangle ABC \) is right angled at B. If AB=9 cm AC = 15 cm. and D and E are the mid points of AB & AC respectively calculate.

   (i) The length of BC

   (ii) The area of trapezium BCED

56. A farmer has divided his field into three parts as in the figure. Ist part is used to take care of his cattles. While II and III are used to grow two different crops.

   Answer the following :

   i) How much area has been used to take care for cattles ?

   ii) Are the two areas part II and part III equal? Justify.

   iii) What is the total area of the field?
57. ABCD is a parallelogram. Side AB is produced on both sides to E & F as in figure such that BE = BC & AF = AD. Show that EC & FD when produced meet at right angle.

58. P is mid point of side CD of a parallelogram ABCD. A line through C parallel to PA intersects AB at Q & DA produced at R. Prove that DA = AR & CQ = QR.
CHAPTER-8
QUADRILATERALS

ANSWERS

1. d) 120°
2. c) 50°
3. a) Parallelogram
4. b) Parallelogram
5. c) 38°
6. a) 60°, 80°, 100°, 120°
7. c) Half
8. d) 96
9. d) 18
10. b) 18
11. c) The opposite angles are congruent
12. a) 90°
13. b) A Triangle
14. c) Supplementary
15. a) 90°
16. d) 72°
17. c) Are Perpendicular to each other
18. a) 40°
19. c) Rhombus
20. c) 60°, 120°
21. (a) T (b) F (c) T (d) F (e) F (g) F
22. 120°, 60°, 120°
23. 30°, 60°, 120°, 150°
24. 100°
25. Rectangle
26. 115°
27. 5 cm
28. 65°
29. 200°
30. 108°, 72°, 108°, 72°
31. 100°, 80°, 100°, 80°
32. Prove
33. Prove
34. $70^\circ, 110^\circ$
35. $x = y = 4$
36. Prove
37. $3.7\text{cm}, 3.1\text{cm}$
38. $72^\circ, 108^\circ, 72^\circ, 108^\circ$
39. $145^\circ$
40. $5.5\text{cm}$
41. $6.3\text{cm}, 4.7\text{cm}$
42. $20x \text{ units}$
43. $x = 60^\circ$
44. Prove
45. $40^\circ - 80^\circ$
46. Prove
47. $7.4\text{cm}$
48. Prove
49. Prove
50. Prove
51. Prove
52. $65^\circ$
53. Prove
54. Prove
55. $12\text{cm}, 40.5\text{cm}^2$
56. (i) $300 \text{ m}^2$
   (ii) Yes
   (iii) $7500 \text{ m}^2$
57. Prove
58. Prove
PRACTICE TEST

Quadrilaterals

1. If the diagonals of a quadrilateral ABCD bisect each other & \( \angle A = 45^\circ \), what is \( \angle B \)?

2. The angles of a Quadrilateral ABCD are in the ratio 2 : 3 : 5 : 8. Find the measure of smallest angle.

3. In a \( \triangle PQR \), median PS is produced to a point T such that PS = ST. Prove that PQTR is a parallelogram.

4. In the Fig. PQRS is a rhombus in which the diagonal PR is produced to T. If \( \angle SRT = 152^\circ \), find x & y.

5. ABCD is a square. A line BM intersects CD at M and the diagonal AC at O such that \( \angle AOB = 70^\circ \), find a

6. AD is median of \( \triangle ABC \) & E is the mid point of AD. BE is produced to meet AC in F. Prove that AF = \( \frac{1}{3} \) AC.

7. Show that the bisectors of angles of a parallelogram forms a rectangle.

8. Show that the quadrilateral formed by joining the mid point of the sides of a square is also a square.
CHAPTER-9
AREAS OF PARALLELOGRAMS AND TRIANGLES

MIND-MAPPING

Same Base CD and Parallel Lines AQ || CD
Parallelograms : ABCD and PQCD
\( \text{ar (ABCD)} = \text{ar (PQCD)} \)

Triangles on Same Base : \( \triangle RDC \) and \( \triangle EDC \)
\( \text{ar (\( \triangle RDC \))} = \text{ar (\( \triangle EDC \))} \)
\( \therefore \text{ar (\( \triangle RDC \))} = \frac{1}{2} \text{ar (ABCD)} = \frac{1}{2} \text{ar (PQCD)} = \text{ar (\( \triangle EDC \))} \)

Same Base CD and Parallel Lines AB || CD

Triangles on Same Base = \( \triangle RDC \) and \( \triangle EDC \)
\( \text{ar (\( \triangle RDC \))} = \text{ar (\( \triangle EDC \))} \)
Also \( \text{ar (\( \triangle RDC \))} = \frac{1}{2} \text{ar (ABCD)} = \text{ar (\( \triangle EDC \))} \)

Same Base CD and Same Parallel Lines PQ || DC

Triangles on same base = \( \triangle RDC \) and \( \triangle EDC \)
\( \text{ar (\( \triangle RDC \))} = \text{ar (\( \triangle EDC \))} \)
Also \( \text{ar (\( \triangle RDC \))} = \frac{1}{2} \text{ar (PQCD)} = \text{ar (\( \triangle EDC \))} \)

Class IX - Mathematics
KEY POINTS

1. Parallelograms on the same base and between same parallels are equal in area.

Two parallelograms ABCD and EFCD on the same base DC and between same parallels AF and DC

\[ \text{ar (ABCD)} = \text{ar (EFCD)} \]

![Diagram of parallelogram](image)

2. Two triangles on the same base and between the same parallels are equal in area.

Two triangles ABC and PBC on the same base BC and between same parallels BC and AP in the given figure then \[ \text{ar (\triangle ABC)} = \text{ar (\triangle PBC)} \]

![Diagram of triangle](image)

3. If a triangle and a parallelogram are on the same base and between the same parallels then the area of the triangle is half of the area of parallelogram.

\[ \text{ar (\triangle LAB)} = \frac{1}{2} \text{ar (ABCD)} \]

![Diagram of triangle and parallelogram](image)

4. The median of a triangle divides it into two triangles of equal area.
PART – A

1. Which of the following figures don't have equal areas if both the figures are on same base and between same parallels?
   a) Two parallelograms  
   b) One parallelogram and one rectangle  
   c) Two Triangles  
   d) One parallelogram and one triangle

2. Which statement is true?
   a) Two congruent figures have always equal areas.  
   b) Two figures having equal areas are always congruent.  
   c) A triangle and a quadrilateral can be congruent.  
   d) Two congruent figures have only some of its parts equal.

3. Δ DEF is divided into two triangles ΔDEM and Δ DFM of equal areas. Which of the following statement is true?
   a) Δ DEM and Δ DFM have equal bases.  
   b) \( \text{ar} (\triangle DEM) = \frac{1}{3} \text{ar} (\triangle DEF) \)  
   c) M is the mid - point of side EF.  
   d) Δ DEM and Δ DFM and congruent.

4. The ratio of the areas of the triangle and a parallel between same parallels and on the same base is:
   a) 1 : 2  
   b) 4 : 1  
   c) 2 : 1  
   d) 1 : 4

5. The area of a parallelogram PQRS is 36 cm². M is any point on the side RS. The area of ΔPMQ is.
   a) 18 cm²  
   b) 9 cm²  
   c) 36 cm²  
   d) 12 cm²

6. AY and BZ are the diagonals of a parallelogram ABYZ, intersecting at O. \( \text{ar} (\triangle BYZ) = ? \)
   a) greater than \( \text{ar} (\triangle ABZ) \)  
   b) is equal to \( \text{ar} (\triangle BOA + \triangle BOY) \)  
   c) more than \( \text{ar} (\triangle BOA + \triangle BOY) \)  
   d) less than \( \text{ar} (\triangle BOA + \triangle BOY) \)

7. AD is the median of ΔABC and E is any point on AD. Which of the
The following statement is true?

a) \( \text{ar (\Delta ABD) > ar (\Delta ACD)} \)
b) \( \text{ar (\Delta ABD) < ar (\Delta ACD)} \)
c) \( \text{ar (\Delta ABE) = ar (\Delta CED)} \)
d) \( \text{ar (\Delta ABE) = ar (\Delta ACE)} \)

8. In the given figure \( \text{ar (\Delta ABC) = ar (\Delta ADE)} \). AC is the median of \( \Delta ADE \). If \( \text{ar (ACE)} = 14 \text{ cm}^2 \) then \( \text{ar (\Delta ABC)} = ? \)

a) 14 cm\(^2\)  
b) 7 cm\(^2\)  
c) 21 cm\(^2\)  
b) 28 cm\(^2\)  

9. In the given figure \( \text{ar (DEFG)} = 40 \text{ cm}^2 \), then \( \text{ar (HDG) + ar (HEF)} = ? \)

a) 10 cm\(^2\)  
b) 20 cm\(^2\)  
c) 30 cm\(^2\)  
d) 40 cm\(^2\)  

10. In the given figure PQRS is a parallelogram. Which of the following statements is true

a) \( QZ = RZ \)
b) \( \text{ar (\Delta PYS) = ar (PQRS)} \)
c) \( \text{ar (\Delta PQZ) = \frac{1}{2} ar (PQRS)} \)
d) \( \angle PQZ = \angle YRZ \)

11. STEP is a parallelogram and \( \text{ar (STEP)} = 84 \text{ cm}^2 \). The length of the altitude of \( \Delta APE \) is

a) \( \frac{7}{4} \text{ cm} \)  
b) \( \frac{7}{2} \text{ cm} \)  
c) 7 cm  
d) 14 cm

12. M, A and P are the mid-points of the sides DE, DF and EF of \( \Delta DEF \) respectively. Which of the following statements is true?
a) \( \text{ar}(\triangle MFP) = 2 \text{ar}(\triangle DEF) \)
b) \( \text{ar}(\triangle MPF) = \frac{1}{2} \text{ar}(\triangle DEF) \)
c) \( \text{ar}(\triangle AMP) = \frac{1}{4} \text{ar}(\triangle DEF) \)
d) \( \text{ar}(\triangle MPF) = \frac{1}{2} \text{ar}(\triangle DEF) \)

13. STOP is a rectangle STAR is a parallelogram in the given figure. Which of the following statement is true?
   a) Perimeter (STAR) > Perimeter (STOP)
   b) Perimeter (STAR) < Perimeter (STOP)
   c) Perimeter (STAR) = Perimeter (STOP)
   d) Perimeter (STAR) = \( \frac{1}{2} \) Perimeter (STOP)

Fill in blanks:

14. The area of a parallelogram is the product of any of its sides and its corresponding ________________

15. The area of parallelogram on the same base and between the same ________________ are equal.

16. The diagonal of a parallelogram divides it into triangles having equal ________________.

17. Area of trapezium = \( \frac{1}{2} \times \text{height} \times \__________ \)

   State True or False:

18. The median of a triangle divides it into two triangles of equal area.

19. The diagonals of a parallelogram are equal.

20. If both the diagonals of a quadrilateral divides it into four triangles of equal area, then the quadrilateral is a rhombus.

21. If area of Parallelogram ABCD is 80 cm². Find the area of \( \triangle APD \).
22. If area of Parallelogram PQRS is 88 cm² find K.

23. PQRS is a Parallelogram and PQM is a triangle. If area of PQM = 18 cm². Find the area of PQRS.

24. In ΔABC, AD is median. If area of ΔABD = 25 cm² find the area of ΔABC.

25. In the given figure area of ΔSRN = 21 cm² RQ = 6 cm find PQ.

26. In the figure ABCD and ABFE are Parallelograms then find ar (ΔBCF).

   If ar (ABCE) = 18 cm²

   ar (ABCD) = 25 cm²

27. If two parallelogram are on equal base and between the same parallels, then what is the ratio of their areas?
28. In \(\triangle ABC\), D, E, F are respectively the mid points of the sides AB, BC and AC. Find ratio of the area of \(\triangle DEF\) and area of \(\triangle ABC\).

29. If the base of a parallelogram is 8 cm and its altitude is 5 cm then find its area.

30. If two triangles are on the same base and between the same parallels. Then find the ratio of area of the two triangles.

31. In given figure. If area of parallelogram ABCD is 30 cm\(^2\) then find ar \((\triangle ADE) + \text{ar} \,(\triangle BCE)\)

![Parallelogram ABCD]

**Part – B**

32. Show that the median of a triangle divides it into two triangles of equal areas.

33. P and Q are any two points lying on the side DC and AD respectively of a parallelogram ABCD. Show that ar \((\text{APB}) = \text{ar} \,(\text{BQC})\).

34. If the ratio of altitude and area of the parallelogram is 2:11 then find the length of the base of parallelogram.

35. In figure if PQRS is a parallelogram in which PQ=12cm, ST=9cm, QM=6cm, ST \(\perp\) PQ, QM \(\perp\) SP then find length of SP.

![Parallelogram PQRS]

36. In given fig. ABCD is a square whose diagonals are interesting at O. If OD = 2 cm then find the length of AB.

![Square ABCD]

Class IX - Mathematics
37. Show that the diagonals of a parallelogram divides it into four triangles of equal area.

38. M is any point on the median AD of \( \triangle ABC \). Show that \( \text{ar (AMB)} = \text{ar (AMC)} \).

39. If D, E and F are respectively the mid points of sides BC, CA, and AB of \( \triangle ABC \) show that.
   i) BDEF is a parallelogram.
   ii) \( \text{ar (DEF)} = \frac{1}{4} \text{ar (\( \triangle ABC \))} \)

40. In the given figure BC = CD = DE

   M is the mid point of CD then find the area of \( \triangle AMC \).

41. ABCD is a parallelogram. Through point A, a line AEF is drawn to meet BC at E. DC produced to meet at F. Show that \( \text{ar (\( \triangle BEF \))} = \text{ar (\( \triangle DCE \))} \).

42. In the given figure, the area of parallelogram ABCD is 40 cm\(^2\). If MN is a median of \( \triangle CDN \) then find the area of \( \triangle NDM \).
Part-C

43. In the figure, P is the point in the interior of parallelogram ABCD then show that

(i) \( \text{ar (APB)} + \text{ar (PCD)} = \frac{1}{2} \text{ar (ABCD)} \)

(ii) \( \text{ar (APD)} + \text{ar (PBC)} = \text{ar (APB)} + \text{ar (PCD)} \)

44. ABCD is a trapezium in which the AB \( \parallel \) DC. If diagonal AC and BD intersect at O. Prove that \( \text{ar (AOD)} = \text{ar (BOC)} \).

45. ABCD is a parallelogram whose diagonals AC and BD intersect at O. A line through O intersects AB at P and DC at Q. Prove that \( \text{ar (APOA)} = \text{ar (APOC)} \).

46. Diagonal PR and QS of quadrilateral PQRS intersects at T such that PT = TR and PS = QR, show that \( \text{ar (PTS)} = \text{ar (RTQ)} \).

47. In the figure, ABC and ABD are two triangles on the same base AB. If line segment CD bisects AB at O show that \( \text{ar (ABC)} = \text{ar (ABD)} \).

48. In given figure AD is median of \( \triangle ABC \). Prove that \( \text{ar (ABD)} = \text{ar (AOD)} \).

Class IX - Mathematics
Part – D

49. Prove that parallelogram on the same base and between same parallels are equal in area.

50. Prove that the two triangles on the same base and between the same parallels are equal in area.

51. If a triangle and parallelogram are on the same base and between the same parallels then prove that the area of triangle is equal to the half the area of parallelogram. Using this find ar (\(\triangle CMD\)).

52. XY is a line parallel to side BC of a triangle ABC. If BE \( \parallel \) AC and CF \( \parallel \) AB meet XY at E and F respectively show that ar (ABE) = ar (ACF).

53. If E, F, G and H are respectively the mid points of the sides of a parallelograms ABCD. Show that ar (EFGH) = 1/2 ar (ABCD).

54. There is a plot in a village in the shape of a quadrilateralABCD. Head of the village wants to get floor cemented so as to use it for panchayat meetings.

Later he decided to construct playground of shape \(\triangle ABP\) for children. If AC \parallel DP then

(a) Prove than ar (ABCD) = ar (ABP)

(b) area (ABCD) = 2x_______

55. A farmer has a square plot of land where he wants to grow five different crops at a time. On half of the area in the middle he want to grow different crops.
a) Explain by diagram how he can divide the area to fulfill his purpose.

b) For same base and between the same parallels write the relation between area of triangle and parallelogram formed.

56. In the adjoining figure, the point D divides the side BC of \( \triangle ABC \) in the ratio \( m:n \). Prove that \( \text{ar} (\triangle ABD) : \text{ar} (\triangle ADC) = m : n \).

57. \( ABCD \) is a parallelogram. \( E \) is a point on \( BA \) such that \( BE = 2EA \) and \( F \) is a point on \( DC \) such that \( DF = 2FC \). Prove that \( AECF \) is a parallelogram whose area is one third of the area of parallelogram \( ABCD \).

58. In the adjoining figure, two parallelogram \( ABCD \) and \( AEFB \) are drawn on opposite sides of \( AB \). Prove that

\[
\text{ar}(\square ABCD) + \text{ar}(\square AEFB) = \text{ar}(\square EFCB)
\]
59. In the given figure BC \parallel XY, BX \parallel CA and AB \parallel YC. Prove that \text{ar} (\triangle ABX) = \text{ar} (\triangle ACY)

60. In the given figure, \text{ar} (\triangle DRC) = \text{ar} (\triangle DPC) and \text{ar} (\triangle BDP) = \text{ar} (\triangle ARC). Show that both the quadrilateral ABCD and DCPR are trapeziums.
CHAPTER-9
AREAS OF PARALLELOGRAMS TRIANGLES

ANSWERS

1. d) One parallelogram and one triangle
2. a) Two congruent figures have always equal areas.
3. c) M is the mid - point of side EF.
4. a) 1 : 2
5. a) 18 cm²
6. b) is equal to ar (∆ BOA + ∆ BOY)
7. d) ar (∆ ABE) = ar (∆ ACE)
8. b) 28 cm²
9. b) 20 cm²
10. d) ∠PQZ = ∠YRZ
11. c) 7 cm
12. b) ar (AMPF) = \(\frac{1}{2}\) ar (∆ DEF)

13. A) Per (STAR) > Per (STOP)
14. altitude
15. parallels
16. areas
17. distance between the parallels
18. True
19. False
20. False
21. 40 cm²
22. 11 cm
23. 36 cm²
24. 50 cm²
25. 7 cm
26. 7 cm²
27. 1 : 1
28. 1 : 4
29. 40 cm²
30. 1 : 1
31. 15 cm²
34. $\frac{11}{2}$ units
35. 18 cm
36. $\sqrt{8}$ cm
39. $\frac{1}{6}$ $\triangle$ ABC
42. 10 cm²
51. 16 cm²
54. $\text{ar (ADPC)} = 2 \times \text{ar (}\triangle\text{ACD)}$
55. Area of triangle =
   \[\frac{1}{2} \times \text{area of parallelogram}\]
PRACTICE TEST
AREAS OF PARALLELOGRAMS & TRIANGLES

Time : 50 Min.                             M.M. 20

1. If area of parallelogram ABCD is 96 cm$^2$, find K.

2. If area of parallelogram ABCD is 60 cm$^2$. Find area of $\triangle APD$.

3. Show that the median of a triangle divides it into two triangles of equal area.

4. In figure if PQRS is a parallelogram in which PQ = 12 cm, ST = 9 cm QM = 6 cm, ST $\perp$ PQ, QM $\perp$ SP, then find length of SP.

5. The base BC of $\triangle ABC$ is divided at D. Such that BD = $\frac{1}{2}$ DC. Prove that $\text{ar}(\triangle ABD) = \frac{1}{3} \text{ar}(\triangle ABC)$

6. ABCD is a parallelogram and O is a point in the interior. Prove that $\text{ar}(\triangle AOB) + \text{ar}(\triangle COD) = \text{ar}(\triangle AOD) + \text{ar}(\triangle BOC)$

7. In the adjoining figure, PQ is a line parallel to the side BC to $\triangle ABC$. If BX $\parallel$ CA and Cy $\parallel$ BA meet the line PQ produced in X and Y respectively. Show that $\text{ar}(\triangle ABX) = \text{ar}(\triangle ACY)$

8. Prove that parallelogram on the same base and between same parallels are equal in area.

Class IX - Mathematics
Centre of Circle = O
Radius of Circle = OP = OQ = OM = ON = r
Diameter of Circle = PQ = d = 2r
Chord of Circle = AB
Sector of Circle = MON = Region
= between two radii and Corresponding are
Segment = ACB
Region between
Chord and Corresponding
Cyclic Quadrilateral :-
If the sum of pair of opposite angles
of quadrilateral is 180° = □PABQ
CHAPTER-10
CIRCLES
KEY POINTS

- The collection of those points in a plane which are at a fixed distance from a given fixed point is called a circle. The fixed point is called centre of the circle and the fixed distance is called radius.

Circle and related Terms!

- There is one and only one circle passing through three non-collinear points.
- Equal chords of a circle subtends equal angles at centre.
- If angles subtended by chords at centre are equal then chords are equal.
- The perpendicular from centre to a chord of a circle, bisects the chord.
• The line joining the centre of a circle to the mid point of a chord is perpendicular to the chord.

• Equal chords of a circle are equidistant from centre.
• Chords equidistant from centre are equal in length.

• If two chords of a circle are equal then corresponding arcs are equal.
• If arcs of a circle are equal then corresponding chords are also equal.

• Congruent arcs (or equal arcs) of a circle subtends equal angles at centre.
  \[ \angle AOB = \angle COD \]

• The angle subtended by an arc at the centre of circle is twice the angle which is subtended at remaining part of the circle.
  \[ \angle AOB = 2\angle APB \]
• Any two angles in the same segment of the circle are equal.
  \[ \angle APB = \angle AQB \]

• Angle in semi circle is right angle.
  \[ \angle APB = 90^\circ \]

• In a cyclic quadrilateral the sum of opposite angles is \(180^\circ\).
  \[ \angle A + \angle C = 180^\circ \]
  \[ \angle B + \angle D = 180^\circ \]

• If sum of opposite angles of a quadrilateral is \(180^\circ\) then that quadrilateral is cyclic quadrilateral.

PART – A

1. In fig. AOB is a diameter of the circle and \(AC = BC\) the \(\angle CAB\) is equal to:
   a) \(30^\circ\)  
   b) \(45^\circ\)  
   c) \(60^\circ\)  
   d) \(90^\circ\)

2. In fig. AB and CD are two equal chords of a circle with centre O. OP and OQ are perpendiculrars on chords AB and CD respectively. If \(\angle POQ = 150^\circ\) then \(\angle APQ\) is equal to
   a) \(30^\circ\)  
   b) \(75^\circ\)  
   c) \(15^\circ\)  
   d) \(60^\circ\)
3. Angles in the same segment of a circle are
   a) Equal                    b) Complementary
   c) Supplementary            d) Vertically Opposite Angles

4. In fig, if OA = 5cm, AB = 8cm and OD is perpendicular to AB. Then CD is equal to:
   a) 2 cm                    b) 3 cm
   c) 4 cm                    d) 5 cm

5. The radius of a circle is 13cm and the length of one of its chords is 10cm. The distance of the chord from the centre is:
   a) 11.5 cm                 b) 12 cm
   c) √69 cm                  d) 23 cm

6. In fig, if ∠ABC = 20°, then ∠AOC is equal to
   a) 20°                     b) 40°
   c) 60°                     d) 10°

7. If AB = 12cm, BC = 16cm and AB is perpendicular to BC, then the radius of the circle passing through the point A, B and C is:
   a) 6 cm                    b) 8 cm
   c) 10 cm                   d) 12 cm

8. In the given figure, AB is chord of a circle with centre O and AB is produced to C such that BC = OB. Also, CO is joined and produced to meet the circle in D. If ∠ACD = 25°, then ∠AOD?
   a) 50°                     b) 75°
   c) 90°                     d) 100°
9. AD is a diameter of a circle and AB is a chord. If AD = 34 cm, AB = 30 cm the distance of AB from the center of the circle is:
   a) 17 cm  
   b) 15 cm  
   c) 4 cm   
   d) 8 cm

10. In the given figure; ∠DAB = 60° and ∠ABD = 50° then ∠ACB = ?
   a) 50°  
   b) 60°  
   c) 70°  
   d) 80°

11. In fig. ∠AOB = 90° and ∠ACB = 30°, then ∠CAO is equal to:
   a) 30°  
   b) 45°  
   c) 90°  
   d) 60°

12. In the given figure O is the center of a circle and ∠BAC = 40°, then ∠OBC = ?
   a) 40°  
   b) 50°  
   c) 80°  
   d) 20°

13. An equilateral triangle of side 9 cm is inscribed in a circle. The radius of the circle is:
   a) 3 cm  
   b) $3\sqrt{2}$ cm  
   c) $3\sqrt{3}$ cm  
   d) 6 cm

14. In fig. BC is a diameter of the circle and ∠BAO = 60° Then ∠ADC is equal to:
   a) 30°  
   b) 60°  
   c) 120°  
   d) 45°
15. In the given figure, the measure of $\angle BCD$ is
   a) $80^\circ$  b) $30^\circ$
   c) $70^\circ$  d) $100^\circ$

16. In the given figure $ABCD$ and $ABEF$ are cyclic quadrilaterals. If $\angle BCD = 110^\circ$ then $\angle BEF =$ ?
   a) $110^\circ$  b) $55^\circ$
   c) $90^\circ$  d) $70^\circ$

17. $ABCD$ is a cyclic quadrilateral such that $AB$ is a diameter of the circle circumscribing it and $\angle ADC = 140^\circ$, then $\angle BAC$ is equal to :
   a) $80^\circ$  b) $30^\circ$
   c) $50^\circ$  d) $40^\circ$

18. The length of the chord which is at a distance of $12$ cm from the centre of a circle of radius $13$ cm is :
   a) $5$ cm  b) $10$ cm
   c) $12$ cm  d) $13$ cm

19. In the given figure, $\angle ECB = 40^\circ$ and $\angle CEB = 105^\circ$ Then, $\angle EAD =$ ?
   a) $35^\circ$  b) $20^\circ$
   c) $50^\circ$  d) $40^\circ$

20. In the following figure, $BC =$ radius $OB$. Then find the value of $\angle OCB$.
   a) $69^\circ$  b) $46^\circ$
   c) $92^\circ$  d) $23^\circ
Fill in the blanks :-

21. A segment of a circle is the region between an arc and a ____________ of the circle.

22. An arc of a circle is called a ____________ if the ends of the arc on the ends of a diameter.

23. Two circles having the same centre and different radii are called ____________.

Write T for True and F for False "

24. The degree measure of a semi circle is 180° (T/F)

25. A circle divides the plane into three parts. (T/F)

26. A circle can have only a finite number of equal chords. (T/F)

27. Write True or False and Justify your answer.
   The angles subtended by a chord at any two points of a circle are equal.

28. Through three collinear points a circle can be drawn.

29. If A, B, C and D are four points such that \( \angle BAC = 45^\circ \) and \( \angle BDC = 45^\circ \) then A, B, C, D are concyclic.

30. A circle of radius 3cm can be drawn through two points A, B such that AB = 6cm.

31. If the sum of a pair of opposite angles of a quadrilateral is 180°, then quadrilateral is ____________.

32. A round pizza is cut into 4 equal pieces. What does each piece represent?

33. AD is a diameter of a circle and AB is a chord if AD = 34cm, AB=30 cm then find the distance of AB from the centre of chord.

34. Given two concentric circles with centre O. A line cut the circle at A, B, C and D respectively. If AB = 10cm, then find the length of CD.

35. Find y in given figure

\[
\begin{align*}
&\text{A} \\
&D \\
&\text{B} \\
&\text{C}
\end{align*}
\]
36. Find $x$

![Diagram]

37. Find $x$

![Diagram]

38. Diameter is the _________ Chord of a circle.

39. Circle having the same centre and different radii are called _________ circles.

40. In given figure OC is perpendicular segment drawn from centre O on chord AB. If OB = 5cm, and OC = 3cm then find length of AB.

![Diagram]

41. In given figure O is centre of circle.

If $\angle OAC = 130^\circ$ then find $\angle ABC$

![Diagram]

42. In given figure AOB is diameter of circle & P is any point on the circle. Find $\angle APB$.

![Diagram]
43. Find the value of $x$ in given figure.

44. Prove that cyclic parallelogram is a rectangle.

45. A chord of a circle is equal to the radius of the circle. Find the angle subtended by the chord at a point on the minor arc and also at a point on the major arc.

46. In the following figure, find the value of $\angle BCN$.

47. In the given figure, find the value of reflex angle POR.

48. In given figure ABCD is a cyclic quadrilateral, chords AB and CD are produced to meet E, show that $EA \times EB = EC \times ED$. 
49. Find the value of \( x \) in figure if \( O \) is centre of circle and \( \angle OAB = 50^\circ \).

50. In the given figure, \( O \) is centre of the circle with radius 5 cm, \( OP \perp CD \), \( OQ \perp AB \), \( AB \parallel CD \), \( AB = 6 \) cm and \( CD = 8 \) cm. Determine \( PQ \).

51. In the given figure, \( O \) is the centre of a circle, \( \angle AOB = 90^\circ \), \( \angle BOC = 120^\circ \), what is measure of \( \angle ABC \)?

52. In the given figure \( AB \) and \( CD \) are parallel chords if the length of arc \( AC \) = 14 cm. What is length of \( BD \)?

53. In given figure \( \angle PQR = 100^\circ \) where \( P, Q \) & \( R \) are points on the circle with centre \( O \). Find \( \angle OPR \).
PART-B

54. In the given figure O is centre of circle. If $\angle ABD = 35^\circ$ and $\angle BAD = 70^\circ$, find $\angle ACB$.

55. Match the following Columns.

Column I

(a) Angle in a semicircle measures
(b) In the given figure, O is the centre of a circle. If $\angle AOB = 100^\circ$, then $\angle ACB = ?$
(c) In the given figure, O is the centre of a circle. If $\angle POR = 90^\circ$ and $\angle POQ = 110^\circ$ then $\angle QPR = ?$
(d) In cyclic quadrilateral ABCD, it is given that $\angle ADC = 130^\circ$ and AOB is a diameter of the circle through A, B, C and D, Then $\angle BAC = ?$

Column II

(p) 40°
(q) 80°
(r) 90°
(s) 50°

The correct answer is
a) __________  b) __________  c) __________  d) __________

56. MCQ based on synthesis

Three statements are given below:

(i) If a diameter of a circle bisect each of the two chords of a circle, then the chords are parallel.
(ii) Two circle of radii 10 cm and 17 cm intersect each other and the length of the common chord is 16 cm. Then, the distance between their centres is 23 cm.

(iii) L is the Line intersecting two concentric circles with centre O at point A, B, C and D as shown. Then AC = DB

Which is true?

a) I and II  

b) I and III  

c) II and III  

d) II only  

PART – C

57. In the given figure, O is the centre of a circle prove that \( \angle x + \angle y = \angle z \).

58. If two non parallel sides of a trapezium are equal prove that it is cyclic quadrilateral.

59. In the given figure determine a, b & c if \( \angle BCD = 43^\circ \), \( \angle BAF = 62^\circ \).

60. In the figure P is the centre prove that \( \angle XPD = 2 (\angle XPD + \angle YXZ) \)
61. In the given figure AD is diameter of the circle whose centre is O and AB || CD prove that AB = CD.

![Diagram of a circle with points A, B, Q, O, and D, and lines AB and CD parallel to each other.]

62. In an equilateral triangle, prove that the centroid and the circumcentre coincide.

63. In the given figure A, B, C and D, E, F are two sets of collinear points. Prove that AD || CF.

![Diagram of a set of intersecting circles with points A, B, C, D, E, and F, and lines AD and CF parallel to each other.]

64. In given figure, O is centre of circle and ∠DAB = 50°, calculate the value of x and y.

![Diagram of a circle with points A, B, O, D, and X, and an angle DAB of 50°.]

65. If two equal chords of a circle intersect within the circle prove that the segment of one chord is equal to corresponding segment of other chord.

66. Prove that if a pair of opposite angles of a quadrilateral is supplementary then the quadrilateral is cyclic.

**Part – D**

67. Bisector of angle A, B and C of a ΔABC intersect its circumcircle at D, E and F respectively, prove that the angles of a triangle DEF are

\[ 90° - \frac{1}{2} A, \ 90° - \frac{1}{2} B, \ 90° - \frac{1}{2} C \]
68. Find the sum of the angles in the four segments exterior to a cyclic quadrilateral.

69. Let the vertex of an angle ABC be located outside a circle and let the sides of the angle intersect equal chords AD and CE with the circle. Prove that $\angle ABC$ is equal to half the difference of the angles subtended by the chords AC and DE at the centre.

\[ \angle ABC = \frac{1}{2} [\angle DOE - \angle AOC] \]

70. In the given figure O is centre of the circle of radius 5 cm, OP $\perp$ CD, AB $\parallel$ CD

AB = 6 cm and CD = 8 cm

Determine PQ

71. In the adjoining figure AC is diameter of a circle with centre O and chord BD $\perp$ AC, intersecting each other at E. Find out the values of p, q, r in terms of x, if $\angle AOD = x^\circ$, $\angle BAC = p^\circ$, $\angle ACD = q^\circ$.

72. During a practical activity in maths lab students were using circular geo board. The angle subtended by an arc at the centre is $(2a+50^\circ)$. Pallavi calculated $\angle BAC$ as $(a+25^\circ)$.

a) Is her finding correct? Justify it.

b) Find $\angle BAC$ if $a = 30^\circ$

c) What will be the value of $\angle BOC$ for $a = 15^\circ$

d) If $a = 30^\circ$ then find the measure of Reflex $\angle BOC$. 
73. Show that if two chords of a circle bisect each other, they must be diameters of the circle.

74. Prove that the quadrilateral formed by angle bisectors of a cyclic quadrilateral is also cyclic.

75. Prove that there is one and only one circle can pass through three non-collinear points.

76. In the given figure OPQR is a square. A circle drawn with centre O cuts the square in X and Y. Prove that QX = QY.

77. Prove that the opposite angles of a cyclic quadrilateral are supplementary.

78. In the given figure, AB is a diameter of a circle (o, r) and chord CD = radius oc. If AC and BD when produced meet at P. Prove that ∠APB is constant.

79. Prove that the angle subtended by an arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.
80. In the given figure, AB is a chord of a circle with centre O and AB is produced to C such that BC = OB. Also, CO is joined and produced to meet the circle in D. If ∠ACD = y° and ∠AOD = x°. Prove that x = 3y.

81. Two circles whose centres are O and O’ intersect at P. Through P, a line I parallel to OO’, intersecting the circle at C and D is drawn. Prove that CD = 2OO’.

82. AB and CD are two parallel chords of a circle which are on opposite sides of the centre O such that AB = 10cm, CD = 24cm and the distance between AB and CD is 17 cm. Find the radius of the circle.
PART-D

83. AB and AC are two chords of a circle of radius r such that AB = 2 AC. If p and q are the distance of AB and AC from the centre, Prove that
   \[4q^2 = p^2 + 3r^2\]

84. In figure, O is the centre of the circle, \(\angle BCO = 30^\circ\) Find x and y.

85. In figure, O is the centre of the circle, BD = OD and CD \(\perp AB\), Find \(\angle CAB\).
CHAPTER-10
CIRCLES
ANSWERS

1. b) 45°
2. b) 75°
3. a) Equal
4. a) 2 cm
5. b) 12 cm
6. b) 40°
7. c) 10 cm
8. b) 75°
9. d) 8 cm
10. c) 70°
11. d) 60°
12. b) 50°
13. c) \(3 \sqrt{3}\) cm
14. b) 60°
15. a) 80°
16. a) 110°
17. c) 50°
18. b) 10 cm
19. a) 35°
20. d) 23°
21. Chord
22. Semicircle
23. Concentric
24. True (T)
25. True (T)
26. False (F)
27. False, If two points lie in the same segment (major or minor) only, then the angles will be equal otherwise they are not equal.
28. False, Because a circle through two points cannot pass through a point which is collinear to these two points.
29. True, Angles in the same segment.
30. True, Because AB will be the diameter
31. Cyclic Quadrilateral
32. Sector
33. 8 cm
34. 10 cm
35. \( y = 40^\circ \)
36. \( x = 35^\circ \)
37. \( x = 140^\circ \)
38. longest
39. concentric
40. 8 cm
41. \( 115^\circ \)
42. \( 90^\circ \)
43. \( 60^\circ \)
45. \( 30^\circ, 150^\circ \)
46. \( 70^\circ \)
47. \( 212^\circ \)
49. \( 50^\circ \)
50. 7 cm
51. \( 75^\circ \)
52. 14 cm
53. \( 10^\circ \)
54. \( 75^\circ \)
55. (A) \( - \) (R), (B) \( - \) (S)
    (C) \( - \) (Q), (D) \( - \) (P)
56. (B) I and III (Distance between centres = 21 cm \( \neq \) 23 cm
59. \( a = 105^\circ, b = 13^\circ, c = 62^\circ \)
64. \( x = 100^\circ, y = 130^\circ \)
68. \( 540^\circ \)
70. 1 cm
71. \( p = 90^\circ - \frac{1}{2} x \)

    \( q = \frac{1}{2} x \)

    \( r = 90^\circ - \frac{1}{2} x \)

72. i) yes
    ii) \( 55^\circ \)
    iii) \( 80^\circ \)
    iv) \( 250^\circ \)
82. 13 cm
84. \( x = 30^\circ, y = 15^\circ \)
85. \( 30^\circ \)
PRACTICE TEST

Circles

1. Find the value of $x$ in the given figure

2. In the given figure: $\angle DAB = 60^\circ$ and $\angle ABD = 50^\circ$. Then $\angle ACB = ?$

3. In the given figure O is the centre of circle. If $\angle AOC = 130^\circ$ then find $\angle ABC$.

4. Prove that equal chords of a circle subtend equal angles at the centre.

5. Prove that the sum of either pair of the opposite angles of a cyclic quadrilateral is $180^\circ$.

6. In the given figure, O is the centre of a circle prove that $\angle x + \angle y = \angle z$

7. In the given figure, AB is a chord of a circle with centre O and AB is produced to C. Such that BC = OB Also CO is joined and produced to meet the circle in D.

7. If $\angle ACD = y^\circ$ and $\angle AOD = x^\circ$. Prove that $x = 3y$.

8. Prove that the angle subtended by an arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.
CHAPTER-11

CONSTRUCTIONS

KEY POINTS

• Following types of constructions using a ruler and compass are important.

1. Construction of angles of 60°, 120°, 30°, 90°, etc.
2. Bisecting a given angle i.e. to draw angle bisector.
3. Construction of the perpendicular bisector of a given line segment.
4. Construction of the perpendiculars to a given line from a point on the line or outside the line.
5. Construction of the lines parallel to a given line.
6. Construction of a triangle given its base, a base angle and the sum of the other two sides.
7. Construction of a triangle given its base, a base angle, and the difference of the other two sides.
8. Construction of a triangle given its perimeter and its two base angles.

Questions

1. Draw a line segment of 7.2 cm and bisect it. Also measure each part.
2. Draw perpendicular bisector of AB = 6.4 cm.
3. Draw a line segment PQ = 8 cm. Draw a perpendicular at P.
4. Draw a line AB = 7.9 cm and draw perpendiculars at A and B. Are these two perpendiculars parallel to each other?
6. Construct the angles of the following measurements using compass.
   90°, 22°, 15°, 75°, 105°, 135°
7. Construct a rhombus whose side is 3.4 cm and one of its angle is 45°.
8. Construct $\triangle XYZ$ in which $XY = 4.5$ cm, $YZ = 5.0$ cm and $ZX = 6.0$ cm. Also draw angle bisector of largest angle.

9. Construct an equilateral triangle of side 6 cm. and label its vertices as $P$, $Q$ and $R$. From point $Q$ draw a median $QT$.

10. Draw a line segment $AB = 13.2$ cm. Find $\frac{1}{4}AB$ using ruler and compass. Write steps of construction.

11. Construct a right triangle $ABC$, $\angle B = 90^\circ AB + AC = 10$ cm., $BC = 6$ cm.

12. Construct a $\triangle PQR$ in which $QR = 7$ cm. $\angle Q = 75^\circ$ and $PQ + PR = 13$ cm.

13. Construct a $\triangle PQR$ in which $QR = 6$ cm. $\angle Q = 30^\circ$ and $PQ – PR = 3$ cm.

14. Construct a $\triangle XYZ$ in which $YZ=4.1$ cm. $\angle Y=45^\circ$, and $XY + XZ = 6.7$ cm.

15. Construct a $\triangle PQR$ in which $QR = 5$ cm. $\angle R=45^\circ$ and $PR-PQ = 1.6$ cm.

16. Construct a $\triangle XYZ$ in which $\angle Y = 30^\circ$, $\angle Z = 90^\circ$ and $XY + YZ + ZX = 11$ cm.

17. Construct a triangle $ABC$ in which $\angle B = 45^\circ$, $\angle C = 60^\circ$ and the perpendicular from the vertex $A$ to the base $BC$ is 4.5 cm.

18. Construct a triangle with perimeter 12 cm and ratio of their angles are $3:4:5$.

19. Government wish to make an old age home of right triangular shape. If one side is 13m and sum of hypotenuse and other side is 15 m then Construct the triangle taking measurement in cm.

20. Eco club of a school created a triangular park $\triangle ABC$ to maintain greenery of the school. If $BC = 7$m, $\angle B=75^\circ$, $AB + AC = 13$m then Construct $\triangle ABC$ taking measurement in cm.

21. Draw a line $\ell$ and take a point $P$ which is not on $\ell$. From point $P$ draw $m \parallel \ell$.

22. Construct a triangle $DEF$ in which $DE = 5$ cm $\angle D = 120^\circ$ and $EF – DF = 3.6$ cm.

23. Construct an equilateral triangle, the sum of its two sides is 8 cm.

24. Construct a right angled triangle with base 5.4 cm and difference of hypotenuse and perpendicular is 1.9 cm.
25. Construct a triangle PQR with PQ = 5 cm. \( \angle P = 105^\circ \) and 
   PR + QR = 8 cm.
26. Construct a triangle whose perimeter is 11.9 cm and base angles are 
   80° and 60°.
27. Construct an isosceles triangle XYZ with YZ = ZX = 8 cm. and median 
   YT = 4 cm.
CHAPTER-12
HERON'S FORMULA
MIND MAPPING

\[ \text{Semi-Perimeter} = \frac{a+b+c}{2} = S \]

\[ \text{Area of Triangle} = \sqrt{S(S-a)(S-b)(S-c)} \]

Heron's Formula

Perimeter and Area of Triangles

(a) Right angle Triangle
\[ b^2 = a^2 + c^2 \]
\[ \text{Perimeter} = a+b+c \]
\[ \text{Area} = \frac{1}{2} \ axc \]
\[ = \frac{1}{2} \ \text{base} \times \text{height} \]

(b) Isosceles Right Triangle
\[ b^2 = 2a^2 \]
\[ \text{Perimeter} = 2a + b \]
\[ \text{Height} = \frac{\sqrt{3}}{2} \ a \]
\[ \text{Area} = \frac{1}{2} \times a \times h \]
\[ = \frac{1}{2} \ ax \frac{\sqrt{3}}{2} \ a \]
\[ = \frac{\sqrt{3}}{4} a^2 \]

(c) Equilateral Triangle
\[ \text{Perimeter} = 3a \]

Class IX - Mathematics
CHAPTER-12
HERON'S FORMULA
KEY POINTS

- **Rectangle**: If length and breadth of a rectangle is 'l' and 'b' respectively then
  1. Perimeter of rectangle = 2(l + b) units
  2. Area of rectangle = l x b sq. units
  3. Diagonal of rectangle = $\sqrt{l^2 + b^2}$ units

- **Square**: If 'a' is the length of side of a square
  1. Perimeter of square = 4a units
  2. Area of square = $(side)^2 = (a)^2$ sq. units
  3. Area of square = $\frac{1}{2} \times (diagonal)^2$

- **Triangle**:

  (A) **Equilateral Triangle**: In this triangle all three sides are equal. If the length of each side is 'a' then
  1. Perimeter = 3a units
  2. Altitude = $\frac{\sqrt{3}}{2} a$ units
  3. Area = $\frac{\sqrt{3}}{4} a^2$ or $\frac{\sqrt{3}}{4} (side)^2$ sq. units

  (B) **Right Angled Triangle**: If one of the angles of a triangle is 90°.
  1. Hypotenuse $k = \sqrt{b^2 + h^2}$ units
  2. Perimeter = $b + h + k$ units
  3. Area = $\frac{1}{2} \times b \times h$ sq. units

  Area of triangle (General Formula)
  = $\frac{1}{2} \times$ base $\times$ Corresponding Altitude
  = $\frac{1}{2} \times b \times h$ sq. units
HERON’S FORMULA

- If the sides of triangle are a, b and c
  
  (i) Perimeter = a + b + c
  
  (ii) Semi Perimeter (S) = \( \frac{a+b+c}{2} \)
  
  (iii) Area of Triangle (\( \Delta ABC \)) = \( \sqrt{s(s-a)(s-b)(s-c)} \)

  Note: Heron's formula is applicable to all types of triangles.

- Area of Parallelogram: If a is the length and b is breadth of a parallelogram and h be the height or perpendicular distance between two parallel sides then.

  Area of parallelogram (ABCD) = Base x Corresponding Height
  = AB x DE
  = a x h sq. units

  Area of \( \Delta ABC \) = \( \frac{1}{2} \times \text{Area of Parallelogram} \)

- Area of Trapezium: Trapezium with parallel sides a and b and the perpendicular distance between two parallel sides as h.

  Area of trapezium
  = \( \frac{1}{2} \times (a + b) \times h \)
  = \( \frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height} \)
PART "A"

1. The sides of a triangle are 3cm, 4cm and 5cm. What is its area?
   (a) 6cm$^2$   (b) 8cm$^2$
   (c) 5cm$^2$   (d) 10cm$^2$

2. What is the area of an equilateral triangle with side 2cm?
   (a) $4\sqrt{3}$cm$^2$   (b) $3\sqrt{3}$cm$^2$
   (c) 6cm$^2$   (d) $\sqrt{3}$cm$^2$

3. The area of a triangle is 150cm$^2$ and its sides are in the ratio 3:4:5. What is its perimeter?
   (a) 10cm   (b) 30cm
   (c) 45cm   (d) 60cm

4. Area of equilateral triangle of side "a" unit is
   (a) $\frac{\sqrt{3}}{2}a^2$   (b) $\frac{\sqrt{3}}{4}a^2$
   (c) $\frac{\sqrt{3}}{2}a$   (d) $\frac{\sqrt{3}}{4}a$

5. The area of an isosceles triangle each of whose equal sides is 13cm and whose base is 24 cm is.
   (a) 45cm$^2$   (b) 48cm$^2$
   (c) 60cm$^2$   (d) 75cm$^2$

6. The height of an equilateral triangle is 6cm. Then the area of the triangle is
   (a) $15\sqrt{3}$ cm$^2$   (b) $32\sqrt{3}$ cm$^2$
   (c) $12\sqrt{3}$ cm$^2$   (d) $17\sqrt{3}$ cm$^2$

7. Sides of a triangle are in the ratio 12:17:25 and its perimeter is 540cm. Its area will be -
   (a) 6000 cm$^2$   (b) 9000 cm$^2$
   (c) 12000 cm$^2$   (d) None of these

8. The area of a triangle two sides of which are 18cm and 10 cm and its perimeter is 42 cm will be -
   (a) $14\sqrt{11}$ cm$^2$   (b) $21\sqrt{11}$ cm$^2$
   (c) $35\sqrt{11}$ cm$^2$   (d) None of these
9. The height corresponding to the longest side of the triangle whose sides are 42cm, 34cm and 20cm in length is.
   (a) 15cm          (d) 36cm
   (c) 16cm          (d) 23cm

10. A park, in the shape of a quadrilateral ABCD has $\angle C=90^\circ$, AB=9M, BC=12m, CD=5m and AD=8m. How much area does it occupy?
    (a) 56.4m$^2$     (b) 55.4m$^2$
    (c) 65.4m$^2$     (d) None of These

11. The altitude of a triangular field is one-third of its base. If the cost of sowing the field at Rs. 58 per hectare is Rs. 783 then its altitude is
    (a) 900m          (b) 600m
    (c) 300m          (d) None of these

12. The height of an equilateral triangle is 6 cm., Then the area of the triangle is.
    (a) $9\sqrt{3}$ cm$^2$ (b) $3\sqrt{3}$ cm$^2$
    (c) $12\sqrt{3}$ cm$^2$ (d) $17\sqrt{3}$ cm$^2$

13. An isosceles triangle has peri meter 30cm and each of equal sides is 12cm. Find the area of the triangle in cm$^2$ is
    (a) $9\sqrt{15}$   (b) $17\sqrt{15}$
    (c) $12\sqrt{15}$  (d) $6\sqrt{15}$

14. The base of a right angled triangle is 48cm and its hypotenuse is 50cm then its area is
    (a) 150 cm$^2$     (b) 336 cm$^2$
    (c) 300 cm$^2$     (d) 475 cm$^2$

15. An isosceles right triangle has area 8 cm$^2$ The length of its hypotenuse is.
    (a) $\sqrt{32}$ cm  (b) $\sqrt{16}$ cm
    (c) $\sqrt{48}$ cm  (d) $\sqrt{24}$ cm

16. The cost of painting the given sign board at the rate of 9 paise per cm$^2$ is
    (a) Rs. 2.00        (b) Rs. 2.16
    (c) Rs. 2.48        (d) Rs. 3.00
17. The perimeter of an equilateral triangle is 60m. The area is
   (a) $10\sqrt{3}$ m$^2$  (b) $15\sqrt{3}$ m$^2$
   (c) $20\sqrt{3}$ m$^2$  (d) $100\sqrt{3}$ m$^2$

18. The sides of a triangle are 35cm, 54cm and 61cm. The length of its longest altitude is
   (a) $16\sqrt{5}$ cm  (b) 28 cm
   (c) $10\sqrt{5}$ cm  (d) $24\sqrt{5}$ cm

19. The base of a triangle is 12cm and height is 8cm then area of triangle is
   (a) 48 cm$^2$  (b) 24 cm$^2$
   (c) 96 cm$^2$  (d) 56 cm$^2$

20. 

![Triangle Diagram]

A gardener want to plant grass inside the given piece of land. How much area does he need to plant.
   (a) $85\sqrt{15}$ m$^2$  (b) $110\sqrt{15}$ m$^2$
   (c) $375\sqrt{15}$ m$^2$  (d) $97\sqrt{15}$ m$^2$

21. Find the area of a triangle whose base and altitudes are 8cm and 5cm.
22. Find the area of an equilateral triangle whose sides are 4cm each.
23. If sum of two sides of a triangle is 17cm and its perimeter is 30cm, then what is the length of third side.
24. If perimeter of a triangle is 24cm and sides are in the ration 2:1:3, then find the longest side ?
25. If each side of a triangle is double then how many times the perimeter of triangle increased ?
26. If area of a triangle is 50cm$^2$ and one of its sides is 10cm then find the length of corresponding altitude.
27. The area of an equilateral triangle is $16\sqrt{3}$ cm$^2$ then what will be the length of each side of that triangle?
28. Find the ratio between the area $\triangle ABC$ and area $\triangle ACD$ of the given rectangle.

![Diagram of rectangle with labels A, B, C, D, and dimensions 4 cm and 3 cm]

29. A square has each side of 5 cm. Find the length of one of its diagonals.

30. If the length and corresponding height of a parallelogram are 10 cm and 8 cm then find the area of a triangle made by its diagonal.

31. If one side of a triangle is 9.5 m and its corresponding altitude is 12 m then what will be the area of triangle.

**Part-B**

32. If $(s-a) = 5 \text{ cm}$
   
   $(s-b) = 10 \text{ cm}$
   
   $(s-c) = 1 \text{ cm}$, Find $a$, $b$ & $c$
   
   where $a$, $b$ & $c$ are sides of the triangle.

33. The ratio between the sides of a triangle are $3 : 5 : 7$ and its perimeter is $300 \text{ cm}$ find the sides of triangle.

34. Find the cost of fencing the ground in the form of triangle with sides 16 m, 12 m and 18 m, The rate of fencing is Rs. 25 per meter.

35. Find the area of isosceles triangle whose non equal side are of 12 cm having the corresponding altitude 7.5 cm.

36. The parallel side of trapezium is 77 cm and 60 cm and its non parallel sides are 26 cm and 25 cm. Find the area of trapezium.

37. Find the area of rhombus in which $AB = 5 \text{ cm}$ and $AC = 8 \text{ cm}$.

![Diagram of rhombus with labels A, B, C, D, and AC = 8 cm]

38. If in a triangle $AB = 15 \text{ cm}$, $BC = 14 \text{ cm}$ and $AC = 13 \text{ cm}$. Find the area of $\triangle ABC$ and hence its altitude corresponding to side BC.
39. Show that the Area of an equilateral triangle is \( \frac{\sqrt{3}}{4} \times x^2 \), where side is x.
40. Perimeter of an isosceles triangle is 32 cm. The ratio of equal side to its base is 3 : 2 Find area of this triangle.

**Part – C**

41. The area of a quadrilaterial is 360m\(^2\) and the perpendiculars drawn to one of the diagonal from the opposite vertices are 10m and 8m. Find the length of the diagonal.

42. If in a triangle with sides a, b & c, \((s-a) = 5\text{cm}\), \((s-b) = 10\text{cm}\) & \((s-c) = 1\text{cm}\). Find area of the triangle.

43. The cost of levelling a park is 2,700 for each 2 km\(^2\). If the park is in right angled triangular form with one side being 45 km. Find the hypotenuse.

44. Find the area of shaded region in the figure.

45. How may triangular flower beds of 6m\(^2\) can be made from this area.  
\[ \text{use } \sqrt{105} = 10.25 \]

46. Find the area of rhombus whose perimeter is 100m and one of whose diagonal is 30 m.

47. The sides of a triangle shaped sheet are 5 cm, 12 cm and 13 cm. Find the cost of painting on the sheet at the rate of ₹ 30 per cm\(^2\).

48. One side of a right angled triangle is 20 cm and the difference in lengths of its hypotenuses & other side is 8 cm. Find the other side and area of the triangle.

49. Find the ratio between the area of triangle \( \triangle ABC \) and \( \triangle DEF \).

49. If perimeter of a triangle is x cm and its sides are p, q and r cm. What will be the area of triangle? Use the Heron's formula.
Part – D

50. A triangular park ABC has sides 120m, 80m and 50m. A gardener has to put a fence all around it and also plant some trees inside the garden to get clean air.

(i) Find the cost of fencing it at the rate of Rs. 50 per meter. Leaving space 5cm wide for the gate on one side.

(ii) Find its area where gardener may plant the tree.

51. A piece of land is in the shape as given in the figure, has been cut along diagonal AC. The two pieces of land has been distributed between Ram and Sohan. Who will get larger piece of land in terms of area? [Use $\sqrt{10}=3.15$]

52. A triangular hoarding of dimensions 11m, 6m and 15m is used for commercial activities. The hoarding yield an earing of ₹ 5000 per m$^2$ per month.

Calculate the total earning by the hoarding in a month. [Use $\sqrt{2} = 1.41$]

53. If each side of a triangle is doubled, find the ratio of the areas of two triangles, the given triangle & the triangle obtained on doubling the sides. Also find the percentage increase in the area of new triangle.
<p>| | | | | | | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>(a)</td>
<td>6 cm²</td>
<td>2.</td>
<td>(d)</td>
<td>$\sqrt{3}$ cm²</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>(d)</td>
<td>60 cm</td>
<td>4.</td>
<td>(b)</td>
<td>$\sqrt{\frac{3}{4}}a^2$</td>
<td></td>
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<tr>
<td>5.</td>
<td>(c)</td>
<td>60 cm²</td>
<td>6.</td>
<td>(b)</td>
<td>$3\sqrt{3}$</td>
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<tr>
<td>7.</td>
<td>(b)</td>
<td>9000 cm²</td>
<td>8.</td>
<td>(b)</td>
<td>$21\sqrt{11}$ cm²</td>
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<tr>
<td>9.</td>
<td>(c)</td>
<td>16 cm</td>
<td>10.</td>
<td>(c)</td>
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<tr>
<td>11.</td>
<td>(d)</td>
<td>None of these</td>
<td>12.</td>
<td>(c)</td>
<td>12$\sqrt{3}$</td>
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<tr>
<td>13.</td>
<td>(a)</td>
<td>$9\sqrt{15}$</td>
<td>14.</td>
<td>(b)</td>
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<tr>
<td>15.</td>
<td>(a)</td>
<td>$\sqrt{32}$ cm</td>
<td>16.</td>
<td>(b)</td>
<td>2.16 Rs.</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>(d)</td>
<td>100$\sqrt{3}$ m²</td>
<td>18.</td>
<td>(d)</td>
<td>$24\sqrt{5}$ cm</td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>(a)</td>
<td>48 cm²</td>
<td>20.</td>
<td>(c)</td>
<td>375$\sqrt{15}$ m²</td>
<td></td>
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<tr>
<td>21.</td>
<td>20 cm²</td>
<td>22.</td>
<td>4$\sqrt{3}$ cm²</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>23.</td>
<td>13 cm</td>
<td>24.</td>
<td>12 cm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>one time</td>
<td>26.</td>
<td>10 cm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>8 cm</td>
<td>28.</td>
<td>1 : 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>$5\sqrt{2}$ cm</td>
<td>30.</td>
<td>40 cm²</td>
<td></td>
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<tr>
<td>31.</td>
<td>57 m²</td>
<td>32.</td>
<td>11 cm, 6 cm, 15 cm</td>
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<td></td>
</tr>
<tr>
<td>33.</td>
<td>60 cm, 100 cm, 140 cm</td>
<td>34.</td>
<td>₹ 1150</td>
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<tr>
<td>35.</td>
<td>45 cm²</td>
<td>36.</td>
<td>1644 m²</td>
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<tr>
<td>37.</td>
<td>24 cm²</td>
<td>38.</td>
<td>84 cm², 12 cm</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>39.</td>
<td>–</td>
<td>40.</td>
<td>$32\sqrt{2}$ cm²</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>41.</td>
<td>40 m</td>
<td>42.</td>
<td>$20\sqrt{2}$ m²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43.</td>
<td>75 km</td>
<td>44.</td>
<td>1047 m², 179</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45.</td>
<td>600 m²</td>
<td>46.</td>
<td>₹ 900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47.</td>
<td>29 cm, 21 cm</td>
<td>48.</td>
<td>1 : 9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49.</td>
<td>$\sqrt{\frac{x}{2}(\frac{x}{2}-p)(\frac{x}{2}-q)(\frac{x}{2}-r)}$</td>
<td>50.</td>
<td>(i) ₹ 12250 (ii) $375\sqrt{15}$ m²</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>51.</td>
<td>Ram 210 m²</td>
<td>52.</td>
<td>₹ 141000</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>53.</td>
<td>(i) 1 : 4 (ii) 300%</td>
<td></td>
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</tr>
</tbody>
</table>
1. Find the length to sides of an equilateral triangle having area $a\sqrt{3} \text{ cm}^2$.  

2. If $(s - a) = 5 \text{ cm}, (s - b) = 10 \text{ cm}, (S - C) = 1 \text{ cm}$. Find $S$.  

3. Find the area of isosceles triangle whose equal sides are of length $15 \text{ cm}$ each & the third side is $12 \text{ cm}$.  

4. If each side of triangle is doubled, then find the ratio of area of new triangle thus formed & the given triangle.  

5. The sides of a triangle are in the ratio $25 : 17 : 12$ and its perimeter is $540 \text{ cm}$. Find the area of the triangle.  

6. The area of trapezium is $475 \text{ cm}^2$ & height is $19 \text{ cm}$. Find length of its parallel sides if one side is $4 \text{ cm}$ greater than the other.  

7. The length of sides of a triangle are $7 \text{ cm}, 12 \text{ cm} & 13 \text{ cm}$. Find the length of perpendicular from opposite vertex to the side whose length is $12 \text{ cm}$.  

8. The cost of fencing a field @ ₹ 5 per metre is ₹ 1920. If semi perimeter is $48 \text{ cm}$ find its area & all sides.
(i) Total surface Area (T.S.A) = Curved Surface Area (C.S.A) + Base Area

(ii) For plane Figure For Curved figure
    Lateral surface Area (L.S.A) curved surface area (C.S.A)

(iii) Volume of cylinder = 3x volume of cone
     Volume of hemisphere = 2x volume of cone

volume of cone : volume of hemisphere : volume of cylinder = 1 : 2 : 3

= \( v_1 : v_2 : v_3 = 1 : 2 : 3 \)
## CHAPTER-13
### SURFACE AREAS AND VOLUMES

**KEY POINTS**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name</th>
<th>Figure</th>
<th>Lateral/Curved Surface Area</th>
<th>Total surface Area</th>
<th>Volume</th>
<th>Symbols used for</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>Cuboid</td>
<td><img src="image" alt="Cuboid" /></td>
<td>$2(l+b) \times h$</td>
<td>$2(lb+bh+hl)$</td>
<td>$lbh$</td>
<td>$l=$Length, $b=$breadth, $h=$height</td>
</tr>
<tr>
<td>2.</td>
<td>Cube</td>
<td><img src="image" alt="Cube" /></td>
<td>$4a^2$</td>
<td>$6a^2$</td>
<td>$a^3$</td>
<td>$a=$side</td>
</tr>
<tr>
<td>3.</td>
<td>Right Circular Cylinder</td>
<td><img src="image" alt="Cylinder" /></td>
<td>$2\pi rh$</td>
<td>$2\pi r(h+r)$</td>
<td>$\pi r^2h$</td>
<td>$h=$height, $r=$radius of base</td>
</tr>
<tr>
<td>4.</td>
<td>Right Circular Cone</td>
<td><img src="image" alt="Cone" /></td>
<td>$\pi rl$</td>
<td>$\pi r(l+r)$</td>
<td>$\frac{1}{3} \pi r^2h$</td>
<td>$h=$height, $r=$radius of base</td>
</tr>
<tr>
<td>5.</td>
<td>Sphere</td>
<td><img src="image" alt="Sphere" /></td>
<td>$4\pi r^2$</td>
<td>$4\pi r^2$</td>
<td>$\frac{4}{3} \pi r^3$</td>
<td>$r =$ radius</td>
</tr>
<tr>
<td>6.</td>
<td>Hemisphere Solid</td>
<td><img src="image" alt="Hemisphere" /></td>
<td>$2\pi r^2$</td>
<td>$3\pi r^2$</td>
<td>$\frac{2}{3} \pi r^3$</td>
<td>$r =$ radius</td>
</tr>
<tr>
<td>7.</td>
<td>Hemisphere hollow</td>
<td><img src="image" alt="Hemisphere Hollow" /></td>
<td>$2\pi r^2$</td>
<td>$2\pi r^2$</td>
<td>$\frac{2}{3} \pi r^3$</td>
<td>$r =$ radius</td>
</tr>
</tbody>
</table>
CHAPTER-13
SURFACE AREAS AND VOLUMES
PART - A

1. If the volume of a sphere is numerically equal to its surface area. Then radius of sphere is.
   (a) 1 unit  
   (b) 3 unit
   (c) 2 unit  
   (d) 6 unit

2. The surface area of a solid hemisphere having radius r.
   (a) $2\pi r^2$  
   (b) $3\pi r^2$
   (c) $4\pi r^2$  
   (d) $\frac{2}{3} \pi r^3$

3. In a cylinders, If radius is halved and height is doubled the volume will be.
   (a) Same  
   (b) double
   (c) halved  
   (d) four times

4. The height of a cone of diameter 10cm and slant height 13cm, is
   (a) 12cm  
   (b) 13cm
   (c) $\sqrt{69} \text{ cm}$  
   (d) $\sqrt{194} \text{ cm}$

5. The radius of a hemispherical balloon increases from 6 cm to 12cm as air is being pumped into it. The ratios of the surface areas of the balloon in the two cases is.
   (a) 1 : 4  
   (b) 1 : 3
   (c) 2 : 3  
   (d) 2 : 1

6. How many bricks will be required to construct a wall 13.5m long; 6m high and 22.5cm thick if each brick measures (27cm $\times$ 12.5cm $\times$ 9cm) ?
   (a) 6000  
   (b) 7500
   (c) 5000  
   (d) 3750

7. The radius of a sphere is 2r, then its volume will be.
   (a) $\frac{32}{3} \pi r^3$  
   (b) $4\pi r^3$
   (c) $\frac{4}{3} \pi r^3$  
   (d) $\frac{8\pi r^3}{3}$

Class IX - Mathematics
8. The radius of a sphere is 21cm. What is the surface area of the sphere?
(a) 12932 cm²  (b) 4312 cm²
(c) 9702 cm²  (d) 5544 cm²

9. The length of the longest pole that can be put in a room of dimensions (10m x 10m x 5m) is
(a) 15m  (b) 16m
(c) 12m  (d) 10m

10. A copper sphere of diameter 6cm is melted and drawn into 36cm long wire of uniform circular cross-section. Then, its radius is
(a) 2cm  (b) 1.5cm
(c) 1.2cm  (d) 1cm

11. The number of planks of dimension (4m x 50cm x 20cm) that can be stored in a pit which is 16m long, 12m wide and 4m deep is.
(a) 1900  (b) 1920
(c) 1800  (d) 1840

12. If the radius of a sphere is increased by 10% then its volume will be increased by
(a) 11.1%  (b) 22.1%
(c) 33.1%  (d) 44.1%

13. In a cylinder, radius is double and height is halved, surface area will be.
(a) halved  (b) doubled
(c) Same  (d) four times

14. Two cubes have their volumes in the ratio 1 : 27. The ratio of their surface area is.
(a) 1 : 3  (b) 1 : 8
(c) 1 : 9  (d) 1 : 18
15. A cone is 8.4 cm high and the radius of its base is 2.1 cm. It is melted and recast into a sphere. The radius of the sphere is:
   (a) 4.2 cm   (b) 2.1 cm
   (c) 2.4 cm   (d) 1.6 cm

16. If the length of diagonal of a cube is $8\sqrt{3}$ cm, then its surface area is.
   (a) 768 cm$^2$   (b) 512 cm$^2$
   (c) 384 cm$^2$   (d) 192 cm$^2$

17. The total surface area of a cube is 96 cm$^2$. The volume of the cube is:
   (a) 8 cm$^3$   (b) 512 cm$^3$
   (c) 64 cm$^3$   (d) 27 cm$^3$

18. If each side of a cube is doubled, then its volume,
   (a) Becomes Doubled   (b) Becomes 4 times
   (c) becomes 6 times   (d) become 8 times

19. If a sphere is inscribed in a cube, then the ratio of the volume of the cube to the volume of the sphere will be:
   (a) $6 : \pi$   (b) $3 : \pi$
   (c) $2 : \pi$   (d) $3 : 2\pi$

20. If each edge of a cube is increased by 50%, then the percentage increase in its surface area is.
   (a) 50 %   (b) 75 %
   (c) 100 %   (d) 125 %

21. The lateral surface area of a cube is 256 cm$^2$. Find its volume.

22. A matchbox measures 4 cm x 2.5 cm x 1.5 cm. What will be the volume of a packet containing 12 such boxes?

23. The ratio of height of two cylinders is 5 : 3, as well as the ratio of their radii is 2 : 3. Find the ratio of the volumes of the cylinders.
24. Find the area of canvas required for a conical tent of height 24m and base radius 7m.

25. Find the ratio of total surface area of a sphere and a hemisphere of same radius.

26. The surface area of the cuboid is 1372 sq. cm. If its dimensions are in the ratio of 4:2:1. Then find its length.

27. If the radius and slant height of a cone are $r/2$ and $2l$. Then find its total surface area.

28. A cone and a hemisphere have equal base and equal volumes. Find the ratio of their heights.

29. The radius of a spherical balloon increase from 6cm to 12 cm as air is being pumped into it. Find the ratio of the surface areas of the balloon in two cases.

30. The largest possible right circular cone is cut out of a cube of edge $r$ cm. What is the volume of cone?

**PART – B**

31. A rectangular sheet of dimension 33 cm x 18 cm is rolled along its breadth to form a cylinder. Find the radius of the cylinder.

32. A roller 1.5 m long has a diameter of 70 cm. How many revolutions will it make to level a play ground measuring 50 m x 33 m?

33. The dimensions of a cuboid are in the ratio of 1 : 2 : 3 and its total surface area is 88$m^2$. Find its dimensions.

34. A solid cylinder has a total surface area of 231 $cm^2$. The curved surface area is $2/3$ of the total surface area. Find the volume of cylinder.

35. The total surface area of a cube is 150sq. cm. Find the perimeter of any one of its faces.

36. Three metal cubes whose edge measures 3cm, 4cm and 5cm respectively are melted to form a single cube. Find the edge of the cube.
37. The length, breadth and height of room are 5m, 4m and 3m respectively. Find the cost of white washing the walls of the room and the ceiling at the rate of ₹ 7.50 per m².

38. Three spheres of radii 3cm, 4cm and 5cm are melted together to form a single sphere. Find the radius of new sphere.

39. The curved surface area of a cylinder is 176 cm² and its base area is 38.5 cm². Find the volume of the cylinder.

40. A cylinder and a cone have the same height and the same radius. The volume of the cylinder is 24 cm³. What will be the volume of the cone?

41. What is the volume of the largest cone that can be inscribed completely in a hollow hemisphere of radius 7 cm?

42. Find the maximum length of the rod that can be placed in a cuboid of dimensions 22.5 cm × 7.5 cm × 10 cm.

43. Which is false in case of a hollow cylinder. Write the correct answer.
   (a) curved surface area of a hollow cylinder = 2\pi h (R + r)
   (b) Total surface area of a hollow cylinder = 2\pi (R + r) (h + R - r)
   (c) Inner curved surface area of a hollow cylinder = 2\pi h (R - r)
   (d) Area of each end of a hollow cylinder = \pi (R² - r²)

44. Which is false? Write the correct answer.

A metal pipe is 63 cm long. Its inner diameter is 4 cm and the outer diameter is 4.4 cm. Then
   (a) Its inner curved surface area = 792 cm²
   (b) Its outer curved surface area = 871.2 cm²
   (c) Surface area of each end = 2.64 cm²
   (d) Its total surface area = 1665.84 cm²
45. Which is false? Write the correct answer.
   (a) Volume of the hollow sphere = \( \frac{4}{3} \pi (R^3 - r^3) \)
   (b) Volume of a hemisphere = \( \frac{2}{3} \pi r^3 \)
   (c) Total surface area of a hemisphere = \( 2\pi r^2 \)
   (d) Curved surface area of a hemisphere = \( \pi r^2 \)

46. Which is false? Write the correct answer.
   For a right circular cylinder of base radius = 7 cm and height = 14 cm.
   (a) curved surface area = 616 cm\(^2\)
   (b) Total surface area = 924 cm\(^2\)
   (c) Volume = 2156 cm\(^3\)
   (d) Total area of the end face = 154 cm\(^2\)

47. Write true or false.

   The largest possible right circular cone is cut out of a cube of edge \( r \) cm. The volume of the cone is \( \frac{1}{12} \pi r^3 \). (T/F)

   **PART – C**

48. A cuboidal vessel is 10 m long and 8 m wide. How high must it be made to hold 380 m\(^3\) of a liquid?

49. A wall of length 10 m was to be built across and open ground. The height of the wall is 4 m and thickness of the wall is 24 cm. If this wall is to be built up with bricks whose dimensions are 24 cm x 10 cm x 8 cm, how many bricks would be required?

50. 1.1 cm\(^3\) of gold is drawn into a wire of 0.1 mm in diameter. Find the length of the wire in metre.

51. A hemispherical bowl of internal diameter 36 cm contain a liquid. This liquid is to be filled in cylindrical bottles of radius 3 cm and height 6 cm. How many bottles are required to empty the bowl?
52. Find the lateral curved surface area of a cylindrical petrol storage tank that is 4.2m in diameter and 4.5m high. How much steel was actually used if 1/12 of steel actually used was wasted in making the closed tank?

53. Water in a canal, 30 dm wide and 12 dm deep is flowing with a speed of 20 km per hour. How much area will it irrigate in 30 min if 9 cm of standing water is desired? (10dm=1m)

54. The radius of a sphere is 10 cm. If the radius is increased by 1 cm, then prove that volume of the sphere is increased by 33.1%.

55. The diameter of a hemisphere is decreased by 30%. What will be the percentage change in its total surface area?

56. A sphere and a cube have the same surface area. Find the ratio of their volumes.

57. The volume of a sphere is 4851 cm$^3$. How much should its radius be reduced so that its volume becomes $-\frac{4312}{3}$ cm$^3$?

58. A semicircular sheet of paper of diameter 14 cm is bent to form an open conical cup. Find the capacity of the cup.

59. If $s$, $t$, and $v$ are curved surface area, total surface area and volume of a cylinder then show that

\[ th^2 = ch^2 + 4v^2 + 8v^2 rh \]

where $r$ and $h$ are radius and height.

**PART-D**

60. A cuboidal tank can store 5040 litres of water. The external dimensions of the tank are 2.2m x 1.7m x 1.7m. If the wall of the tank are 5 cm thick, then what is the thickness of the bottom of the tank?

61. A metallic sheet is of the rectangular shape with dimensions 48cm x 36cm. From each one of its corners, a square of 8cm is cut off. An open box is made of the remaining sheet. Find the volume of the box.
62. A right triangle having side 6cm, 8cm and 10cm is revolved about the side of length 8cm. Find the volume of the solid so formed.

63. A right circular cone is 5.4 cm high and radius of its base is 2cm. It is melted and recast into another right circular one with radius of base as 1.5 cm. Find the height of new cone formed.

64. A cylindrical tub of radius 12cm contains water to the depth of 20cm. A spherical ball is dropped into the tub raising the level of water by 6.75cm. What is radius of ball?

65. A cylinder is within the cube touching all the vertical faces. A cone is inside the cylinder. If their height are the same with the same base find the ratio of their volumes.

66. A plot of land is in the form of rectangle with dimension 240m x 180m. A drainlet 10m wide is dug around it (on the outside). And the earth dug out is evenly spread out over the plot increasing its surface level by 25cm. Find the depth of the drainlet.

67. A residential colony has a population of 5400 and 60 litres of water is required per person per day. For the effective utilization of rain water, a group of people decided to the WATER HARVESTING. They constructed a water reservoir measuring 48m x 27m x 25m to collect the rain water.

For how many days the water of this tank is sufficient-fi during rain the height of water level is 5m.

68. 50 students of class IX planned a visit to an old age home and to spend the whole day with its inmates. Each one prepared a cylindrical flower vase using card board to gift the inmates. The radius of cylinder is 4.2cm and the height is 11.2 cm.

What is the amount spent for purchasing the card board at the rate of 20 per 100 m².

69. Rahul wanted to make a temporary shelter for street dogs, by making a box like structure with tarpaulin that covers all the four sides and the
top of the house. How much tarpaulin would be required to make the shelter of height 2.5 m with base dimensions 4m x 3m. Assuming sticking margin is negligible.

70. Twenty Seven solid iron spheres each of radius r and surface area S are melted to form sphere with surface area S'. Find the
   (i) radius R of the new sphere.
   (ii) Ratio of S and S'.

71. The diameter of a metallic ball is 4.2cm. What is the mass of the ball, if the density of the metal is 8.9g per cm³.

72. A lead pencil consists of a cylinder of wood with a solid cylinder of graphite filled in the interior.
    The diameter of the pencil is 7mm and the diameter of the graphite is 1mm. If the length of the pencil is 14cm. Find the volume of the wood and that of the graphite.

73. A soft drink is available in two packs. (i) a tin can with a rectangular base of length 5cm and width 4cm, having a height of 15cm and (ii) a plastic cylinder with circular base of diameter 7cm and height 10cm. Which container has greater capacity and by how much?

74. A bus stop is barricaded from the remaining part of the road, by using 50 hollow cones made of recycled cardboard. Each cone has a base diameter of 40cm and height 1m. If the outer side of each of the cone is to be painted ans the cost of painting is ₹ 12per m², What will be the cost of painting all these cones ? (Use 𝜋=3.14 and √1.04 = 1.02)

75. A spere of diameter 6cm is dropped in a right circular cylinder vessel partly filled with water. The diameter of the cylindrical vessel is 12cm. If the sphere is completely submerged in water, by how much will the level of water rise in the cylindrical vessel?

76. Marbles of diameter, 1.4cm are dropped into a cylindrical beaker, of diameter 7cm. Containing some water. Find the number of marbles
that should be dropped into the beaker, so that the water level rises by 5.6 cm.

77. Right circular cylinder having diameter 12 cm and height 15 cm is full of ice-cream. The Ice-Cream is to be filled in cones of height 12 cm and diameter 6 cm having a hemispherical shaped on the top. Find the number of such cones which can be filled with Ice-Cream.

78. A toy is in the form of a cone mounted a hemisphere of diameter 7 cm. The total height of the toy is 14.5 cm. Find the volume and the total surface area of the toy. (Take \( \pi = \frac{22}{7} \))

79. If \( h \), \( c \) and \( v \) respectively, are the height, the curved surface and volume of the cone, prove that

\[
3\pi vh^3 - c^2h^2 + 9v^2 = 0
\]

80. A wooden box with dimensions 36 cm \( \times \) 24 cm \( \times \) 12 cm is 2 cm thick. Find the weight of the wood if density of the wood is 100 gm/m\(^3\).

81. A rectangular reservoir is 210 m long and 75 m wide. Water is flowing into it through a square pipe of side 25 cm such that water rises to 3.5 m in 15 hours. Find the speed of the water.

82. A hemispherical bowl is to be painted from inside at the rate of Rs. 20 per 100 m\(^2\). The total cost of painting is Rs. 30.80. Find

(i) Inner surface area of the bowl.

(ii) Volume of air inside the bowl.

**PART-D**

83. The volumes of the two spheres are in the ratio 64 : 27 find the ratio of their surface areas.

84. A cube of side 4 cm contains a sphere touching its sides. Find the volume of the gap in between.

85. A sphere and a right circular cylinder of the same radius have equal volumes. By what percentage does the diameter of the cylinder exceeds its heights?
### CHAPTER-13
SURFACE AREAS AND VOLUMES

#### ANSWERS

1. (b) 3 Units
2. (b) $3\pi r^2$
3. (c) halved
4. (a) 12 cm
5. (a) 1 : 4
6. (a) 6000
7. (a) $\frac{32}{3} \pi r^3$
8. (d) $5544\text{cm}^2$
9. (a) 15 m
10. (d) 1 cm
11. (b) 1920
12. (c) 33.1%
13. (c) same
14. (c) 1 : 9
15. (b) 2.1 cm
16. (c) 384 cm$^2$
17. (c) 64 cm$^3$
18. (d) becomes 8 times
19. (a) 6 : $\pi$
20. (d) 125%
21. $512\text{cm}^2$
22. 180 cm$^2$
23. 20 : 27
24. 550 m$^2$
25. 4 : 3
26. 28 cm
27. $\pi r (l+r/4)$
28. 2 : 1
29. 1 : 4
30. $v = \frac{1}{12} \pi r^3$
31. 2.8 cm
32. 500
33. 2 m, 4 m, 6 m
34. 269.5 cm$^2$
35. 20 cm
36. 6 cm
37. ₹ 555
38. 6 cm
39. $308\text{cm}^3$
40. $8\text{cm}^3$
41. $359.33\text{cm}^3$
42. 25.7 cm
43. (c) $2\pi h (R-r) = 2\pi rh$
44. (d) $1665.84\text{cm}^2 = 1668.48\text{cm}^2$
45. (d) $\pi R^2 = 2\pi R^2$
46. (d) $154\text{cm}^2 = 308\text{cm}^2$
47. True
48. 4.75 cm
49. 5000
50. 140 m
51. 72
52. 59.4 m$^2$, 95.04 m$^2$
53. 4,00,000 m$^2$
54. 51%
55. 6.5 cm
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>58.</td>
<td>79.2 cm³</td>
</tr>
<tr>
<td>60.</td>
<td>10cm</td>
</tr>
<tr>
<td>61.</td>
<td>5120 cm³</td>
</tr>
<tr>
<td>62.</td>
<td>96 (\pi ) cm³</td>
</tr>
<tr>
<td>63.</td>
<td>9.6 cm</td>
</tr>
<tr>
<td>64.</td>
<td>9cm</td>
</tr>
<tr>
<td>65.</td>
<td>(v_1 : v_2 : v_3 = 42:33:11)</td>
</tr>
<tr>
<td>66.</td>
<td>1.227 m</td>
</tr>
<tr>
<td>67.</td>
<td>20 days</td>
</tr>
<tr>
<td>68.</td>
<td>₹ 3511.20</td>
</tr>
<tr>
<td>69.</td>
<td>47 m²</td>
</tr>
<tr>
<td>70.</td>
<td>(i) (R=3r) (ii) (s:s¹=1:9)</td>
</tr>
<tr>
<td>71.</td>
<td>345.39 g</td>
</tr>
<tr>
<td>72.</td>
<td>5.28 cm³, 0.11 cm³</td>
</tr>
<tr>
<td>73.</td>
<td>Plastic Cylinders 85 cm³</td>
</tr>
<tr>
<td>74.</td>
<td>384.34</td>
</tr>
<tr>
<td>75.</td>
<td>1 cm</td>
</tr>
<tr>
<td>76.</td>
<td>150</td>
</tr>
<tr>
<td>77.</td>
<td>10</td>
</tr>
<tr>
<td>78.</td>
<td>231 cm³, 204.05 cm²</td>
</tr>
<tr>
<td>79.</td>
<td>58.8 km</td>
</tr>
<tr>
<td>80.</td>
<td>3968 g</td>
</tr>
<tr>
<td>81.</td>
<td>16.9</td>
</tr>
<tr>
<td>82.</td>
<td>(i) 154 m² (ii) 251.5 m³</td>
</tr>
<tr>
<td>83.</td>
<td>50%</td>
</tr>
<tr>
<td>84.</td>
<td>30.48 cm³</td>
</tr>
</tbody>
</table>
1. If l, b and h are the length, breadth and height of a room then what will be the total area of the four walls?

2. The volume of a sphere is $310.4 \text{ cm}^3$. Find its radius.

3. The circumference of the base of a cylinder is 30.8 cm. Its curved surface area is $289.52 \text{ cm}^2$. Find the height of the cylinder.

4. The side of a cube is double the length of the cuboid. The breadth and height of the cuboid are half of its length. Find the ratio of the curved surface area of cube to cuboid.

5. The seed of a corn has dimensions $1.8 \text{ cm} \times 0.8 \text{ cm} \times 0.2 \text{ cm}$. The height of the corn-tube is 13.7 cm and its radius is 4.2 cm. Assuming that the corn-seeds have negligible distance between them and all seeds are of same size, find the number of seeds on the corn-tube.

6. The length, breadth and height of a cuboid are increased by 30%. Find the percent increase in the total surface area.

7. Ajay prepared a dish and kept it in a hemispherical bowl of 30 cm diameter. He distributed the dish in cylinder cups of diameter 15 cm and height 4 cm among his friends and himself. How many friends were with Ajay?

8. A river 15 m deep 50 m wide is flowing at the rate of 2 cm per second. How many litres of water will fall from the river into the sea in 9 hours?
CHAPTER-14
STATISTICS
MIND MAP

Primary Data
Secondary Data
Raw Data
ungrouped data
Grouped Data
Collection
Presentation

Mean
Mode
Median

Central Tendency

Graphical Representation
Bar Graph
Histogram
Frequency Polygon

Knowledge about Data

Range
Class Interval
Class Size
Class Mark
Lower Limit
Upper Limit

Measures of Central Tendency
Statistics
CHAPTER-14

STATISTICS

KEY POINTS

• In Statistics we study collection, presentation, analysis and interpretation of data.
• Facts or figures collected with a definite purpose are called data.
• The number of times an observation occurs in the given data is called frequency of the observation.
• Class intervals are the groups in which all observations are divided.
• For class-interval 20-30, 30 is called upper class limit and 20 is called lower class limit.
• Class mark = \( \frac{\text{Lower class limit} + \text{Upper class limit}}{2} \)

• Average or mean = \( \frac{\text{Sum of all observations}}{\text{number of observations}} \)

• For raw data, mean \( \overline{x} = \frac{\sum_{i=1}^{n} x_i}{n} \)  Mean \( \overline{x} = \frac{X_1 + X_2 + \ldots + X_n}{n} \)

• When frequency \( f_i \) is given Mean \( \overline{x} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i} \)

• Mode is the value of observation which occurs most frequently.
• For Median arrange the data in ascending order or descending order.

  If number of observation 'n' is odd
  Then Median = \( \frac{(n+1)^{th}}{2} \)

  If number of observation 'n’ is even

  Then Median = \( \frac{\left(\frac{n}{2}\right)^{th} \text{term} + \left(\frac{n}{2} + 1\right)^{th} \text{term}}{2} \)
1. Facts or Figures, collected with a definite purpose are -
   (a) Frequency  (b) Data
   (c) Tally Marks  (d) Bars

2. To compare this years result with last years result, teacher went to the class and collected this years number of distinctions from the students. For last years number of distinctions, she opened the result register & wrote the required number of distinctions. The data collected by her from the students & register respectively, are examples of -
   (a) Primary data & secondary data  (b) Primary data & raw data
   (c) Both primary data  (d) Secondary data & Primary data

3. How is a histogram different from bar graph.
   (a) Histogram is same as bar graph but joined together.
   (b) no difference
   (c) We use class - intervals in histogram instead to variables.
   (d) (A) & (B) both are correct.

4. Which of the figures represent a histogram correctly-
   (a)  
   (b)  
   (c)  
   (d)  

---

Class IX - Mathematics
5. In a Histogram when we join midpoints of the tops of the rectangles (bars) we get:
   (a) Bar Graph        (b) line graph
   (c) Frequency Polygon (d) Pie graph

6. To draw a frequency polygon we need _______ of the class interval for x-axis and frequency of the respective class for y-axis.
   (a) upper limit      (b) lower limit
   (c) class-mark        (d) range

7. In a continuous frequency distribution, class mark of a class is 15 and lower limit is 13, then its upper limit is:
   (a) 16              (b) 14
   (c) 13              (d) 17

8. If class mark of a class-interval is 8.5. The class size is 5, then the class limits of the corresponding class-interval is
   (a) 6.5-11.5        (b) 6-11
   (c) 5.5-10.5        (d) 7-12

9. Let x be the class mark & y be the upper limit of a class-interval in a continuous frequency-distribution.
   The lower limit of the class is:
   (a) 2x+y            (b) 2x-y
   (c) x-y             (d) x+y

10. The mean of \(x_1, x_2, \ldots, x_n\) is 10, then the mean of \(5x_1, 5x_2, \ldots, 5x_n\) is ________.
    (a) 50              (b) 10
    (c) 15              (d) 5

11. The mean of first five prime numbers is
    (a) 3.6             (b) 5
    (c) 5.6             (d) 6

12. The mean of 5 observations is 10. If each observation of the data is increased by 5, the new mean is -
    (a) 50              (b) 15
    (c) 5               (d) No change, 10

13. The mean of 10 observations is 15. The sum of all observations is -
    (a) 15              (b) 10
    (c) 75              (d) 150
14. \( a_1, a_2, a_3, a_4 \text{ & } a_5 \) are five consecutive odd integers, then their mean is .
   (a) \( a_1 + 4 \)  
   (b) \( 5 (a_1 + a_2 + \ldots + a_5) \)  
   (c) \( \frac{a_1 \times a_2 \times a_3 \times a_4 \times a_5}{5} \)  
   (d) \( a_1 + 5 \)

15. If the mean of \( x, x + 2, x + 4, x + 6, x + 8 \) is 11, then the mean of first three observations is -
   (a) 9  
   (c) 8  
   (b) 10  
   (d) 11

16. The mean of first three observations is 15 and the mean of next two observation is 20. The mean of all five observations is -
   (a) 45  
   (c) 17  
   (b) 15  
   (d) 40

17. The mean of first two observations is 6 & the mean of first three observations is 7. The third observation is -
   (a) 8  
   (c) 6  
   (b) 7  
   (d) 9

18. Mean of 20 observations is 15.5. Later on it was found that the observation 24 was taken as 42. The correct mean is -
   (a) 14  
   (c) 14.4  
   (b) 14.2  
   (d) 14.6

19. If the mode of the data.
   \( 13, 27, 24, 13, 17, 16, 17, 21, 22, x, 13, 17, \) is 17 then the value of \( x \) is -
   (a) 16  
   (c) 21  
   (b) 17  
   (d) 13

20. If the median of the data arranged in ascending order -
   \( 7, 10, 14, x + 4, x + 8, x + 11, 27, 30 \) is 19 then \( x \) is -
   (a) 13  
   (c) 26  
   (b) 19  
   (d) 20

21. The mean of the prime factors of 24 is -
   (a) 2  
   (c) 4  
   (b) 2.5  
   (d) 7.5

22. If 9 observations are arranged in descending order which observation will be the median ?
   (a) 3rd  
   (c) 5th  
   (b) 4th  
   (d) 6th
23. 15 observations are arranged in ascending order. 9th observation is increased by 2. Then the new median will.
   (a) increases by 2  (b) Decrease by 2
   (c) no change      (d) Becomes two times

24. Out of total of 20 observations arranged in ascending order. 9th, 10th & 11th observations are 36, 40 and 44 then median is.
   (a) 36  (b) 42
   (c) 40  (d) 44

25. If mode of 4, 9, 5, 4, 9, 4, 9 and x-10 is 9 then x is-
   (a) 10  (b) 12
   (c) 14  (d) 19

26. In a frequency distribution table the numbers 4, 6 and 8 have frequencies (x-3), x & (x+1) respectively. If their mean is 8 then x is-
   (a) 8  (b) 0
   (c) 1  (d) 2

Fill in the Blanks :-
27. In a bar graph 0.2 cm length of a bar represents 100 people. The length of bar which represents 1300 people is ____________.

28. The marks of 5 students in a subject out of 50 are 32, 48, 50, 27 & 37, the range is ____________.

29. A set of data contains 64 as the highest value and its range is 13, the lowest value of the data is ____________.

30. The mid point of a class is called ____________.

31. The class mark of the class interval 4.7 – 6.3 is ____________.

Write True or False :-
32. The difference of the highest & the lowest value in the data is called class - size of the data.  
   [ ]

33. Cumulative frequency of the last class is the total of all frequencies in the data.  
   [ ]

34. The mean of 35 observations is 45. If the new mean is 51, then each of the observations is increased by 8.  
   [ ]
35. **Match the columns**

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) The mean of one digit prime numbers is</td>
<td>(a) $\bar{x}-3$</td>
</tr>
<tr>
<td>(2) The median of 11 observations is</td>
<td>(b) 2</td>
</tr>
<tr>
<td>(3) The value of x for which mode of 2, 2, 4, 4, x, 6 is 2 is</td>
<td>(c) $\bar{x}+3$</td>
</tr>
<tr>
<td>(4) If 3 is subtracted from each observation whose mean is $\bar{x}$, then new mean is</td>
<td>(d) 4.25</td>
</tr>
<tr>
<td></td>
<td>(e) 6th term</td>
</tr>
</tbody>
</table>

**PART-B**

36. Write the class size end class limits of 104, 114, 124, 134,

37. If the mean of the observations $x$, $2x+1$, $2x+5$, $2x+9$ is 30. What is mean of last two observations?

38. Find the mean from the following table.

<table>
<thead>
<tr>
<th>$x_i$</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f_i$</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

39. The mean of five numbers is 27. If one of the number is excluded, the mean gets reduced by 2. What is the value of the excluded number?

40. Find the mode of the data 15, 14, 19, 20, 14, 15, 16, 14, 15, 18, 14, 19, 15, 17, 15. If last observation is changed to 14 then find the new mode.

41. The mean monthly salary of 40 workers of a factory is $x$ in a particular year. Each one was given ₹ 3000 as Diwali Bonus. What will be the mean monthly salary in that month.

42. In the question 20 instead of bonus, ₹ 300 be deducted from each workers salary for April to February, what will be their mean monthly salary for December month?

43. For what value of $x$ the mode of the following data : 13, 24, 13, 27, 17, 16, 17, $x$, 22, 21, 13, 17 is 17?

44. The average age of Shikha and her husband Amit is 48 years. The average age of Shikha, Amit and their daughter Advika is 39 years. Find the age of Advika.
45. The mean of 6, 10, 11, x, 12, y is 10. Also y is 7 more than x. Find the value of x and y.

PART–C

46. In three unit tests of Mathematics Priyal got 75, 82 and 90 marks. How many marks must she obtain in Unit Test IV to have an average of 85 in all the four unit tests?

47. Time taken in seconds by 25 students in an examination to solve certain question is given below.

20, 16, 20, 27, 27, 28, 30, 33, 37, 50, 40, 42, 46, 28, 43, 46, 46, 48, 49, 52, 58, 59, 60, 64, 52.

By, taking class interval of size 10, make a frequency distribution table.

48. Find the mean from the following table

<table>
<thead>
<tr>
<th>xi</th>
<th>5</th>
<th>15</th>
<th>25</th>
<th>35</th>
<th>45</th>
</tr>
</thead>
<tbody>
<tr>
<td>fi</td>
<td>6</td>
<td>4</td>
<td>9</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

49. Draw the histogram from the following data

<table>
<thead>
<tr>
<th>Class</th>
<th>0-10</th>
<th>10-20</th>
<th>20-30</th>
<th>30-40</th>
<th>40-50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>8</td>
<td>15</td>
<td>20</td>
<td>12</td>
<td>16</td>
</tr>
</tbody>
</table>

50. Given below is a cumulative frequency distribution table showing the marks scored by 50 students of a class.

<table>
<thead>
<tr>
<th>Marks</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 20</td>
<td>17</td>
</tr>
<tr>
<td>Below 40</td>
<td>22</td>
</tr>
<tr>
<td>Below 60</td>
<td>29</td>
</tr>
<tr>
<td>Below 80</td>
<td>37</td>
</tr>
<tr>
<td>Below 100</td>
<td>50</td>
</tr>
</tbody>
</table>

Form a frequency table from the above data.
51. Given below are the seats won by different political parties in a state assembly election.

<table>
<thead>
<tr>
<th>Political Party</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seat Won</td>
<td>75</td>
<td>55</td>
<td>37</td>
<td>29</td>
<td>10</td>
<td>37</td>
<td>50</td>
</tr>
</tbody>
</table>

Draw a bar graph for above data.

52. Find the value of 'p' from the following distribution if the mean is 6.

<table>
<thead>
<tr>
<th>xi</th>
<th></th>
<th></th>
<th></th>
<th>p+5</th>
</tr>
</thead>
<tbody>
<tr>
<td>fi</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

53. Given below is the data of students who participated in different activities.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Sports</th>
<th>Meditation</th>
<th>Yoga</th>
<th>Walking</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Girls</td>
<td>42</td>
<td>35</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>No. of Boys</td>
<td>90</td>
<td>64</td>
<td>130</td>
<td>86</td>
</tr>
</tbody>
</table>

Draw double bar graph.

54. Draw histogram to represent the data given below.

<table>
<thead>
<tr>
<th>Age (in years)</th>
<th>No of children</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 2</td>
<td>5</td>
</tr>
<tr>
<td>2 - 3</td>
<td>4</td>
</tr>
<tr>
<td>3 - 5</td>
<td>10</td>
</tr>
<tr>
<td>5 - 7</td>
<td>12</td>
</tr>
<tr>
<td>7 - 10</td>
<td>9</td>
</tr>
<tr>
<td>10 - 15</td>
<td>10</td>
</tr>
<tr>
<td>15 - 17</td>
<td>8</td>
</tr>
</tbody>
</table>

55. The mean marks of boys & girls in periodical test are 36 and 39 respectively. If the mean marks of all the students of class IX in that test are 37. Find the ratio of the number of boys to the number of girls.

PART-D

56. The mean of the following data is 50.

<table>
<thead>
<tr>
<th>xi</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>fi</td>
<td>17</td>
<td>5a+3</td>
<td>32</td>
<td>7a-11</td>
</tr>
</tbody>
</table>

find 'a' & the frequencies for xi = 30 & xi = 70
57. Draw a frequency polygon for the following data

<table>
<thead>
<tr>
<th>Marks</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10</td>
<td>03</td>
</tr>
<tr>
<td>10 - 20</td>
<td>09</td>
</tr>
<tr>
<td>20 - 30</td>
<td>18</td>
</tr>
<tr>
<td>30 - 40</td>
<td>16</td>
</tr>
<tr>
<td>40 - 50</td>
<td>12</td>
</tr>
<tr>
<td>50 - 60</td>
<td>02</td>
</tr>
</tbody>
</table>

58. If the 26 English alphabets are taken such that A=1, B=2, C=3, ........ Z=26 then find

(i) The mean and median of the numbers corresponding to the vowels.

(ii) Which alphabet corresponds to the median.

59. In a school a student who scored 80% or above in his/her previous class is eligible for "Merit scholarship" Marks obtained by two students Nishi and Vinayak of class IX in their previous class (VIII) in all subjects are given below.

<table>
<thead>
<tr>
<th>Name</th>
<th>Hindi</th>
<th>English</th>
<th>Maths</th>
<th>Science</th>
<th>SSt.</th>
<th>Skt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nishi</td>
<td>78</td>
<td>74</td>
<td>86</td>
<td>85</td>
<td>73</td>
<td>83</td>
</tr>
<tr>
<td>Vinayak</td>
<td>79</td>
<td>76</td>
<td>88</td>
<td>83</td>
<td>71</td>
<td>85</td>
</tr>
</tbody>
</table>

Find average percentage score of Nishi and Vinayak, which of the two are eligible for merit scholarship?

60. The blood group of 30 students of class IX are recorded as follows.

A, B, B, B, O, B, B, A, AB, A, O, B, O, AB, O
AB, AB, B, AB, B, A, O, AB, B, A, O, AB, A, A, AB

a) Make a frequency distribution table for the above data.

b) Mr. 'X' meets an accident and needs blood, His blood group is AB. How many of these students are universal Donors and how many are Universal Recipient.

61. 15 students of Govt. school spend the following numbers of hours in a month for cleanliness of their street 25, 15, 20, 20, 9, 20, 25, 15, 7, 13, 20, 12, 10, 15, 8

Find mean, median and mode from above data.
62. A doctor suggests two ways for treatment of a particular disease one by taking medicine only and other by doing meditation and yoga.

<table>
<thead>
<tr>
<th>Age group</th>
<th>No. of patients taking medicines</th>
<th>No. of patients doing meditation &amp; yoga</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30</td>
<td>20</td>
<td>05</td>
</tr>
<tr>
<td>30-40</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>40-50</td>
<td>42</td>
<td>20</td>
</tr>
<tr>
<td>50-60</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>60-70</td>
<td>30</td>
<td>20</td>
</tr>
</tbody>
</table>

i) Draw Frequency polygons for the above data on the graph.

63. Represent the marks of both the sections on the same graph by two frequency polygons.

The following table shows number of voluntary blood donors as per day in voluntary blood donation camp organized in Delhi.

<table>
<thead>
<tr>
<th>Days</th>
<th>No. of Donars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunday</td>
<td>100</td>
</tr>
<tr>
<td>Monday</td>
<td>80</td>
</tr>
<tr>
<td>Tuesday</td>
<td>110</td>
</tr>
<tr>
<td>Wednesday</td>
<td>80</td>
</tr>
<tr>
<td>Thursday</td>
<td>60</td>
</tr>
<tr>
<td>Friday</td>
<td>70</td>
</tr>
<tr>
<td>Saturday</td>
<td>120</td>
</tr>
</tbody>
</table>

i) Draw a bar graph showing above information.

ii) On which day donation was maximum and on which day it was minimum.
STATISTICS

Answers

1. (b) Data
2. (d) Secondary data & Primary Data
3. (c) We use class-intervals in histogram
4. (b)  

![Bar Graph]

5. (c) Frequency Polygon.
6. (c) Class mark
7. (d) 17
8. (b) 6-11
9. (b) 2x-y
10. (a) 50
11. (c) 5.6
12. (b) 15
13. (d) 150
14. (a) \( a_1 + \frac{4(a_1+a_2+a_2+4a_1+6a_1+8)}{5} \)
15. (a) 9
16. (c) 17
17. (d) 9
18. (d) 14.6
19. (b) 17
20. (a) 13
21. (b) 2.5
22. (c) 5th
23. (c) No change
24. (b) 42
25. (d) 19
26. (d) 2 \( \{18x-4 = 8x (x-3+x+1)\} \)
27. 2.6 cm
28. 23
29. 51
30. Class Mark
31. 5.5
32. False
33. True
34. False
35. (i) d, (ii) e, (iii) b, (iv) a
37. 37
38. 6
39. 35
40. 15:14
41. \( x + 3000 \)
42. x-300
43. 17
44. 21 years
45. \( x=7, y=14 \)
46. 93
47. \[
\begin{array}{cccccc}
3 & 6 & 4 & 7 & 5 \\
\end{array}
\]
48. 25
49. 50.

Class 0 - 20 20 - 40 40 - 60 60 - 80 80 - 100
Freq. 17 5 7 8 13

202 Class IX - Mathematics
52. p=8
53. 2:1
54. 5, 28, 24
55. 102, 9, I
56. 79.83, 80.33 Vinayak
57. (b) –6, 30
58. Mean = 15.6, Median = 15, Mode = 20
59. Saturday, Thursday
PRACTICE TEST

Statistics

1. Write class size and class limits of the following: 47, 52, 57, 62, 67, 72, 77

2. Find the value of "x" if mode of the following data is 5. Find x. 2, 4, 3, 5, 4, 5, 6, 4, x, 7, 5

3. The median of the following observations arranged in ascending order is 25. Find x. 11, 13, 15, 19, x + 2, x + 4, 30, 35, 39, 46

4. Find the median of the first 10 natural numbers. Is it equal to their mean?

5. The mean of 40 observations was 160. It was detected on rechecking that the value of 165 was wrongly copied as 125 for computation of mean. Find the correct mean.

6. If the mean of the following distribution is 6. Find the value of "R".

<table>
<thead>
<tr>
<th>X</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>R + 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

7. Draw histogram of the weekly pocket expenses of students of a School given below

<table>
<thead>
<tr>
<th>Weekly Expenses (Rs.)</th>
<th>No. of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 – 20</td>
<td>10</td>
</tr>
<tr>
<td>20 – 30</td>
<td>15</td>
</tr>
<tr>
<td>30 – 50</td>
<td>40</td>
</tr>
<tr>
<td>50 – 60</td>
<td>25</td>
</tr>
<tr>
<td>60 – 90</td>
<td>30</td>
</tr>
<tr>
<td>90 – 100</td>
<td>5</td>
</tr>
</tbody>
</table>

8. Draw Histogram and Frequency polygon.

<table>
<thead>
<tr>
<th>Marks</th>
<th>0 - 10</th>
<th>10-20</th>
<th>20-30</th>
<th>30-10</th>
<th>40-50</th>
<th>50-60</th>
<th>60 - 70</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Students</td>
<td>5</td>
<td>10</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>
CHAPTER-15
PROBABILITY
MIND MAP

Event/Trail (E)

Tossing a coin

Throwing a dice

P (Ē) Probability of non-occurrence of an event

Outcome/result

P(E) = Probability of Occuring of an event

PROBABILITY

Formula

P (E) = \frac{\text{Favourable outcomes}}{\text{Total outcomes}}

Rules

0 ≤ P (E) ≤ 1

Possible Event

P (E) = 1

Impossible Event

P (E) = 0

P(E) + P (Ē) = 1
KEY – POINTS

Trials - Trial is an action which results in one or several outcomes.

Example:

(i) Tossing of a win every time is a trial.
(ii) Throwing a dice every time is a trail.

• Probability of an event \( E \) is given by

\[
P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of trials}}
\]

The probability of an event always occur between 0 and 1.

\[0 \leq P(E) \leq 1\]

The probability of any sure event is 1.

\[P(a) = 1\]

The probability of an unsure event \( B \) is 0.

\[P(B) = 0\]

The sum of all the probabilities of all the trials of an event is 1.

\[P(E_1) + P(E_2) + P(E_3) + \ldots = 1\]

The sum of probabilities of happening and non-happening of an event is 1.

\[P(E) + P(\overline{E}) = 1\]
PART – A

1. Which of the following cannot be a probability of happening of an event?
   (a) 0          (b) Less than 0
   (c) More than 0 but less than 1     (d) 1

2. Which of the following result is possible on throwing a dice?
   (a) 0          (b) -1
   (c) 7          (d) 5

3. A fruit basket contains 8 apples, 5 mangoes and 10 Oranges. The probability of choosing a mango from the basket is:
   (a) $\frac{1}{5}$      (b) 5
   (c) $\frac{1}{6}$      (d) 6

4. A letter is chosen at random from English alphabets. The probability of that letter to be one of the letters of the word CYLINDER is.
   (a) $\frac{4}{13}$      (b) $\frac{13}{4}$
   (c) $\frac{2}{13}$      (d) $\frac{13}{2}$

5. The probability of not happening of an event is 0-63. The probability of happening of that event is:
   (a) 0.36     (b) 3-6
   (c) 3-7      (d) 0.37

6. The probability of having a multiple of 5 an throwing a dice is:
   (a) 0          (b) 1
   (c) $\frac{1}{6}$     (d) $\frac{5}{6}$

For Q-No. 8 - 12

The ages (in years) of the workers of a factory is given below:

<table>
<thead>
<tr>
<th>Age (in years)</th>
<th>10 - 19</th>
<th>20 - 29</th>
<th>30 - 39</th>
<th>40 - 49</th>
<th>50 - 59</th>
<th>60 and more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Workers</td>
<td>5</td>
<td>42</td>
<td>33</td>
<td>15</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>

A worker is chosen at random. The probability of the age of the chosen worker being
8. 40 years or more is:
   (a) 3/11 (b) 3/22
   (c) 1/11 (d) 1/22

9. in between 30 - 39 is:
   (a) 3/11 (b) 3/10
   (c) 11/3 (d) 10/3

10. 39 years or less is:
    (a) 3/11 (b) 5/11
    (c) 6/11 (d) 8/11

11. The probability of 'number of workers' being a multiple of 5 is.
    (a) 1/3 (b) 3/2
    (c) 2/3 (d) 4/3

12. The probability of 'number of workers' being greater than 10 is:
    (a) 2/3 (b) 1/2
    (c) 3/2 (d) 1/3

13. The probability of the diameter of a circle being the longest chord of the circle is:
    (a) 1 (b) 0
    (c) 1/2 (d) cannot be determined

14. A coin is tossed 200 times. If head appears 120 times then the probability of having a tail is:
    (a) 3/5 (b) 5/3
    (c) 2/5 (d) 5/2

15. The probability of choosing a quadrilateral out of the given quadrilaterals having only its opposite sides equal is:

   Rectangle Square Trapezium
   Parallelogram Kite Rhombus

   (a) 1/6 (b) 1/3
   (c) 2/3 (d) 1/2
16. The probability of falling friday on the 8th day of June is.
   (a) 1/7        (b) 1/30
   (c) 1/8        (d) 2/8

17. A letter is selected at random from English alphabets. The probability of it being a roman number is
   (a) 5/26       (b) 3/13
   (c) 7/26       (d) 4/13

For Q. No. 18-20

18. There are 150 steel utensils, 20 alluminium utensils and 80 glass utensils in a kitchen. A utensil is chose at random. Find the probability that the selected utensil is:
   (a) 3/5        (b) 2/15
   (c) 1          (d) 0

19. not of steel:
   (a) 3/5        (b) 2/5
   (c) 5/3        (d) 5/2

20. is of metal:
   (a) 17/25      (b) 25/17
   (c) 3/5        (d) 2/25

Fill in the blanks:
21. The probability of happening of an event can never be more than _____.
22. The probability of an impossible event is __________.
23. On tossing a coin, the possible outcomes are _____ and ______.
24. Getting a 9 on throwing a dice is _______ event.
25. The sum of the probabilities of all the trials of an event is ________.

State True or False
26. The probability of choosing a white square on the chess board is 50%.
27. While calculating the probability, numerator is always greater than denominator.

28. The probability of an event can be √4.
29. If the probability of an event is 1, then the event is possible.
30. If the probability of happening of an event is 0.42 then the probability of non-happening of that event is 0.58.

Match the following:
31. Probability of possible event (i) 1
32. Probability of choosing 'P' from the word APPLE (ii) 0
33. Probability of an impossible event (iii) 3
34. Not the probability of an event (iv) 2

35. What is the sum of the probabilities of happening of an event & not happening of the event?
36. What could be the probability of happening of an event E?
37. If the probability of an event to occur is 55%, then what is the probability of non occurrence of that event.
38. What is sum of the probabilities of all the possible events of a random experiment?
39. What is the probability of coming a prime number on throwing of a die?

40. A coin in tossed once, what is the probability of getting a tail?
41. A die is tossed once, what is the probability of getting an even number?
42. A bag contains 2 red, 3 green & 1 white ball, what is the probability that the ball picked up is black.
43. In the word MATHEMATICS, what is the probability of choosing a vowel?
44. During an interview for estate manager 15 candidates appeared. Out of which 8 were retired army man, 4 were retired principals & 3 others from different departments. What is the probability of selecting a retired army man for this post?
45. A bag contains slips with numbers between 3 & 32. What is the probability that a slip chosen contains multiples of 4?

PART-B

46. Below is the table showing marks secured in mathematics by students of class IX: What is

<table>
<thead>
<tr>
<th>Marks secured</th>
<th>0-20</th>
<th>20-30</th>
<th>30-40</th>
<th>40-50</th>
<th>50-60</th>
<th>60-70</th>
<th>70-80</th>
<th>80-90</th>
<th>90-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>0</td>
<td>1</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>
i) Probability of getting marks less than 50%
ii) Probability of getting 90% & above 90%

47. Cards numbered from 7 to 49 are put in a box & mixed thoroughly. A card is drawn from the box, what is the probability that the number written on it is:
   i) A prime number
   ii) A multiple of 7.

48. The number of hours spent by Ashu, a school student on various activities on a working day are given below:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Sleep</th>
<th>School</th>
<th>H.W.</th>
<th>Tuition out of home</th>
<th>Outdoor games</th>
<th>Other Acti. at home</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Hours</td>
<td>7</td>
<td>7</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

A friend Sonu came to his house to study together. What is the probability that
   i) Ashu is available at home.
   ii) Ashu's friend will play with Ashu.

49. At a traffic light on 28th April, out of 310 vehicles which crossed the light, 200 were cars, 60 were two wheelers & 50 were autos. 18 were fined for jumping the red light or not wearing of belt or helmet, 5 were fined for using car with odd number, four were left after giving warning. What is the probability that
   i) A car is chosen & it bears even number.
   ii) A fine was given.

50. The following data was collected from an old age home.

<table>
<thead>
<tr>
<th>Drink</th>
<th>Campa/Soft Drink</th>
<th>Shikanji</th>
<th>Milk</th>
<th>Canned Juice</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of people</td>
<td>6</td>
<td>10</td>
<td>16</td>
<td>8</td>
</tr>
</tbody>
</table>

What is the probability that a person chosen likes.
   i) Natural drink
   ii) Canned Juice
51. There are 35 students in class IXA, 34 in IX-B & 33 in IX C. If even roll numbers are allotted project on chapter 2, Polynomials & odd roll number are allotted for chapter-1, Number system. What is the probability that the student chosen
   i) Prepares project on chapter 1
   ii) Prepares project on chapter 2

52. If the difference between the probabilities of happening & non happening of an event E is $\frac{3}{7}$. Find the probability of happening of the event E.

53. Following table shows the birth month of 40 students of a class.

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>July</th>
<th>February</th>
<th>April</th>
<th>May</th>
<th>June</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Month</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

A students is chosen what is the probability that
   i) its birth month is November
   ii) The month contains 31 days.

PART-C

54. After a medical check up for HB level of 35 students of class IX Following data was recorded.

<table>
<thead>
<tr>
<th>HB Level</th>
<th>Below 8</th>
<th>Below 10</th>
<th>Below 12</th>
<th>Below 14</th>
<th>Below 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Students</td>
<td>3</td>
<td>7</td>
<td>13</td>
<td>23</td>
<td>35</td>
</tr>
</tbody>
</table>

What is the probability that a student choosen has
   i) HB level less than 10.
   ii) HB level greater than or equal to 12 but less than 16.

55. To know the opinion of 35 students about sixth subject as automobile engineering or financial management a survey was done. The data is recorded in the following table in favour of choosing automobile engineers.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No of student like</td>
<td>20</td>
</tr>
<tr>
<td>Dislike</td>
<td>15</td>
</tr>
</tbody>
</table>
Find the probability that a student will opt.

i) automobile engineering

ii) Financial management

56. A die is thrown 100 times by a player during a game. The data is recorded in the table given below.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>20</td>
<td>12</td>
<td>18</td>
<td>19</td>
<td>16</td>
<td>15</td>
</tr>
</tbody>
</table>

A Player will get one more chance if he gets 1 or 6 & loses his/her next chance if 3 or 5 comes.

i) What is the probability of loosing the next chance?

ii) What is the probability of getting one more chance?

57. Following is the table showing marks obtained by 200 students out of 100 in an examination.

<table>
<thead>
<tr>
<th>Marks</th>
<th>No. of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>20</td>
</tr>
<tr>
<td>10-20</td>
<td>40</td>
</tr>
<tr>
<td>20-30</td>
<td>15</td>
</tr>
<tr>
<td>30-40</td>
<td>24</td>
</tr>
<tr>
<td>40-50</td>
<td>25</td>
</tr>
<tr>
<td>50-60</td>
<td>12</td>
</tr>
<tr>
<td>60-70</td>
<td>9</td>
</tr>
<tr>
<td>70-80</td>
<td>7</td>
</tr>
<tr>
<td>80-90</td>
<td>12</td>
</tr>
<tr>
<td>90-100</td>
<td>36</td>
</tr>
</tbody>
</table>

Find the probability that a students chosen.

i) Obtained less than 40 marks.

ii) Obtained greater than or equal to 60 but less than 80.

iii) Obtained 80 & above.

58. Mathematics book of class IX contains 15 chapters. A maths teacher asked one of the students to write the name of each chapter on slips, One name on one slip. She mixed the slips thoroughly in a box.

She called a student to pick up one of the slips. What is the probability that the chapter written on it is from

(i) Geometry    (ii) Algebra
59. Out of quadrilaterals - Square, rectangle, rhombus, parallelogram and trapezium, a quadrilateral is chosen at random. Find the probability that the quadrilateral chosen has.
   i) All the angles right angles.
   ii) both the diagonals bisect each other.
   iii) Diagonals are perpendicular to each other.
   iv) Only one of the diagonal bisect the other.

60. How many pages of NCERT class IX Mathematics book of English medium contains? A page is selected at random. What is the probability that the page number contains.
   i) 9 at one's place.
   ii) multiple of 4
   iii) perfect square

61. The following table shows per day salary of 1000 workers.

<table>
<thead>
<tr>
<th>Salary Per Day (₹)</th>
<th>500-700</th>
<th>701-900</th>
<th>901-1100</th>
<th>1101-1300</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Workers</td>
<td>280</td>
<td>175</td>
<td>420</td>
<td>125</td>
</tr>
</tbody>
</table>

If a worker is chosen at random, find the probability that he is getting.
   i) at least ₹ 701 daily
   ii) at most ₹ 900 daily
   iii) at most ₹ 1300 daily

62. BMI = \[
\frac{\text{Mass in Kg.}}{(\text{height in metres})^2}
\]

The following table shows the BMI of different categories.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Category</th>
<th>BMI (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Under weight</td>
<td>16.0-18.5</td>
</tr>
<tr>
<td>2.</td>
<td>Normal weight</td>
<td>18.5-25.0</td>
</tr>
<tr>
<td>3.</td>
<td>Over weight</td>
<td>25.0-30.0</td>
</tr>
<tr>
<td>4.</td>
<td>Obesity</td>
<td>Above 30.0</td>
</tr>
</tbody>
</table>

Three persons x, y, z have the same height 170 cm and their masses are 70 kg., 85 kg. & 65 kg. respectively.

Find the probability that a person chosen is overweight.
63. Read the lines carefully
Horse is horse, of course, of course.
And no one can talk to horse of course.
That is, of course, unless the horse is the famous mister ID.
Find the probability of the word 'course' from the above stanza.
Name the word which has the same probability as the word 'course' has.

64. The bar graph below shows the number of students in different classes of a school.

![Bar Graph]

In the annual function of primary classes, class IX & X was deputed for discipline duty, students of class VII & VIII for sitting, class VI students were to welcome the chief guests.
Find the probability that a student chosen is
i) Deputed for sitting
ii) a student of class X.
iii) member of welcome committee.

65. In a park, there is a right angled triangular flower bed. It's two small sides are 5m & 12m respectively. Along its all sides at a distance of 1/2m each, plants of different types are to be planted. Rose plants are to be planted along the shortest side, Marigold plants are to be planted along he longest side & sunflower plant along the third side. At each of the vertex a different type of flower plant is to be planted. A plant is chosen at random. Find the probability that the chosen plant is
(i) On the longest side.
(ii) Sunflower plants.

66. Out of 1000 small coloured bulbs $81^{3/2}$ are of white colour. $5^3$ are red coloured, $2^6$ are green coloured & rest are blue coloured. What is the probability that bulb chosen is:
   (i) blue coloured
   (ii) red coloured.
   (iii) white coloured.

67. In a school there are 682 students. The mode of transport used by them is as follows:

<table>
<thead>
<tr>
<th>Mode of Transport</th>
<th>Car with Parents</th>
<th>Bicycle</th>
<th>Pedestrian</th>
<th>DTC Bus</th>
<th>Bike with Parents</th>
<th>Van</th>
<th>Auto rickshaw</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Students</td>
<td>64</td>
<td>52</td>
<td>128</td>
<td>100</td>
<td>86</td>
<td>172</td>
<td>80</td>
</tr>
</tbody>
</table>

A student is chosen at random. What is the probability that he comes by:
   (i) Four wheeler
   (ii) Two wheeler
CHAPTER – 15
PROBABILITY

1. (b) Less than 0
2. (d) 5
3. (c) \( \frac{1}{6} \)
4. (a) \( \frac{4}{13} \)
5. (d) 0.37
6. (b) 1
7. (c) \( \frac{1}{6} \)
8. (a) \( \frac{3}{11} \)
9. (b) \( \frac{3}{10} \)
10. (d) \( \frac{8}{11} \)
11. (c) \( \frac{2}{3} \)
12. (b) \( \frac{1}{2} \)
13. (a) 1
14. (c) \( \frac{2}{5} \)
15. (b) \( \frac{1}{3} \)
16. (a) \( \frac{1}{7} \)
17. (c) \( \frac{7}{26} \)
18. (d) 0
19. (b) \( \frac{2}{5} \)
20. (a) \( \frac{17}{25} \)
21. 1
22. 0
23. Head, Tail
24. Impossible
25. 1
26. True
27. False
28. False
29. True
30. True
31. (ii) 0
32. (iv) \( \frac{2}{5} \)
33. (i) 1
34. (iii) 3
35. 1
36. $0 \leq P(E) \leq 1$
37. 45%
38. 1
39. $\frac{1}{2}$
40. $\frac{1}{2}$
41. $\frac{1}{2}$
42. 0
43. $\frac{4}{11}$
44. $\frac{8}{15}$
45. $\frac{7}{28} = \frac{1}{4}$
46. (i) $\frac{5}{12}$ (ii) $\frac{1}{24}$
47. (i) $\frac{11}{43}$ (ii) $\frac{7}{43}$
48. (i) $\frac{11}{24}$ (ii) $\frac{1}{8}$
49. (i) $\frac{39}{40}$ (ii) $\frac{23}{310}$
50. (i) $\frac{13}{20}$ (ii) $\frac{1}{5}$
51. (i) $\frac{26}{51}$ (ii) $\frac{25}{51}$
52. $\frac{5}{7}$
53. (i) $\frac{1}{10}$ (ii) $\frac{7}{12}$
54. (i) $\frac{2}{7}$ (ii) $\frac{22}{35}$
55. (i) $\frac{4}{7}$  
(ii) $\frac{3}{7}$

56. (i) $\frac{17}{50}$  
(ii) $\frac{7}{20}$

57. (i) $\frac{99}{200}$  
(ii) $\frac{2}{25}$  
(iii) $\frac{6}{25}$

58. (i) $\frac{7}{15}$  
(ii) $\frac{2}{15}$

59. (i) $\frac{2}{5}$  
(ii) $\frac{4}{5}$  
(iii) $\frac{3}{5}$  
(iv) $\frac{1}{5}$

60. (i) $\frac{32}{323}$  
(ii) $\frac{80}{323}$  
(iii) $\frac{17}{323}$

61. (i) $\frac{18}{25}$  
(ii) $\frac{91}{200}$  
(iii) 1

62. $\frac{1}{3}$

63. (i) $\frac{1}{7}$  
(ii) Horse

64. (i) $\frac{92}{205}$  
(ii) $\frac{28}{205}$  
(iii) $\frac{11}{41}$

65. (i) $\frac{9}{20}$  
(ii) $\frac{23}{60}$

66. (i) $\frac{41}{500}$  
(ii) $\frac{1}{8}$  
(iii) $\frac{729}{1000}$

67. (i) $\frac{236}{682}$  
(ii) $\frac{138}{682}$
PRACTICE TEST

1. Write the probability of an impossible event. (1)
2. Write the probability of a sure event. (1)
3. A dice is thrown once. Find the probability of getting a prime number. (2)
4. A letter of English alphabet is chosen at random. Calculate the probability that letter chosen is a vowel. (2)
5. A bag contains 15 cards numbered 1 to 15. Find the probability of drawing a card from the bag randomly. (3)
   (i) Card has a number multiple of 3.
   (ii) Card has a prime number.
6. One number is chosen at random from numbers 1 to 100. Find the probability that it is divisible by 4 or 6. (3)
7. In a one day international cricket match, a batsman play 50 balls. The run scored as follows

<table>
<thead>
<tr>
<th>Run Scored</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Balls</td>
<td>13</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

Find the probability that batsman will score (4)
(a) 6 runs (b) 4 or 6 runs
(c) Runs less than 2 (d) 3 Runs

8. Three coins are tossed simultaneously 200 times with the following frequencies of different out comes. (4)

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>3 Head</th>
<th>2 Head</th>
<th>1 Head</th>
<th>No Head</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>23</td>
<td>72</td>
<td>77</td>
<td>28</td>
</tr>
</tbody>
</table>

Find the probability of getting:
(a) Two heads, (b) Three heads, (iii) At least two heads
PRACTICE QUESTION PAPER - I
CLASS-IX
MATHEMATICS

Time: 3 Hrs. M.M. 80

General Instruction:
1. All questions are compulsory.
2. The paper consists of 40 questions divided into four sections A, B, C and D. Section A comprises of 20 questions of 1 marks each. Section B comprises of 6 question of 2 marks each. Section C comprises of 8 questions of 3 marks each. Section D comprises of 6 question of 4 marks each.
3. There is no over all choice in this question paper. All though internal choices has been provided in some question.

SECTION - A

1. \( \sqrt[3]{2^x} \)
   a) \( 2^{-\frac{1}{6}} \)  
   b) \( 2^{-6} \)
   c) \( 2^{\frac{1}{6}} \)  
   d) \( 2^6 \)

   or

   \((625)^{0.16} \times (625)^{0.09} = ?\)
   a) 5  
   b) 25  
   c) 125  
   d) 625.25

2. If \( \frac{x}{y} + \frac{y}{x} = -1 \) (x, y \( \neq 0 \)). the value of \( x^3 - y^3 \) is
   a) -1  
   b) 1  
   c) 0  
   d) \( \frac{1}{2} \)

3. If a + b + c = 0 then \( \frac{a^2}{bc} + \frac{b^2}{ca} + \frac{c^2}{ab} = ? \)
   a) 1  
   b) 0  
   c) -1  
   d) 3
4. The values of $249^2 - 248^2$ is
   a) $1^2$  
   b) 477  
   c) 487  
   d) 497

5. If $(2, 0)$ is a solution of the linear equation $2x + 3y = K$, then the value of $K$ is
   a) 4  
   b) 6  
   c) 5  
   d) 2

6. How many linear equations is $x$ and $y$ can be satisfied by $x = 1$ and $y = 2$?
   a) Only One  
   b) Two  
   c) Infinitely many  
   d) Three

7. The point whose ordinate is 4 and which lies on y-axis is
   a) $(4, 0)$  
   b) $(0, 4)$  
   c) $(1, 4)$  
   d) $(4, 2)$

   or

   If $P(-1, 1)$, $Q(3, -4)$, $R(1, -1)$, $S(-2, -3)$ and $T(-4, 4)$ are plotted on the graph paper, then the points in the fourth quadrant are
   a) $P$ and $T$  
   b) $Q$ and $R$  
   c) Only $S$  
   d) $P$ and $R$

8. The angles of a triangle are in the ratio $2 : 4 : 3$. The smallest angle of the triangle is
   a) $60^\circ$  
   b) $40^\circ$  
   c) $80^\circ$  
   d) $20^\circ$

9. Two sides of a triangle are of length 5cm and 1.5cm. The length of the third side of the triangle cannot be.
   a) 3.4cm  
   b) 3.6cm  
   c) 3.8cm  
   d) 4.1cm
10. The figure obtained by joining the mid point of the sides of a rhombus, taken in order is
   a) a rhombus       b) a rectangle
   c) a square        d) any Parallelogram

11. In Fig. AB and CD are two equal chords of a circle with centre O. OP and OQ are perpendiculars on chords AB and CD respectively. If ∠POQ = 150°, then ∠APQ is equal to
   a) 30°    b) 75°
   c) 15°    d) 60°

12. By the Heron's formula, the area of ΔABC is given by Δ = __________ sq. unit.

13. The sides of a triangle are 56cm, 60cm, and 52cm long. Then the area of the triangle is
   a) 1322cm²       b) 1311cm²
   c) 1344cm²       d) 1392cm²

14. The sides of a triangle are in the ratio 5:12:13 and its perimeter is 150cm. The area of the triangle is
   a) 375cm²       b) 750cm²
   c) 250cm²       d) 500cm²

15. The total surface area of a cone whose radius is \( \frac{r}{2} \) and short height \( 2l \) is
   a) \( 2\pi r (l + r) \)       b) \( \pi r (l + \frac{r}{4}) \)
   c) \( \pi r (l + r) \)       d) \( 2\pi rl \)

16. The radius of a hemispherical balloon increases from 6cm to 12cm as air is being pumped into it. the ratios of the surface areas of the
balloon in the two cases is
a) 1 : 4  
   b) 1 : 3
   c) 2 : 3  
   d) 2 : 1

17. The class mark of the class 90 – 120 is :
   a) 90  
   b) 105
   c) 115  
   d) 120

18. The mean of five number is 30. If one number is excluded their mean becomes 28. The excluded number is :
   a) 28  
   b) 30
   c) 35  
   d) 38

19. A coin is tossed 60 times and the tail appears 35 times. What is the probability of getting a head ?
   a) \( \frac{7}{12} \)  
   b) \( \frac{12}{7} \)
   c) \( \frac{5}{12} \)  
   d) \( \frac{12}{5} \)

20. Fill in the blanks :
   If \( E \) be an event, then \( P(E) + P(\text{not } E) = \) _____________

**SECTION - B**

21. If the point (3, 4) lies on the graph of \( 3y = ax + 7 \), then find the value of \( a \).

or

Find four different solutions of \( 2x + y = 6 \).

22. If \( PQ \parallel ST \), \( \angle PQR = 110^\circ \) and \( \angle RST = 130^\circ \), find \( \angle QRS \)

\[ \text{Diagram:} \quad \begin{aligned}
\angle PQR &= 110^\circ \\
\angle RST &= 130^\circ \\
\end{aligned} \]
23. Find the area of the trapezium whose parallel sides are 14cm and 10cm and whose height is 6cm.

24. The perimeter of a an isosceles triangle is 32cm. The ratio of the equal side to its base is 3:2. Find the area of the triangle.

25. The diameter of a roller is 84cm and its length is 120cm. It takes 500 complete revolutions to move once cover to level a playground. Find the area of the playground is $m^2$.

26. A die was rolled 100 times and the number of times 6 appeared was noted. If the probability of getting a 6 be $\frac{2}{5}$, how many times did 6 come up?

or

1500 families with 2 children each, were selected randomly and the following data were recorded.

<table>
<thead>
<tr>
<th>Number of girls is a family</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of families</td>
<td>102</td>
<td>675</td>
<td>723</td>
</tr>
</tbody>
</table>

out of these families, one family is selected at random. What is the probability that the selected family has.

i) 2 girls

ii) 1 girl

SECTION - C

27. If $a = 2 + \sqrt{3}$, then find the value of $a - \frac{1}{a}$.

28. Factories : $a(a-1) - b(b-1)$

or

If $P = 2 - a$, prove that $a^2 + 6ap + p^3 - 8 = 0$

29. The taxi fare in a city as follows : for the first kilometre, the fare is ₹25 and for the subsequent distance it is ₹14 per km. Taking the distance covered as $x$ km and total fare as ₹$y$, write the linear equation for this information and draw its graph.

30. Three vertices of a rectangle are $(3, 2)$, $(-4, 2)$ and $(-4, 5)$, plot these points on a graph paper and the coordinates of the fourth vertex.
31. Prove that the sum of three angles of a triangle is $180^\circ$.

In a $\triangle ABC$, $\angle B > \angle C$ if $AM$ is the bisector of $\angle ABC$ and $AN \perp BC$. Prove that $\angle MAN = \frac{1}{2} (\angle B - \angle C)$

32. The measure of angles of a quadrilateral are $(x+20)^\circ$, $(x-20)^\circ$, $(2x+5)^\circ$ & $(2x-5)^\circ$. Find the value of $x$.

or

E is the mid point of the median $AD$ of $\triangle ABC$ and $BE$ is produced to meet $AC$ at $F$. Show that $AF = \frac{1}{3} AC$.

33. Prove that parallelogram on the same base and between the same parallels are equal in area.

or

$ABCD$ is trapezium in which $AB \parallel DC$, $DC=30$ cm and $AB=50$ cm. If $x$ and $y$ are, respectively the mid points of $AD$ and $BC$ prove that

$$\text{ar} \ (DCYX) = \frac{7}{9} \text{ar} \ (XYBA)$$

34. In figure, $O$ is the centre of the circle. $\angle BCO = 30^\circ$. Find $x$ and $y$.

35. Show that:

$$\frac{1}{(3 - \sqrt{8})} - \frac{1}{(\sqrt{8} - \sqrt{7})} + \frac{1}{(\sqrt{7} - \sqrt{6})} - \frac{1}{(\sqrt{6} - \sqrt{5})} + \frac{1}{(\sqrt{7} - 6)} = 5$$
36. Factories the expression

\[ 8x^3 + 27y^3 + 36x^2y + 54xy^2 \]

37. In a \( \triangle ABC \).

i) The sides \( AB \) and \( AC \) are produced to \( P \) and \( Q \) respectively. If the bisectors of
\( \angle PBC \) and \( \angle QCB \) intersect at a point \( O \).
Prove that \( \angle BOC = 90^\circ - \frac{1}{2} \angle A \)

ii) The bisectors of \( \angle B \) and \( \angle C \) intersect each other at a point \( O \).
Prove that \( \angle BOC = 90^\circ + \frac{1}{2} \angle A \)

If the bisector of an angle of a triangle also bisect the opposite side. Prove that the triangle is isosceles.

38. Construct a triangle \( XYZ \) in which \( \angle Y = 30^\circ \), \( \angle Z = 90^\circ \) and \( XY + YX + ZX = 11 \text{ cm} \). Write steps of construction also.

39. The radius of a sphere is increased by 10%. Prove that the volume will be increased by 33.1% approximately.

or

The ratio of the curved surface area and the total surface area of a circular cylinder is 1:2 and the total surface area is \( 616 \text{ cm}^2 \). Find its volume

40. The mean marks (out of 100) of boys and girls in an examination are 70 and 73 respectively. If the mean marks of all the students is the examination is 71. Find the ratio of the number of boys to the number of girls.

or

The mean of 100 items was found to be 64. Later on it was discovered that two items misread as 26 and 9 instead of 36 and 90 respectively. Find the correct mean.
1. c) $2^{\frac{1}{2}}$ or a) 5
2. c) 0
3. d) 3
4. d) 497
5. a) 4
6. c) Infinitely many
7. b) (0, 4) or b) Q and R
8. b) 40°
9. a) 3.4cm
10. b) a rectangle
11. b) 75°
12. $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$
13. c) 134 4cm²
14. b) 750cm²
15. b) $\pi r (l + \frac{r}{4})$
16. a) 1 : 4
17. b0 105
18. d) 38
19. c) $\frac{5}{12}$
20. P(E) + P(Not E) = 1 [P(E) + P(\bar{E}) = 1]
21. a = $\frac{5}{3}$ or y = 6 - 2x Four solutions are
   
   (x = 1 $\Rightarrow$ y = 4) (x = 3 $\Rightarrow$ y = 0)
   
   (x = 2 $\Rightarrow$ y = 2) (x = 4 $\Rightarrow$ y = -2)

22. $\angle QRS = 60^\circ$
23. 72cm²

Class IX - Mathematics
24. $32\sqrt{2}$ cm²
25. 1584 m²
26. 40 times or i) $\frac{102}{1500} = 0.068$ ii) $\frac{675}{1500} = 0.45$
27. $a - \frac{1}{a} = 2\sqrt{3}$
   $\therefore a = 2 + \sqrt{3}$
   $\therefore \frac{1}{a} = 2 - \sqrt{3}$
   $a - \frac{1}{a} = (2+\sqrt{3}) - (2-\sqrt{3}) = 2\sqrt{3} - 2 + \sqrt{3} = 2\sqrt{3}$
28. $a(a-1) - b(b-1) = a^2 - a - b^2 + b = (a^2 - b^2) - (a-b) = (a-b)(a+b)-(a-b)$
   $= (a-b)(a+b-1)$
   Hence $a(a-b) - b(b-1) = (a-b)(a+b-1)$
   or
   $P = 2-a$ $\Rightarrow a+p+(-2) = 0$
   $\Rightarrow a^3 + p^3 + (-2)^3 = 3\times a\times p\times(-2)$
   $\Rightarrow a^3 + p^3 - 8 = -6ap$
   $\Rightarrow a^3 + 6ap + p^3 - 8 = 0$
29. $Y = 25 + 14(x-1) \Rightarrow y = 25 + 14x-14 \Rightarrow y=14x+9$
   Take any two points such as $(x=0 \Rightarrow y=9)$ and $(x=-1 \Rightarrow y=-5)$
on the graph paper take distance along $x$–axis and fare (in ₹) along $y$-axis.
   Now, plot the points A(0, 9) and B(-1, -5) on the graph paper
   Join AB and produce it on both side to obtain the required graph.
30. Plot the three vertices of the rectangle as A(3, 2), B(−4, 2), C(−4, 5). To find the coordinate of the fourth vertex D. Since ABCD is a rectangle. The opposite sides of a rectangle are equal. So the abscissa of D should be equal to abscissa of A. i.e. 3 and the ordinate of D should be equal to ordinate of C. i.e. 5. So the coordinates of D are (3, 5).
31. Prove that the sum of the three angles of a triangle is 180°.

In a ∆ABC, ∠B > ∠C, If AM is the bisector of ∠BAC and AN ⊥ BC.
Prove that \(\angle MAN = \frac{1}{2} (\angle B - \angle C)\)

Given : ∆ABC, in which ∠B > ∠C, AN ⊥ BC
and AM is the bisector of ∠A
To prove : \(\angle MAN = \frac{1}{2} (\angle B - \angle C)\)

Proof : Since AM is the bisector of ∠A ⇒ \(\angle MAB = \frac{1}{2} \angle A\) ______ (i)

In the right angle ∆ANB
\(\angle B + \angle NAB = 90° \Rightarrow \angle NAB = 90° - \angle B\) ___________ (ii)

\[\therefore \angle MAN = \angle MAB - \angle NAB = \angle A - (90° - \angle B)\]
\[= \frac{1}{2} \angle A - \frac{1}{2} (\angle A + \angle B + \angle C) + \angle B\]
\[= \frac{1}{2} (\angle B - \angle C)\]
Hence \(\angle MAN = \frac{1}{2} (\angle B - \angle C)\)
32. We know that 
\[(x+20)^\circ + (x - 20)^\circ + (2x+5)^\circ + (2x-5)^\circ = 360^\circ\]
\[= 6x + 360^\circ\]
\[x = \frac{360^\circ}{6}\]
\[x = 60\]

or

Draw DP || EF

In \(\triangle ADP\), E is the mid point of AD and EF || DP

\(\therefore F\) is the mid point of AP

(By converse of mid point theorem)

in \(\triangle FBC\), D is the mid point of BC and DP || BF

\(\therefore P\) is the mid point of FC

Then AF = FP = PC

\[AF + FP + PC = AC\]

\[AF + AF + AF = AC \Rightarrow 3AF = AC \Rightarrow AF = \frac{1}{3} AC\]

Hence AF = \(\frac{1}{3} AC\)

33. Given : Two \(\parallel\) gms ABCD and ABEF on the same base AB and between the same parallel lines AB and FC.

To prove : ar (\(\parallel\) gm ABCD) = ar (\(\parallel\) gm ABEF)

Proof : In \(\triangle ADF\) and \(\triangle BCE\)

\[AD = BC\] (opposite sides of \(\parallel\) gm)

\[AF = BE\] (opposite sides of \(\parallel\) gm)

\[\angle DAF = \angle CBE\] (\(\therefore AD \parallel BC\) and \(AF \parallel BE\))

angle between AD and AF = angle between BC and BE

\(\therefore \triangle ADF \cong \triangle BCE\) (SAS Criteria)

\(\therefore \text{ar} (\triangle ADF) = \text{ar} (\triangle BCE)\) \(\text{(i)}\)

\(\therefore \text{ar} (\parallel \text{gm} \ AB\ CD) = \text{ar} (\square \ ABED) + \text{ar} (\triangle BCE)\)

\[= \text{ar} (\square \ ABED) + \text{ar} (\triangle ADF)\] using \(\text{(i)}\)

\[= \text{ar} (\parallel \text{gm} \ AB\ EF)\]

Hence \(\text{ar} (\parallel \text{gm} \ AB\ CD) = \text{ar} (\parallel \text{gm} \ AB\ EF)\)
or

\[ xy = \frac{1}{2} (a+b) \]

Let \( d \) be distance between \( AB \) and \( XY \)

then \( D \) is the distance between \( XY \) and \( DC \).

\[ \text{ar (trap. ABXY)} = \frac{1}{2} (a + \frac{a+b}{2}) \cdot d = \frac{(3a+b)d}{4} \]

\[ \text{ar (trap XYCD)} = \frac{1}{2} \left( \frac{a+b}{2} + b \right) \cdot d = \frac{(a+3b)d}{4} \]

\[ \frac{\text{ar (trap XY)} \text{ar (trap XYBA)}}{\text{ar (trap XYBA)}} = \frac{\text{ar (DCYX)}}{\text{ar (XYBA)}} = \frac{(3a+b)d}{4} \]

\[ \frac{\text{ar (DCYX)}}{\text{ar (XYBA)}} = \frac{a+3b}{3a+b} = \frac{50+3\times30}{3\times50+30} = \frac{50+90}{150+30} = \frac{140}{180} = \frac{7}{9} \]

\[ \therefore \, \text{ar (DCYX)} = \frac{7}{9} \text{ ar (XYBA)} \]

34. In \( \triangle OEC \)

\[ \angle EOC = 180^\circ - (90^\circ + 30^\circ) = 180^\circ - 120^\circ - 60^\circ \]

\[ \therefore \angle COD = 90^\circ - 60^\circ = 30^\circ \]

\[ \angle CBD = \frac{1}{2} \angle COD = \frac{1}{2} \times 30^\circ = 15^\circ \]

\[ \Rightarrow y = 15^\circ \quad \because \angle CBD = y \]

Again \( \angle ABD = \frac{1}{2} \angle AOD = \frac{1}{2} \times 90^\circ = 45^\circ \)

and \( \angle ABC = \angle ABD + y = 45^\circ + 15^\circ = 60^\circ = \angle ABE \)

In \( \triangle ABE \)

\[ \angle BAE = 180^\circ - (90^\circ + \angle ABE) = 180^\circ - (90^\circ + 60^\circ) \]

\[ x = \angle BAE = 180^\circ - 150^\circ = 30^\circ \]

\[ \Rightarrow x = 30^\circ \]

Hence \( x = 30^\circ \) and \( y = 15^\circ \)
35. on Rationalising

\[
\frac{1}{3-\sqrt{8}} = \frac{1}{(3-\sqrt{6})(3+\sqrt{8})} = \frac{3+\sqrt{8}}{9-8} = \frac{3+\sqrt{8}}{1} = 3+\sqrt{8}
\]

Similarly

\[
\frac{1}{\sqrt{8}-\sqrt{7}} = \sqrt{8}+\sqrt{7}, \quad \frac{1}{\sqrt{7}-\sqrt{6}} = \sqrt{7}+\sqrt{6}, \quad \frac{1}{\sqrt{6}-\sqrt{5}} = \sqrt{6}+\sqrt{5}, \quad \frac{1}{\sqrt{5}-2} = \sqrt{5}+2
\]

L.H.S.

\[
\frac{1}{(3-\sqrt{8})} - \frac{1}{(\sqrt{8}-\sqrt{7})} + \frac{1}{(\sqrt{7}-\sqrt{6})} - \frac{1}{(\sqrt{6}-\sqrt{5})} + \frac{1}{(\sqrt{5}-2)}
\]

\[
(3-\sqrt{8}) - (\sqrt{8}-\sqrt{7}) + (\sqrt{7}-\sqrt{6}) - (\sqrt{6}-\sqrt{5}) + (\sqrt{5}+2)
\]

\[
3-\sqrt{8} - \sqrt{8}-\sqrt{7} + \sqrt{7}-\sqrt{6} - \sqrt{6}-\sqrt{5} + \sqrt{5}+2
\]

\[
3+2
\]

\[
5 = \text{R.H.S}
\]

36. \(8x^3 + 27y^3 + 36x^2y + 54xy^2\)

\[= (2x)^3 + (3y)^3 + 18xy(2x+3y) \quad [\therefore a^3+b^3+3ab(a+b)=(a+b)^3] \]

\[= (2x)^3 + (3y)^3 + 3(2x)(3y)(2x+3y) \]

\[= (2x+3y)^3 = (2x+3y)(2x+3y)(2x+3y) \]

37. i) \(\angle B + \angle CBP = 180^\circ\) (Linear Pair)

\[
\Rightarrow \quad \frac{1}{2} \angle B + \frac{1}{2} \angle CBP = 90^\circ
\]

\[
= \frac{1}{2} \angle B + \angle 1 = 90^\circ
\]

\[
\angle 1 = 90^\circ - \frac{1}{2} \angle B
\]

Again \(\angle C + \angle BCQ = 180^\circ\)

\[
= \frac{1}{2} \angle C + \frac{1}{2} \angle BCQ = +0^\circ
\]

\[
= \frac{1}{2} \angle C + \angle 2 = 90^\circ
\]
\[ \Rightarrow \angle 2 = 90^\circ - \frac{1}{2} \angle C \quad \text{(ii)} \]

In \( \triangle BOC \) \( \angle 1 + \angle 2 + \angle BOC = 180^\circ \) (Angle sum property of \( \triangle \)s)

\[ \angle BOC = 180^\circ - (\angle 1 + \angle 2) = 180^\circ - (90^\circ - \frac{1}{2} \angle B + 90^\circ - \frac{1}{2} \angle C) \]

\[ \angle BOC = \frac{1}{2}(\angle B + \angle C) = \frac{1}{2}(\angle A + \angle B + \angle C) - \frac{1}{2} \angle A \]

\[ = \frac{1}{2} \times 180^\circ - \frac{1}{2} \angle A \quad \text{[\( \therefore \angle A + \angle B + \angle C = 180^\circ \)]} \]

\[ \angle BOC = 90^\circ - \frac{1}{2} \angle A \]

ii) In \( \triangle ABC \)

\[ \angle A + \angle B + \angle C = 180^\circ \] (Angle sum property \( \triangle \)s)

\[ \Rightarrow \frac{1}{2} \angle A + \frac{1}{2} \angle B + \frac{1}{2} \angle C = 90^\circ \]

\[ \Rightarrow \frac{1}{2} \angle A + \angle 1 + \angle 2 = 90^\circ \]

\[ \Rightarrow \angle 1 + \angle 2 = (90^\circ - \frac{1}{2} \angle A) \quad \text{(i)} \]

In \( \triangle BOC \)

\( (\angle 1 + \angle 2) + \angle BOC = 180^\circ \)

\( (90^\circ - \frac{1}{2} \angle A) + \angle BOC = 180^\circ \)

\[ \angle BOC = 90^\circ + \frac{1}{2} \angle A \]

or

Given :- A point D on side BC of a \( \triangle ABC \) such that

\[ \angle BAD = \angle CAD \]

and \ AD = CD \]

To prove :- \ AB = AC \]

Construction :- Produce AD to a point E such that

\ AD = DE and Join EC \]

Proof : In \( \triangle ABD \) and \( \triangle ECD \)

\ BD = CD \ (Given) \]

\ AD = ED \ (By construction) \]

\[ \angle ADB = \angle EDC \ (V.O.A.) \]

\[ \Rightarrow \triangle ABD \cong \triangle ECD \ (SAS) \]
So, \[ AB = EC \] 
and \[ \angle BAD = \angle CED \] \( \text{(CPT)} \) \( \text{(i)} \)

Also \[ \angle BAD = \angle CAD \] \( \text{(Given)} \) \( \text{(ii)} \)

From (i) and (ii)
\[ \angle CAD = \angle CED \]

\[ \Rightarrow AC = EC \] \( \text{[side opposite to equal angles]} \) \( \text{(iii)} \)

From (i) and (iii)
\[ \begin{align*}
AB &= EC \\
AC &= EC \\
\Rightarrow AB &= AC
\end{align*} \]

Hence \( \triangle ABC \) is isosceles.

39. The volume of the sphere = \( \frac{4}{3} \pi r^3 \)

10% increase in radius = 10% \( r \)

Increase radius = \( r + \frac{1}{10} r = \frac{11}{10} r \)

the volume of the sphere now becomes

\[ = \frac{4}{3} \pi \left( \frac{11}{10} r \right)^3 = \frac{4}{3} \pi \times \frac{1331}{1000} r^3 \]

\[ = \frac{4}{3} \pi \times 1.331 r^3 \]

\[ = \frac{4}{3} \pi \times 1.331 r^3 - \frac{4}{3} \pi r^3 = \frac{4}{3} \pi r^3 (1.331 - 1) \]

\[ = \frac{4}{3} \pi r^3 \times 0.331 \]

% increase in volume = \( \frac{\frac{4}{3} \pi r^3 \times 0.331}{\frac{4}{3} \pi r^3} \times 100\% = 33.1\% \)

or

\[ \frac{C.S.A.}{T.S.A.} = \frac{2\pi rh}{2\pi r(h+r)} = \frac{1}{2} \]

\[ \Rightarrow \frac{h}{h+r} = \frac{1}{2} \]
\[ h + r = 2h \quad \Rightarrow \quad h = r \]

T.S.A. = \(2\pi r (h+r) = 616\) = \(2\pi r (r+r) = 616\)

\[ = 2\pi r \times 2r = 616 \Rightarrow 4\pi r^2 = 61.6 \]

\[ = 4 \times \frac{22}{7} \times r^2 = 616 \times \frac{7}{88} \Rightarrow r = 7 = h \]

Volume of cylinder = \(\pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 7 = 1078\text{ cm}^3\)

Volume of cylinder = 1078 cm³

40. Let number of boys = \(x\), number of girls = \(y\)

Total marks obtained by boys = 70\(x\)

Total marks obtained by girls = 73\(y\)

Total marks obtained by both = 71\((x+y)\)

\[ \therefore 70x + 73y = 71 (x+y) \]

\[ \Rightarrow 73y - 71y = 71x - 70x \]

\[ \Rightarrow 2y = x \quad \Rightarrow \quad \frac{x}{y} = \frac{2}{1} \quad \Rightarrow \quad x:y = 2:1 \]

or

Mean of item = 64

Total items = 100

Num. of items = 64 \times 100 = 6400

Correct new sum of items = 6400 – (26+9)+(36+90)

= 6400 – 35 + 126

\[ \therefore \text{Correct new sums of items} = 6491 \]

\[ \therefore \text{Correct mean} = \frac{6491}{100} = 64.91 \]
PART – A

1. Which of the following is the formula for the volume of the sphere?
   a) \( \frac{1}{3} \pi r^3 \)  
   b) \( \frac{2}{3} \pi r^3 \)
   c) \( \pi r^3 \)  
   d) \( \frac{4}{3} \pi r^3 \)

2. If \( x=0 \) and \( y=k \) are the solutions of the equation \( 5x-3y=3 \), the value of \( k \) is:
   a) \( \frac{3}{2} \)  
   b) \( 0 \)
   c) \( -1 \)  
   d) \( -\frac{2}{3} \)

3. The class mark of the interval 100 – 120 is:
   a) 100  
   b) 110
   c) 120  
   d) 20
4. How many triangle are possible having angles 60°, 90° and 30°?
   a) only one  b) None  c) Infinite  d) only 3

5. Which of the following is true if \( \triangle PQR \cong \triangle SET \)?
   a) \( PQ = SE \)  b) \( QR = ST \)  c) \( \angle P = \angle T \)  d) \( PR = SE \)

6. Which of the following is a rational number?
   a) 0.123456...,  b) \( \sqrt{23} \),
   c) \( \sqrt{36} \)  d) \( 2\sqrt{3} \)

7. The base and height of a parallelogram are 10cm and 6cm respectively. The area of parallelogram is:
   a) \( 30\text{cm}^2 \)  b) \( 60\text{cm}^2 \),
   c) \( 16\text{cm}^2 \)  d) \( 8\text{cm}^2 \)

8. The probability of getting a factor of 6 on throwing a dice is:
   a) \( \frac{2}{3} \)  b) \( \frac{1}{3} \),
   c) \( \frac{1}{6} \)  d) \( \frac{3}{2} \)

9. The angle of the semicircle is:
   a) \( 120^\circ \)  b) \( 60^\circ \),
   c) \( 180^\circ \)  d) \( 90^\circ \)

10. Which quadrant has both ordinate and abscissa negative?
    a) I  b) II  c) III  d) IV

11. Find the value of C if in a triangle S=13, a=8, and b=7.

12. Find the value of x from the following figure.
13. Find the decimal expansion of \( \frac{31}{16} \).

14. If \((x-1)\) is a factor of the polynomial \(2x^2 - 2a\) then find the value of \(a\).

15. If the median of 6, 4, 7, 13 and \(p\) is 8 then find the value of \(p\).

16. Match the following

   i) 9

17. Distance of point \((4, 9)\) from x-axis

   ii) \(25^\circ\)

18. i) 9

   iii) \(115^\circ\)

19. Mode of data 4, 9, 5, 4, 9, 5, 4, 5, 9, 5

   iv) SAS Congruency

20. Supplementary angle of \(65^\circ\)

   v) 5

**PART B**

21. Find any two solutions of the equation \(4x + 3y = 12\).

22. If each side of triangle is doubled then find the ratio of area of new triangle thus formed and the given triangle.

   or

   In the figure, MORE is a parallelogram and \(RN \perp ME\) and \(MP \perp ER\). If \(MO=16\text{cm}\), \(MP=8\text{cm}\) and \(RN=10\text{cm}\) then find the value of \(ME\).

23. The volume of a right circular cone is \(9856\text{cm}^3\). If the radius of the base is \(14\text{ cm}\) then find the height of the cone. (Use \(\pi = 22/7\))

24. Solve: \((625)^{0.06} \times (625)^{0.19}\)
25. Factorize : \((p-q)^3 + (q-r)^3 + (r-p)^3\)
   
   or
   
   If \(p(x) = x+5\) then find the value of \(p(x) + p(-x)\)

26. The side of cube is 8cm. Find the lateral surface area of the cube.

**PART - C**

27. A dice is thrown 80 times. If the probability of having an even number is 7/10 then how many times an odd number appears on dice?

28. The cost of four chairs and five tables is ₹ 3200. Write a linear equation in two variables for this statement and find out its two solutions.
   
   or
   
   Solve for \(x : (5x+1) (x+3) − 8 = 5(x+1) (x+2)\)

29. In the given figure if \(l \parallel m\) then find the value of \(x\).

![Figure with angles](image)

30. The sides of a triangle are in the ration 11:19:24 and its perimeter is 540cm. Find the area of the triangle.
   
   or
   
   The side of a triangle shaped sheet are 5cm, 12cm and 13cm. Find the cost of painting on the sheet at the rate of ₹ 30 per cm².

31. Divide the polynomial \(9x^3−3x^2+15x−3\) by \((3x−1)\) and find its quotient and remainder.

32. Prove that the angle opposite to the equal sides of an equilateral triangle are equal.
   
   or
   
   In the given figure, \(AD = BD = CD\). Find \(\angle BAC\).

![Figure](image)
33. In a rhombus $ABCD$, $\angle ABC = 72^\circ$. Find $\angle ACD$

or

In the figure $ABCD$ is a parallelogram $x$ and $y$ are mid-point of sides $AB$ and $DC$. Prove that $AXCY$ is a parallelogram.

![Diagram of a rhombus and parallelogram]

**PART – D**

35. Prove that the angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.

or

In the given figure, $O$ is the centre of the circle and $\angle BCO = 30^\circ$. Find the value of $x$ and $y$.

![Diagram of a circle and triangle]

36. Draw the frequency polygon for the following distribution.

<table>
<thead>
<tr>
<th>Marks</th>
<th>No. of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>7</td>
</tr>
<tr>
<td>10-20</td>
<td>10</td>
</tr>
<tr>
<td>20-30</td>
<td>6</td>
</tr>
<tr>
<td>30-40</td>
<td>8</td>
</tr>
<tr>
<td>40-50</td>
<td>12</td>
</tr>
<tr>
<td>50-60</td>
<td>3</td>
</tr>
<tr>
<td>60-70</td>
<td>2</td>
</tr>
<tr>
<td>70-80</td>
<td>2</td>
</tr>
</tbody>
</table>
or
Find the mean, median and mode for the following distribution.
75, 62, 88, 55, 90, 95, 85, 59, 72, 78, 90, 95, 90, 95, 80, 71, 44, 57, 68, 90.

37. Construct a triangle having perimeter 6.4 cm and its basic angle are 60° and 45°.

38. The inner diameter of a cylindrical wooden pipe is 24cm and its outer diameter is 28cm - The length of this pipe is 35cm. Find the mass of the pipe if 1cm³ of wood has a mass of 0.6 gram.

39. Simplify: \[
\frac{(361)^3 + (139)^3}{(361)^2 - (361 \times 139) + (139)^2}
\]

or

Express 0.245 in the form \( \frac{p}{q} \).

40. If \((x+a)\) is a factor of the polynomials \((x^2+px+q)\) and \((x^2+mx+n)\) then prove that
\[
a = \frac{n - q}{m - p}
\]
SOLUTION
PRACTICE QUESTION PAPER - 2

1. d) \(\frac{4}{3}\pi r^3\)
2. c) \(-1\)
3. b) \(110\)
4. c) Infinite
5. a) \(PQ = SE\)
6. c) \(\sqrt{36}\)
7. b) \(60\text{cm}^2\)
8. a) \(\frac{2}{3}\)
9. d) \(90^\circ\)
10. c) III
11. C = 11
12. x = 140°
13. 1.9375
14. a = 1
15. p = 10
16. iv) SAS
17. i) 9
18. vi) SSS
19. v) 5
20. iii) 115°
21. Any two solutions
22. 4 : 1 or \(ME=12.8\text{cm}\)
23. \(h = 48\text{cm}\)
24. 5
25. 3(p-q) (q-r) (r-p) or 5
26. \(256\text{cm}^3\)
27. 24 times
28. No. of chair = \(x\)
29. x = 15
30. \(7200\sqrt{2}\text{ cm}^2\)
31. \(\text{Quotient} = 3x^2+5\)
32. \(\angle BAC = 90^\circ\)
33. Non-collinear
34. \(\angle ACD = 54^\circ\)
35. x = 30°
36. Means = 76.95
37. Median = 79
38. 3432gm
39. 500
40. 3.432 kg
41. \(\frac{245}{999}\)
PRACTICES QUESTION PAPER - 3
CLASS-IX
MATHEMATICS

Time: 3 Hrs. M.M. 80

General Instruction:
1. All questions are compulsory.
2. The paper consists of 40 questions divided into four sections A, B, C and D. Section A comprises of 20 questions of 1 marks each. Section B comprises of 6 questions of 2 marks each. Section C comprises of 8 questions of 3 marks each. Section D comprises of 6 questions of 4 marks each.
3. There is no over all choice in this question paper. All though internal choices has been provided in some question.

SECTION - A

1. A national number \(\frac{5}{7}\) is equivalent to
   a) \(\frac{15}{17}\)  
   b) \(\frac{25}{27}\) 
   c) \(\frac{10}{14}\)  
   d) \(\frac{10}{27}\)

2. The zero of the polynomial \(p(x) = 2x+5\) is
   a) 2  
   b) \(\frac{2}{5}\) 
   c) 5  
   d) \(-\frac{5}{2}\)

3. The polynomial of type \(ax^2+bx+c\), when \(a=0\)
   a) Linear  
   b) Quadratic 
   c) Cubic  
   d) Biquadratic

4. Through which of the following point, the graph of \(y = -x\) passes?
   a) (1, 1)  
   b) (0, 1) 
   c) (−1, 1)  
   d) (0, 0)
5. Graph of which question is parallel to $x$-axis?
   a) $y = x + 1$
   b) $y = 2$
   c) $x = 3$
   d) $x = 2y$

6. What is the measure of an angle whose measure is $32^\circ$ less than its supplement?
   a) $148^\circ$
   b) $60^\circ$
   c) $74^\circ$
   d) $55^\circ$

7. If $\angle P$ and $100^\circ$ form a linear pair. What is the measure of $\angle P$.
   a) $80^\circ$
   b) $180^\circ$
   c) $120^\circ$
   d) $75^\circ$

8. In the given figure AD is the median then $\angle BAD$ is
   a) $70^\circ$
   b) $55^\circ$
   c) $110^\circ$
   d) $35^\circ$

9. In two triangles $ABC$ and $DEF$, $AB = DE$, $BC = DF$ and $AC = EF$ then
   a) $\triangle ABC \cong \triangle DEF$
   b) $\triangle ABC \cong \triangle FED$
   c) $\triangle ABC \cong \triangle EDE$
   d) None of these

10. If $P(E) = 0.37$ then $P(\text{Not } E)$ will be
    a) $0.37$
    b) $0.74$
    c) $0.57$
    d) $0.63$

11. The radius of hemisphere is "$r\"$ what is its total surface area.
    a) $\frac{2}{3} \pi r^3$
    b) $3\pi r^2$
    c) $2\pi r^2$
    d) $\frac{4}{3} \pi r^2$

12. The sides of a triangle are in the ration $3 : 4 : 5$. If its perimeter is 36cm. Then what is its area?
    a) $72cm^2$
    b) $67cm^2$
    c) $32cm^2$
    d) $54cm^2$

13. The mean of 5 numbers is 30. If one number is excluded their mean becomes 28. What is excluded number.
    a) $38$
    b) $35$
    c) $32$
    d) $36$
14. In the given figure if O is the centre of a circle, then measure of $\angle ACB$ is
   a) $80^\circ$  
   b) $40^\circ$  
   c) $160^\circ$  
   d) $35^\circ$

15. In $\triangle ABC$, $AB = AC$ and $\angle B = 65^\circ$ then $\angle C$ is equal to
   a) $130^\circ$  
   b) $32^\circ$  
   c) $70^\circ$  
   d) $65^\circ$

16. For what value of $x+y$ in given figure ABC be a line? justify y-axis answer.

17. How many linear equations is $x$ and $y$ can be satisfied by $x=1$ and $y=2$?

18. Fill in the blank
   An arc is a __________ when its ends are the ends of a diameter.

19. Write the class size of 0–4, 5–9, 10–14
   *Write the class limits in 10.4, 11.4, 12.4

20. Two parallelograms are on same base and between same parallels. The ratio of their areas is 1:1 (True/False)
   or
   A median of a triangle divide it in to triangle of equal area (True/False)

**SECTION - B**

21. Find the value of the polynomial $5x-4x^2+3$ at
   a) $x = 0$  
   b) $x = 2$

22. Write any two solution of the equation $\pi x + y = 9$.

23. If the base of a parallelogram is 8cm and its altitude is 5cm. then find its area?

24. Write the co-efficient of $x^2$ in each of following
   i) $2 - x^2 + x$  
   ii) $\sqrt{2}x - 1$
or
Find the product without multiplying directly $107 \times 93$

25. The total surface area of a cube is $150\text{cm}^2$. Find the perimeter of any one of its faces?

26. Find the ratio of total surface area of a sphere and a hemisphere of same radius?

or
Find the curved surface area of a cone whose height is $12\text{cm}$ and base radius is $5\text{cm}$?

**SECTION – C**

27. Two coins are tossed simultaneously $500$ times and we get
   
   - two heads = $105$ times
   - one heads = $275$ times
   - No heads = $120$ times

   Find the probability of each of these events?

28. Give the geometric representation of $2x+9=0$ as an equation.
   i) In one variable ii) in two variables

29. Construct a triangle $ABC$ in which $BC=8\text{cm} \quad \angle B=45^\circ$ and $AB-AC=3.5\text{cm}$.

30. Prove that equal chords of a circle subtend equal angles at the centre.

   or
   If the non parallel sides of a trapezium are equal. Prove that it is cyclic.

31. Draw the graph of following linear equation in two variables $x+y=4$

   or
   If $x=3k-2$ and $y=2k$ is a solution of equation $4x-7y+12=0$ then find the value of K.

32. $ABCD$ is a rectangle and $P$, $Q$, $R$ and $S$ are mid points of the sides $AB$, $BC$, $CD$ and $DA$ respectively. Show that the quadrilateral $PQRS$ is a rhombus.

   or
   In a triangle $ABC$, $D$, $E$ and $F$ are respectively mid points of sides $AB$, $BC$ and $AC$. Show that $\triangle ABC$ is divided in to four congruent triangles by joining $D$, $E$ and $F$.  

248 Class IX - Mathematics
33. Simplify the given expression \((5+\sqrt{7})(2+\sqrt{5})\)
34. The sides of a triangle shaped sheet are 5cm, 12cm and 13cm. Find the cost of painting on the sheet at the rate of ₹ 30 per cm²?

**SECTION-D**

35. Given below is the data of students who participated in different activities.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Sports</th>
<th>Meditation</th>
<th>Yoga</th>
<th>Wacking</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Girls</td>
<td>40</td>
<td>35</td>
<td>100</td>
<td>120</td>
</tr>
</tbody>
</table>

Draw the bar graph for the given data.

or

If \(x+y+z=0\) show that
\[x^3+y^3+z^3=3xyz\]

37. Rationalise the denominator \(\frac{5}{\sqrt{3}-\sqrt{5}}\)

or

Express 0.3178 is the form of \(\frac{p}{q}\) where \(p\) and \(q\) are ______ and \(q \neq 0\).

38. \(\triangle ABC\) is an isosceles triangle in which \(AB=AC\).
Side \(BA\) is produced to \(D\) such that \(AD=AB\)
Show that \(\angle BCD\) is a right angle.

or

Prove that
In a right angle triangle, the hypotenuse is the longest side.

39. In the given figure \(POQ\) is a straight line. \(RO \perp PQ\). \(SO\) is a ray from \(O\) then prove that \(\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)\)
40. A godown measures $40 \text{m} \times 25 \text{m} \times 15 \text{m}$. Find the maximum number of wooden boxes each measuring $1.5 \text{m} \times 1.25 \text{m} \times 0.5 \text{m}$ that can be stored the godown.

or

The value of right circular cone is $9856 \text{ cm}^3$. If the diameter of base is $20 \text{cm}$. Find

i) Slant height

ii) Height of the cone.

iii) Curved surface area of the cone.
SOLUTION
PRACTICE QUESTION PAPER - 3

1. c) 10/14
2. d) −5/2
3. a) linear
4. c) (−1, 1)
5. b) y = 2
6. c) 74°
7. a) 80°
8. b) 55°
9. c) ΔABC ≅ ΔEDF
10. d) 0.63
11. b) 3πr²
12. d) 54cm²
13. a) 38
14. b) 40°
15. d) 65°
16. x + y = 180°
17. Infinitely many
18. Semi circle
19. 5 or 9.9, 10.9, 11.9
20. True or False
21. i) 3 ii) −3
22. Any two solutions
23. 40cm²
24. −1, 0 or
9951[using(100+7)×(100−7)]
25. 20 cm
26. 4:3 or 204.28cm²
27. i) P (2 head) = 21/100
   ii) P (one head) = 11/20
   iii) P (no head) = 6/25
28. Correct representation, x = −9/2
29. Correct construction
30. Correct proof or
   Correct proof
31. Correct graph for
   x+y=4 or k=2
32. correct proof
33. 10 + 5√5 + 2√7 + √35
34. ₹ 900
35. Correct draw of bar graph
36. 0 × [x²+y²+z²−xy−yz−zx] = 0
   −5/2(√3+√5) or 3175/9990
37. 3175/9990
38. Correct proof
39. Correct proof
40. 16000
or
i) 50cm
ii) 48cm
iii) 2200cm²