# DIRECTORATE OF EDUCATION
## Govt. of NCT, Delhi

## SUPPORT MATERIAL

## ( 2022-2023)

## Class : IX

# MATHEMATICS
## (ENGLISH MEDIUM)

Under the Guidance of

## Shri Ashok Kumar

Secretary  (Education)

## Shri Himanshu Gupta

Director  (Education)

## Dr. Rita Sharma

Addl. DE (School & Exam.)

### *Coordinators*

| **Mr. Sanjay Subhas Kumar** | **Mrs. Sunita Dua** | **Mr. Raj Kumar** | **Mr. Krishan Kumar** |
|---|---|---|---|
| DDE (Exam) | OSD (Exam) | OSD (Exam) | OSD (Exam) |

**Production Team**
Anil Kumar Sharma

**ASHOK KUMAR**
**IAS**

सचिव ( शिक्षा )
राष्ट्रीय राजधानी क्षेत्र
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## MESSAGE

Remembering the words of John Deway, "Education is not preparation for life, education is life itself, I highly commend the sincere efforts of the officials and subject experts from Directorate of Education involved in the development of Support Material for classes IX to XII for the session 2022-23.

The Support Material is a comprehensive, yet concise learning support tool to strengthen the subject competencies of the students. I am sure that this will help our students in performing to the best of their abilities.

I am sure that the Heads of School and teachers will motivate the students to utilise this material and the students will make optimum use of this Support Material to enrich themselves.

I would like to congratulate the team of the Examination Branch along with all the Subject Experts for their incessant and diligent efforts in making this material so useful for students.

I extend my Best Wishes to all the students for success in their future endeavours.

**(Ashok Kumar)**

**HIMANSHU GUPTA, IAS**
Director, Education & Sports

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# MESSAGE

"A good education is a foundation for a better future."
- Elizabeth Warren

Believing in this quote, Directorate of Education, GNCT of Delhi tries to fulfill its objective of providing quality education to all its students.

Keeping this aim in mind, every year support material is developed for the students of classes IX to XII. Our expert faculty members undertake the responsibility to review and update the Support Material incorporating the latest changes made by CBSE. This helps the students become familiar with the new approaches and methods, enabling them to become good at problem solving and critical thinking. This year too, I am positive that it will help our students to excel in academics.

The support material is the outcome of persistent and sincere efforts of our dedicated team of subject experts from the Directorate of Education. This Support Material has been especially prepared for the students. I believe its thoughtful and intelligent use will definitely lead to learning enhancement.

Lastly, I would like to applaud the entire team for their valuable contribution in making this Support Material so beneficial and practical for our students.

Best wishes to all the students for a bright future.

**(HIMANSHU GUPTA)**
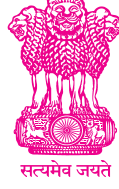
# संदेश

शिक्षा निदेशालय, दिल्ली सरकार का महत्वपूर्ण लक्ष्य अपने विद्यार्थियों का सर्वांगीण विकास करना है। इस उद्देश्य को ध्यान में रखते हुए शिक्षा निदेशालय ने अपने विद्यार्थियों को उच्च कोटि के शैक्षणिक मानकों के अनुरूप विद्यार्थियों के स्तरानुकूल सहायक सामग्री कराने का प्रयास किया है। कोरोना काल के कठिनतम समय में भी शिक्षण अधिगम की प्रक्रिया को निर्बाध रूप से संचालित करने के लिए संबंधित समस्त अकादमि समूहों और क्रियान्वित करने वाले शिक्षकों को हार्दिक बधाई देती हूँ।

प्रत्येक वर्ष की भाँति इस वर्ष भी कक्षा 9वीं से कक्षा 12वीं तक की सहायक सामग्रियों में सी.बी.एस.ई के नवीनतम दिशा–निर्देशों के अनुसार पाठयक्रम में आवश्यक संशोधन किए गए हैं। साथ ही साथ मूल्यांकन से संबंधित आवश्यक निर्देश भी दिए गए हैं। इन सहायक सामग्रियों में कठिन से कठिन सामग्री को भी सरलतम रूप में प्रस्तुत किया गया है ताकि शिक्षा निदेशालय के विद्यार्थियों को इसका भरपूर लाभ मिल सके।

मुझे आशा है कि इन सहायक सामग्रियों के गहन और निरंतर अध्ययन के फलस्वरूप विद्यार्थियों में गुणात्मक शैक्षणिक संवर्धन का विस्तार उनके प्रदर्शनो में भी परिलक्षित होगा। इस उत्कृष्ट सहायक सामग्री को तैयार करने में शामिल सभी अधिकारियों तथा शिक्षकों को हार्दिक बधाई देती हूँ तथा सभी विद्यार्थियों को उनके उज्जवल भविष्य की शुभकामनाएं देती हूँ।

रीता शर्मा
( रीता शर्मा )

# DIRECTORATE OF EDUCATION
## Govt. of NCT, Delhi

## SUPPORT MATERIAL
## ( 2022-2023)

# Class : IX

# MATHEMATICS
## (ENGLISH MEDIUM)

# NOT FOR SALE

# भारत का संविधान

*भाग 4क*

# नागरिकों के मूल कर्तव्य

**मूल कर्तव्य** – भारत के प्रत्येक नागरिक का यह कर्तव्य होगा कि वह –

(क)  संविधान का पालन करे और उसके आदर्शों, संस्थाओं, राष्ट्रध्वज और राष्ट्रगान का आदर करे;

(ख)  स्वतंत्रता के लिए हमारे राष्ट्रीय आंदोलन को प्रेरित करने वाले उच्च आदर्शों को हृदय में संजोए रखे और उनका पालन करे;

(ग)  भारत की संप्रभुता, एकता और अखंडता की रक्षा करे और उसे अक्षुण्ण बनाए रखे;

(घ)  देश की रक्षा करे और आह्वान किए जाने पर राष्ट्र की सेवा करे;

(ङ)  भारत के सभी लोगों में समरसता और समान भ्रातृत्व की भावना का निर्माण करे जो धर्म, भाषा और प्रदेश या वर्ग पर आधारित सभी भेदभावों से परे हो, ऐसी प्रथाओं का त्याग करे जो महिलाओं के सम्मान के विरुद्ध हों;

(च)  हमारी सामासिक संस्कृति की गौरवशाली परंपरा का महत्त्व समझे और उसका परिरक्षण करे;

(छ)  प्राकृतिक पर्यावरण की, जिसके अंतर्गत वन, झील, नदी और वन्य जीव हैं, रक्षा करे और उसका संवर्धन करे तथा प्राणिमात्र के प्रति दयाभाव रखे;

(ज)  वैज्ञानिक दृष्टिकोण, मानववाद और ज्ञानार्जन तथा सुधार की भावना का विकास करे;

(झ)  सार्वजनिक संपत्ति को सुरक्षित रखे और हिंसा से दूर रहे;

(ञ)  व्यक्तिगत और सामूहिक गतिविधियों के सभी क्षेत्रों में उत्कर्ष की ओर बढ़ने का सतत् प्रयास करे, जिससे राष्ट्र निरंतर बढ़ते हुए प्रयत्न और उपलब्धि की नई ऊँचाइयों को छू सके; और

(ट)  यदि माता-पिता या संरक्षक है, छह वर्ष से चौदह वर्ष तक की आयु वाले अपने, यथास्थिति, बालक या प्रतिपाल्य को शिक्षा के अवसर प्रदान करे।

# Constitution of India

### Part IV A (Article 51 A)

# Fundamental Duties

It shall be the duty of every citizen of India —

(a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

(b) to cherish and follow the noble ideals which inspired our national struggle for freedom;

(c) to uphold and protect the sovereignty, unity and integrity of India;

(d) to defend the country and render national service when called upon to do so;

(e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;

(f) to value and preserve the rich heritage of our composite culture;

(g) to protect and improve the natural environment including forests, lakes, rivers, wildlife and to have compassion for living creatures;

(h) to develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) to safeguard public property and to abjure violence;

(j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;

*(k) who is a parent or guardian, to provide opportunities for education to his child or, as the case may be, ward between the age of six and fourteen years.

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**Note:** The Article 51A containing Fundamental Duties was inserted by the Constitution (42nd Amendment) Act, 1976 (with effect from 3 January 1977).

*(k) was inserted by the Constitution (86th Amendment) Act, 2002 (with effect from 1 April 2010).

# भारत का संविधान

## उद्देशिका

हम, भारत के लोग, भारत को एक [1][संपूर्ण प्रभुत्व-संपन्न समाजवादी पंथनिरपेक्ष लोकतंत्रात्मक गणराज्य] बनाने के लिए, तथा उसके समस्त नागरिकों को :

सामाजिक, आर्थिक और राजनैतिक **न्याय**,

विचार, अभिव्यक्ति, विश्वास, धर्म

और उपासना की **स्वतंत्रता**,

प्रतिष्ठा और अवसर की **समता**

प्राप्त कराने के लिए,

तथा उन **सब में**

व्यक्ति की गरिमा और [2][राष्ट्र की एकता

और अखंडता] सुनिश्चित करने वाली **बंधुता**

बढ़ाने के लिए

दृढ़संकल्प होकर **अपनी इस संविधान सभा में** आज तारीख 26 नवंबर, 1949 ई. को **एतद्द्वारा इस संविधान को अंगीकृत, अधिनियमित और आत्मार्पित करते हैं।**

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1. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 की धारा 2 द्वारा (3.1.1977 से) ''प्रभुत्व-संपन्न लोकतंत्रात्मक गणराज्य'' के स्थान पर प्रतिस्थापित।

2. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 की धारा 2 द्वारा (3.1.1977 से) ''राष्ट्र की एकता'' के स्थान पर प्रतिस्थापित।

# THE CONSTITUTION OF INDIA

## PREAMBLE

**WE, THE PEOPLE OF INDIA,** having solemnly resolved to constitute India into a [1][**SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]** and to secure to all its citizens :

**JUSTICE,** social, economic and political;

**LIBERTY** of thought, expression, belief, faith and worship;

**EQUALITY** of status and of opportunity; and to promote among them all

**FRATERNITY** assuring the dignity of the individual and the [2][unity and integrity of the Nation];

**IN OUR CONSTITUENT ASSEMBLY** this twenty-sixth day of November, 1949 do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**

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1. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)

<h1 style="text-align:center;">MATHEMATICS (IX)</h1>

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 and 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.

## TERM-WISE SYLLABUS
## SESSION: 2022-23
## CLASS: IX
## SUBJECT: MATHEMATICS (CODE: 041)
## COURSE STRUCTURE

| Units | Unit Name | Marks |
|-------|-----------|-------|
| I | Number Systems | 10 |
| II | Algebra | 20 |
| III | Coordinate Geometry | 04 |
| IV | Geometry | 27 |
| V | Mensuration | 13 |
| VI | Statistics & Probability | 60 |
| | Total | 80 |
| | Internal Assessment | 20 |
| | Grand Total | 100 |

## Term I
## Chapter 1: Number Systems

Review of representation of natural numbers, integers and rational numbers on the number line.

Rational numbers as recurring/ terminating decimals. Operations on real numbers.

Examples of non-recurring/non-terminating decimals. Existence of non-rational numbers (irrational numbers) such as $\sqrt{2}$, $\sqrt{3}$ 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.

Definition of nth root of a real number.

Rationalization (with precise meaning) of real numbers of the type and $\dfrac{1}{a + b\sqrt{x}}$ and

$\dfrac{1}{\sqrt{x} + \sqrt{y}}$ (and their combinations) where $x$ and y are natural number and $a$ and $b$ are integers.

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.)

## Chapter 3: Coordinate Geometry

The Cartesian plane, coordinates of a point, names and terms associated with the coordinate plane. notations.

## Chapter 4: Linear Equations in Two Variables

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.

## Chapter 6: Lines and Angles

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) Lines which are parallel to a given line are parallel.

## Chapter 7: Triangles

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.  (Motivate) 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.

## Chapter 12: Heron's Formula

Area of a triangle using Heron's formula (without proof).

## Chapter 14: Statistics

Bar graphs, histograms (with varying base lengths) and frequency polygons.

- **Mental Maths**
- **Revision from Support Material**

## Term II

## Chapter 2: Polynomials

Definition of a polynomial in one variable with examples and counter examples. Co-efficients 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. Zeroes 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:

$$(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$$

$$(x \pm y)^3 = x^3 + y^3 \pm 3xy(x \pm y)$$

$$x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yx - xz)$$

and their use in factorization of polynomials.

## Chapter 5: Introduction To Euclid's Geometry

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.

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.

## Chapter 8: Quadrilaterals

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 is half of it and (motivate) its converse.

## Chapter 10: Circles

1. (Prove) Equal chords of a circle subtend equal angles at the centre and (motivate) its converse.

2. (Motivate) The perpendicular from the centre of a circle to a chord bisects the chord and conversely, the line drawn through the centre of a circle to bisect a chord is perpendicular to the chord.

3. (Motivate) Equal chords of a circle (or of congruent circles) are equidistant from the centre (or their respective centre) and conversely.

4. (Motivate) The angle subtended by an are at the centre is double the angle subtended by it at any point on the remaining part of the circle.

5. (Motivate) Angles in the same segment of a circle are equal.

6. (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.

7. (Motivate) The sum of either of the pair of the opposite angles of a cyclic quadrilateral is 180° and its converse.

## Chapter 13: Surface Areas and Volumes

Surface areas and volumes of spheres (including hemispheres) and right circular cones.

- Mental Maths
- Revision from Support Material

# Mathematics
## Code (041)
## Question Paper Design
## Class – IX (2022-23)

**Time: 3 Hrs.**                                                    **M.M: 80**

| S. No. | Typology of Questions | Total Marks | % Weightage (approx.) |
|--------|----------------------|-------------|----------------------|
| 1. | **Remembering:** Exhibit memory of previously lerned material by recalling facts, terms, basic concepts and answers. | 43 | 54 |
| | **Understanding:** Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions and stating main ideas. | | |
| 2. | **Applying:** Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way. | 19 | 24 |
| 3. | **Analysing:** Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations. | 18 | 22 |
| | **Evaluating:** Present and defend opinions by making judgments 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 propsing alternative solutions. | | |
| | Total | 80 | 100 |

| Internal Assessment | 20 Marks |
|---------------------|----------|
| Pen Paper Test and Multiple Assessment (5 + 5) | 10 Marks |
| Portfolio | 05 Marks |
| Lab Practical (Lab activities to be done from the prescribed books) | 05 Marks |

# List of Group Leader and Subject-Experts For Preparation/Review of Support Material

# Class-IX (2022-23)
# Subject : Mathematics

1.      Ms. Barkha Dawar                Vice Principal
                                        GGSSS, A Block Saraswati
                                        Vihar, Delhi (1411042)

2.      Ms. Aakanksha                   PGT (Mathematics)
                                        Core Academic Unit (CAU)

3.      Ms. Neha Chaudhary              TGT (Mathematics)
                                        Core Academic Unit (CAU)

4.      Mr. Sunil Kumar Tiwari          TGT (Mathematics)
                                        SBV, Moti Nagar, Delhi
                                        (1516010)

5.      Ms. Gagandeep Kaur              TGT (Mathematics)
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Note: Chapter – 9, 11 and 15 are not included for assessment purpose for the session 2022-23 as per CBSE guidelines.

# NUMBER SYSTEMS

## MIND MAP
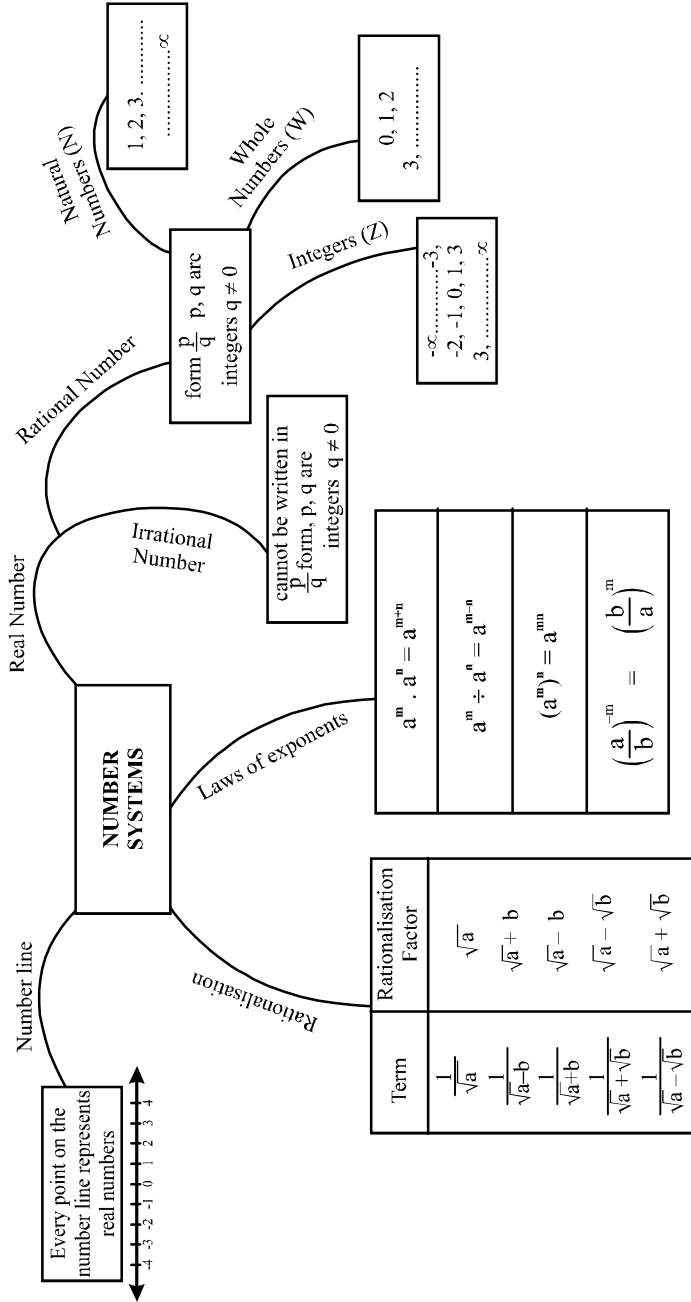
# CHAPTER-1
## NUMBER SYSTEMS
### KEY POINTS
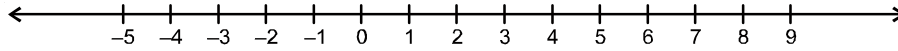


- 1, 2, 3, ............. are natural numbers which are represented by N.

- 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 if

  (a) it can be represented in the form of $p/q$, where $p$ and $q$ are integers and $q \neq 0$.

  or

  (b) its decimal expansion is terminating (e.g. $\dfrac{2}{5} = 0.4$)

  or

  (c) its decimal expansion is non-terminating recurring (repeating) (e.g. $0.\overline{1234} = 0.1234234..........$)

- A number is irrational number if

  (a) it can not be represented in the form of $\dfrac{p}{q}$, where p and q are integers and $q \neq 0$.

  or

  (b) its decimal expansion is non-terminating non-recurring (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 $\dfrac{1}{\sqrt{a} \pm b}$, we multiply this by $\dfrac{\sqrt{a} \mp b}{\sqrt{a} \mp b}$, where $a$ is a natural number and $b$ is an integer.

- If $r$ is rational and $s$ is irrational then $r+s, r-s, r.s$ are always irrational numbers but $r/s$ may be rational or irrational.

- Law of Exponents: Let $a > 0$ be a real number and m amd 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) $a^m . b^m = (ab)^m$

  (5) $a^0 = 1$            (6) $a^{-m} = \dfrac{1}{a^m}$

- For positive real numbers a and b, the following identities hold

  (1) $\sqrt{a} . \sqrt{b} = \sqrt{ab}$            (2) $\sqrt{a} \div \sqrt{b} = \sqrt{\dfrac{a}{b}}$

  (3) $\left(\sqrt{a} + \sqrt{b}\right)\left(\sqrt{a} - \sqrt{b}\right) = a - b$      (4) $\left(\sqrt{a} + \sqrt{b}\right)^2 = a + 2\sqrt{ab} + b$

  (5) $\left(a + \sqrt{b}\right)\left(a - \sqrt{b}\right) = a^2 - b$

  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 number which have more than two factors are known as composite number. e.g., 4, 6, 8, 9, 10, 12, ...

  1 is neither prime nor composite.

  $\sqrt[n]{a} = a^{1/n}$ where '$a$' is positive real number and $n$ is $a$ positive integer

  $a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m = \sqrt[n]{a^m}$ where a is positive real number $m$ and $n$ are co-prime integers and $n > 0$

# Types of Numbers

Real Numbers

Rational Numbers $\left(\dfrac{p}{q}\right)$     Irrational Numbers

Terminating Decimal Expansion

$q = 2^m \times 5^n$

$\left(\dfrac{2}{5} = 0.4\right)$

Non Terminating Recurring Decimal Expansion

$\left(\dfrac{10}{3} = 3.33... = 3.\overline{3}\right)$

Non-Terminating Non-Recurring Decimal Expansion

$\left(\sqrt{2} = 1.414...\right)$

Real Numbers

Rational Numbers

Eg : $\left(-5, \dfrac{-7}{3}, 0, \dfrac{5}{6}\right)$

Irrational Numbers

Eg. : $\left(\sqrt{2}, \sqrt{3}, \sqrt{5}, \pi, 0.010010001.....\right)$

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

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

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 ...)

(1)
[Neither Prime nor composite]

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

Composite Numbers
(9, 15 ...)

**Very-Very Short Answer type**

**Multiple Choice Questions (1 mark)**

1. Which of the following is a rational number?

   (a) $1 + \sqrt{5}$          (b) $2\sqrt{3}$

   (c) $0$          (d) $\pi$

2. Which of the following is irrational?

   (a) $\sqrt{\dfrac{4}{9}}$          (b) $\dfrac{\sqrt{12}}{\sqrt{3}}$

   (c) $\sqrt{81}$          (d) $\sqrt{5}$

3. If $x = 2 + \sqrt{3}$ then $(1/x)$ is equal to

   (a) $2 + \dfrac{1}{\sqrt{3}}$          (b) $\dfrac{1}{2 - \sqrt{3}}$

   (c) $2 - \sqrt{3}$          (d) $\dfrac{1}{2} + \sqrt{3}$

4. An irrational number between $\sqrt{2}$ and $\sqrt{3}$ is

   (a) $6^{1/4}$          (b) $\dfrac{-\sqrt{2} + \sqrt{3}}{2}$

   (c) $\sqrt{2} \times \sqrt{3}$          (d) $\sqrt{5}$

5. If $10^{2y} = 25$ then $10^{-y}$ is equal to

   (a) $\dfrac{-1}{5}$          (b) $\dfrac{1}{50}$

   (c) $\dfrac{1}{625}$          (d) $\dfrac{1}{5}$

**Fill in the blanks:**

6. $\sqrt{6} \times \sqrt{8}$ = _____

7. The decimal expansion of the number $\sqrt{3}$ is _____ and _____

8. _____ is a whole number but not a natural number.

9. $\sqrt[2]{(81)^{0.50}}$ = _____

10. Between two distinct rational number there lie _____ rational numbers.

11. The sum and difference of rational and irrational number is always _____ numbers.

12. Every rational number is a _____ number.

13. Find a rational number between $\dfrac{-2}{3}$ and $\dfrac{1}{4}$ .

14. Express $0.\overline{7}$ in the form $\dfrac{p}{q}$ , where $p$ and $q$ are integers and $q \neq 0$.

15. Find the value of $0.\overline{23} + 0.\overline{22}$

16. Find the value of $x$, if $5^{x-3} \cdot 3^{2x-8} = 225$

17. Find the value of $[(4-5(4-5)^4]^3$

18. Write first five whole numbers in $\dfrac{p}{q}$ form, where p and q are integers and $q \neq 0$.

19. Find two irrational numbers between $\sqrt{25}$ and $\sqrt{27}$ .

20. Write two numbers whose decimal expansions are terminating.

21. Find the value of $(256)^{0.16} \times (256)^{0.09}$

22. Evaluate $\left(\dfrac{3}{5}\right)^3 \times \left(\dfrac{5}{3}\right)^5$

23. What can be the maximum number of digits in the repeating block of digits in the decimal expansion of $\dfrac{5}{7}$ .

## Very Short Answer type Questions (2 Marks)

24. Represent following on number line

(a) $\dfrac{-7}{5}$            (b) $\sqrt{3}$

25. Find the value of $x$, $\sqrt[3]{2x + 3} = 5$

26. Express the mixed recurring decimal $1.\overline{27}$ in the form $\dfrac{p}{q}$.

27. Simplify $\dfrac{\sqrt{5} + \sqrt{3}}{\sqrt{80} + \sqrt{48} - \sqrt{45} - \sqrt{27}}$

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

(a) $\dfrac{135}{50}$           (b) $\dfrac{4}{11}$

(c) $\dfrac{5^2 \times 3^3}{2 \times 5^3 \times 27}$      (b) $\dfrac{55}{9}$

29. **Classify the numbers as terminating decimal or non-terminating recurring decimal or non-terminating non-recurring decimals.**

(a) 0.1666              (b) 0.27696

(c) 2.142857142857........     (d) 2.502500250002........

(e) $4.\overline{123456789}$

Also classify these numbers as rational and irrational numbers.

30. **Classify the following numbers as rational or irrational numbers.**

(a) $\dfrac{7\sqrt{7}}{\sqrt{343}}$        (b) $5 + 2\sqrt{23} - \left(\sqrt{25} + \sqrt{92}\right)$

(c) $\sqrt{360}$           (d) $\dfrac{22}{7}$

(e) $\pi$

**31.** Solve

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

    (b) Multiply $\left(-3 + \sqrt{5}\right)$ and $\left(7 + \sqrt{3}\right)$

    (c) Divide $2\sqrt{216} - 3\sqrt{27}$ by 3

**Short Answer type Questions (3 Marks)**

**32.** If $\dfrac{3 + 2\sqrt{5}}{3 - 2\sqrt{5}} = p + q\sqrt{5}$, then find the value of $11\,(p+q)$

**33.** Simplify $\dfrac{\left(25\right)^{5/2} \times \left(81\right)^{1/4}}{\left(125\right)^{2/3} \times \left(27\right)^{2/3} \times 8^{4/3}}$

**34.** If $32^{2x-5} = 4 \times 8^{x-5}$ then find the value of $x$.

**35.** Evaluate

    (a) $\dfrac{2^{38} + 2^{37} + 2^{36}}{2^{39} + 2^{38} + 2^{37}}$                 (b) $\left(9 + \sqrt{2} - \sqrt{3}\right)^2$

    (c) $\left[5\left(8^{1/3} + 27^{1/3}\right)^7\right]^{1/4}$          (d) $\left(6 - \sqrt{2}\right)\left(2 + \sqrt{3}\right)$

**36.** If $5^{2x-1} - (25)^{x-1} = 2500$ then find the value of $x$?

**37.** If $x = 3 - 2\sqrt{2}$, show that $\left(\sqrt{x} - \dfrac{1}{\sqrt{x}}\right) = \pm 2$

**38.** If $xyz = 1$ then simplify

    $\left(1 + x + y^{-1}\right)^{-1} + \left(1 + y + z^{-1}\right)^{-1} + \left(1 + z + x^{-1}\right)^{-1}$

**39.** Find the value of $x$ if

    (a) $25^{2x-3} = 5^{2x+3}$               (b) $(4)^{2x-1} - (16)^{x-1} = 384$

**40.** Solve

$$\frac{1}{1+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \frac{1}{\sqrt{3}+\sqrt{4}} + \frac{1}{\sqrt{4}+\sqrt{5}} + \frac{1}{\sqrt{5}+\sqrt{6}} + \frac{1}{\sqrt{6}+\sqrt{7}} + \frac{1}{\sqrt{7}+\sqrt{8}} + \frac{1}{\sqrt{8}+\sqrt{9}}$$

**41.** Express $0.6 + 0.\overline{7} + 0.\overline{47}$ in the form $\frac{p}{q}$, where $p$ and $q$ are integers and $q \neq 0$.

## Long Answer type Questions (5 marks)

**42.** Evaluate $\dfrac{64^{\frac{a}{6}}}{4^a} \times \dfrac{2^{2a+1}}{2^{a-1}}$

**43.** Simplify $\dfrac{1}{1+x^{b-a}+x^{c-a}} + \dfrac{1}{1+x^{a-b}+x^{c-b}} + \dfrac{1}{1+x^{a-c}+x^{b-c}}$

**44.** Simplify $\left(\dfrac{x^a}{x^{-b}}\right)^{a-b} \times \left(\dfrac{x^b}{x^{-c}}\right)^{b-c} \times \left(\dfrac{x^c}{x^{-a}}\right)^{c-a}$

**45.** Show that $\dfrac{7\sqrt{3}}{\left(\sqrt{10}+\sqrt{3}\right)} - \dfrac{2\sqrt{5}}{\left(\sqrt{6}+\sqrt{5}\right)} - \dfrac{3\sqrt{2}}{\left(\sqrt{15}+3\sqrt{2}\right)} = 1$

**46.** Show that $a = \dfrac{\sqrt{7}-\sqrt{6}}{\sqrt{7}+\sqrt{6}}$ and $b = \dfrac{\sqrt{7}+\sqrt{6}}{\sqrt{7}-\sqrt{6}}$, then find the value of $a^2 + b^2 + ab$

**47.** If $x = 9 - 4\sqrt{5}$ then find

(a) $x + \dfrac{1}{x}$          (b) $x - \dfrac{1}{x}$

(c) $x^2 + \dfrac{1}{x^2}$          (d) $x^2 - \dfrac{1}{x^2}$

(e) $x^3 + \dfrac{1}{x^3}$          (f) $x^3 - \dfrac{1}{x^3}$

(g) $\sqrt{x} + \dfrac{1}{\sqrt{x}}$

(h) $\sqrt{x} - \dfrac{1}{\sqrt{x}}$

(i) $x + \dfrac{14}{x}$

**48.** If $P = 5 - 2\sqrt{6}$ find

(a) $P^2 + \dfrac{1}{P^2}$

(b) $P^2 - \dfrac{1}{P^2}$

(c) $P^4 + \dfrac{1}{P^4}$

**49.** Find the value of $\dfrac{4}{(216)^{-2/3}} + \dfrac{1}{(256)^{-3/4}} + \dfrac{2}{(243)^{-1/5}}$

**50.** If $\dfrac{9^n \times 3^2 \times \left(3^{-n/2}\right)^{-2} - (27)^n}{3^{3m} \times 2^3} = \dfrac{1}{729}$ prove that $m - n = 2$

**51.** If $x = 2^y$ and $\dfrac{9 \times 3^{2x} - 3^x \times 3^{x-2}}{2} = 360$. Find the value of $y$.

**52.** If $a = 2$, $b = 3$ then find the values of the following

(a) $(a^b + b^a)^{-1}$

(b) $(a^a + b^b)^{-1}$

**53.** If $ab + bc + ca = 0$, find the value of $\dfrac{1}{a^2 - bc} + \dfrac{1}{b^2 - ca} + \dfrac{1}{c^2 - ab}$

1. (c) 0

2. (d) $\sqrt{5}$

3. (c) $2 - \sqrt{3}$

4. (a) $6^{1/4}$

5. (d) $\dfrac{1}{5}$

6. $4\sqrt{3}$

7. Non-terminating and non-repeating

8. 0

9. 3

10. Infinite

11. Irrational

12. Real

13. Hint: $\dfrac{a+b}{2}$ or make denominators equal

    $\dfrac{1}{12}$ : (other answer are also possible)

14. $\dfrac{7}{9}$

15. $\dfrac{5}{11}$

16. Hint: Compare powers

    $x = 5$

17. $-1$

**18.** $\dfrac{0}{1}, \dfrac{1}{1}, \dfrac{2}{1}, \dfrac{3}{1}, \dfrac{4}{1}$

**19.** $\sqrt{25} = 5$

$\sqrt{27} = 3\sqrt{3} = 3 \times 1.732 = 5.196$

Two irrational No. 5.012301234012345........

5.1378424134876........

(other answers are also possible)

**20.** $\dfrac{17}{5}, \dfrac{43}{10}$ (other answers are also possible)

**21.** 4

**22.** $\left(\dfrac{5}{3}\right)^2$

**23.** 6

**25.** Hint: cubing on both sides

$$\left(\sqrt[3]{2x+3}\right)^3 = 5^3$$
$$2x + 3 = 125$$
$$x = 61$$

**26.** $\dfrac{14}{11}$

**27.** 1

**28.** (i)   Terminating decimal

(ii)   Non-terminating but recurring decimal

(iii)   Hint: simplify it first

Terminating decimal

(iv)   Non-terminating but recurring decimal

**29.** (i)    Terminating decimal/Rational number

    (ii)   Terminating decimal/Rational number

    (iii)  Non-terminating but repeating/Rational number

    (iv)  Non-terminating non-Repeating/Irrational number

    (v)   Non-terminating but Repeating/Rational number.

**30.** (i)    Rational

    (ii)   Rational

    (iii)  Irrational

    (iv)  Rational

    (v)   Irrational

**31.** (i)    $5\sqrt{3}$

    (ii)   $-21 - 3\sqrt{3} + 7\sqrt{5} + \sqrt{15}$

    (iii)  $4 - 3\sqrt{3}$

**32.**   Hint: Rationalise the denominator

$$p = \frac{-29}{11},$$

$$q = \frac{-12}{11}$$

$$-41$$

**33.**   Hint: $\dfrac{\left(5^2\right)^{5/2} \times \left(3^4\right)^{1/4}}{5^2 \times 3^2 \times 2^4} = \dfrac{5^3}{3 \times 2^4} = \dfrac{125}{48}$

**34.**   Hint:

$$2^{5(2x-5)} = 2^2 \times 2^{3(x-5)}$$

$$2^{10x-25} = 2^{3x-15+2}$$

$$10x - 25 = 3x - 13$$

$$x = \frac{12}{7}$$

**35.** (i) Hint : $\dfrac{2^{36}\left(2^{2}+2^{1}+1\right)}{2^{37}\left(2^{2}+2^{1}+1\right)}=\dfrac{1}{2}$

(ii) Hint: $(9)^{2}+\left(\sqrt{2}-\sqrt{3}\right)^{2}+2\times 9\left(\sqrt{2}-\sqrt{3}\right)=2\left(43-\sqrt{6}+9\sqrt{2}-9\sqrt{3}\right)$

(iii) 25

(iv) $12+6\sqrt{3}-2\sqrt{2}-\sqrt{6}$

**36.** Hint:

$$5^{2x-1}-5^{2(x-1)}=5^{4}\times 2^{2}$$

$$5^{2x-1}\dfrac{-5^{2x-1}}{5}=5^{4}\times 2^{2}$$

$$5^{2x-1}\left(\dfrac{4}{5}\right)=5^{4}\times 2^{2}$$

$$5^{2x-2}\times 2^{2}=5^{4}\times 2^{2}$$

$$2x-2=4$$

$$x=3$$

**37.** Hint:

$$\left(\sqrt{x}-\dfrac{1}{\sqrt{x}}\right)^{2}=x+\dfrac{1}{x}-2$$

$$=3-2\sqrt{2}+3+2\sqrt{2}-2=4$$

$$\left(\sqrt{x}-\dfrac{1}{\sqrt{x}}\right)=\pm 2$$

**38.** Hint: replace

$$y=\dfrac{1}{xz}$$

$$=(1+x+xz)^{-1}+\left(1+\dfrac{1}{xz}+\dfrac{1}{z}\right)^{-1}+\left(1+z+\dfrac{1}{x}\right)^{-1}$$

$$= \frac{1}{1 + x + xz} + \left(\frac{xz + 1\ x}{xz}\right)^{-1} + \left(\frac{x + xz + 1}{x}\right)^{-1}$$

$$= \frac{1}{1 + x + xz} + \frac{xz}{1 + x + xz} + \frac{x}{1 + x + xz}$$

$$= \frac{1 + zx + x}{1 + x + xz} = 1$$

**39.** (i) Hint:

$$5^{2(2x - 3)} = 5^{2x + 3}$$

$$x = \frac{9}{2}$$

(ii) Hint:

$$2^{2(2x - 1)} - 2^{4(x - 1)} = 2^7 \times 3$$

$$2^{4x - 2} - 2^{4x - 4} = 2^7 \times 3$$

$$2^{4x - 2}(1 - 2^{-2}) = 2^7 \times 3$$

$$2^{4x - 2} \times \frac{3}{4} = 2^7 \times 3$$

$$2^{4x - 4} = 2^7$$

$$4x - 4 = 7$$

$$x = \frac{11}{4}$$

**40.** Hint:

$$\frac{1}{1 + \sqrt{2}} \times \frac{1 - \sqrt{2}}{1 - \sqrt{2}} = \frac{1 - \sqrt{2}}{1 - 2} = -(1 - \sqrt{2})$$

$$= \sqrt{2} - 1 + \sqrt{3} - \sqrt{2} + \sqrt{4} - \sqrt{3} + \sqrt{5} - \sqrt{4} + \sqrt{6} - \sqrt{5}$$

$$+ \sqrt{7} - \sqrt{6} + \sqrt{8} - \sqrt{7} + \sqrt{9} - \sqrt{8}$$

$$= \sqrt{9} - 1 = 3 - 1 = 2$$

**41.** $\dfrac{167}{90}$

**42.** 4

**43.** 1

**44.** 1

**45.** 1

**46.** Hint:

$$a = \dfrac{\sqrt{7}-\sqrt{6}}{\sqrt{7}+\sqrt{6}} \times \dfrac{\sqrt{7}-\sqrt{6}}{\sqrt{7}-\sqrt{6}}$$

$$= \dfrac{7+6-2\sqrt{42}}{7-6} = 13-2\sqrt{42}$$

$$b = 13+2\sqrt{42}$$

$$(a+b)^2 - ab = a^2 + b^2 + ab$$

$$a^2 + b^2 + ab = \left(13-2\sqrt{42}+13+2\sqrt{42}\right)^2 - \left(13-2\sqrt{42}\right)\left(13+2\sqrt{42}\right)$$

$$a^2 + b^2 + ab = (26)^2 - (169-168)$$

$$= 676 - 1 = 675$$

**47.** (i)    18

(ii)   $-8\sqrt{5}$

(iii)  322

(iv)   $-144\sqrt{5}$

(v)    Hint:

$$x^3 + \dfrac{1}{x^3} = \left(x+\dfrac{1}{x}\right)^3 - 3\left(x+\dfrac{1}{x}\right)$$

$$= 18^3 - 3 \times 18 = 5778$$

(vi) Hint:

$$x^3 - \frac{1}{x^3} = \left(x - \frac{1}{x}\right)^3 + 3\left(x - \frac{1}{x}\right)$$

$$= (-8\sqrt{5})^3 + 3 \times (-8\sqrt{5})$$

$$= -2584\sqrt{5}$$

(vii) $2\sqrt{5}$

(viii) 4

(ix) $145 + 52\sqrt{5}$

**48.** (i) 98

(ii) Hint: $p^2 - \dfrac{1}{p^2} = \left(p + \dfrac{1}{p}\right)\left(p - \dfrac{1}{p}\right)$  $-40\sqrt{6}$

(iii) Hint: $p^4 + \dfrac{1}{p^4} = \left(p^2 + \dfrac{1}{p^2}\right)^2 - 2 = 9602$

**49.** 214

**50.** Hint:

$$\frac{3^{2n} \times 3^2 \times 3^{\frac{-n}{2} \times -2} - 3^{3n}}{3^{3m} \times 2^3} = \frac{1}{729}$$

$$\frac{3^{2n+2+n} - 3^{3n}}{3^{3m} \times 2^3} = \frac{1}{729}$$

$$\frac{3^{3n}(3^2 - 1)}{3^{3m} \times 8} = \frac{1}{729}$$

$$3^{3n-3m} = 3^{-6}$$

$$n - m = -2$$

$$\therefore \qquad m - n = 2$$

**51.** Hint:

$$\frac{3^2 \times 3^{2x} - 3^x \times 3^{x-2}}{2} = 360$$

$$\frac{3^{2x+2} - 3^{2x-2}}{2} = 360$$

$$\frac{3^{2x}\left(3^2 - 3^{-2}\right)}{2} = 360$$

$$\frac{3^{2x}\left(9 - \dfrac{1}{9}\right)}{2} = 360$$

$$\frac{3^{2x} \times 80}{2 \times 9} = 360$$

$$3^{2x} = 81$$

$$3^{2x} = 3^4$$

$$x = 2$$

$$x = 2^y$$

$$2 = 2^y$$

$$y = 1$$

**52.** (i) $\dfrac{1}{17}$

(ii) $\dfrac{1}{31}$

**53.** Hint: $ab = -(bc + ca)$; $bc = -(ca + ab)$; $ca = -(ab + bc)$

$$= \frac{1}{a^2 + ac + ab} + \frac{1}{b^2 + ab + bc} + \frac{1}{c^2 + bc + ca}$$

$$= \frac{1}{a(a + b + c)} + \frac{1}{b(a + b + c)} + \frac{1}{c(a + b + c)}$$

$$= \frac{bc + ac + ab}{abc(a + b + c)}$$

$$= \frac{0}{abc(a + b + c)} = 0$$

# CHAPTER-1
## NUMBER SYSTEM
## PRACTICE TEST

**Time: 1 hr**                                                       **M.M: 20**

1. Write one rational number and one irrational number.     (1)

2. If $p = 5 - 2\sqrt{6}$ then find $\dfrac{1}{p}$     (1)

3. Simplify $4\sqrt{3} + \sqrt[3]{48} - \dfrac{5}{2}\sqrt{12}$     (2)

4. If $(5)^{2x-1}(25)^{x-1} = 2500$ then find the value of $x$.     (2)

5. Find the value of $x$ and $y$

$$\frac{\sqrt{11} - \sqrt{7}}{\sqrt{11} + \sqrt{7}} = x - y\sqrt{77}$$     (3)

6. Represent $\left(2 + \sqrt{3}\right)$ on 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 followig in the form $p/q$ where $p$ and $q$ are integers and $q \neq 0$

$0.\overline{4} + 0.1\overline{8}$     (4)

# POLYNOMIALS

## MIND MAP



**COEFFICIENTS**
Constants are the coefficients of a polynomial

**ZERO POLYNOMIAL**
When all the constants of a polynomial are zero

**CONSTANT POLYNOMIAL**
It is the polynomial of degree zero like 3,-8 etc. 3 can be written as $3x^0$

**Factor Theorem:** If $p(x)$ is a polynomial of degree greater than equal to 0 and a is any real number then
1. $(x-a)$ is a factor of $p(x)$ if $p(a)=0$.
2. $p(a)=0$ if $(x-a)$ is a factor of $p(x)$.

**Remainder Theorem:** Let $p(x)$ be any polynomial of degree greater than equal to 0 and a is any real number. If $p(x)$ is divided by linear polynomial $(x-a)$ then $p(a)$ is the remainder.

**Algebraic Identities :**

1. $(x+y)^2 = x^2+2xy+y^2$
2. $(x-y)^2 = x^2-2xy+y^2$
3. $(x^2-y^2) = (x-y)(x+y)$
4. $(x+a)(x+b) = x^2+(a+b)x+ab$
5. $(x+y+z)^2 = x^2+y^2+z^2+2xy+2yz+2zx$
6. $(x+y)^3 = x^3+y^3+3xy(x+y) = x^3+y^3+3x^2y+3xy^2$
7. $(x-y)^3 = x^3-y^3-3xy(x-y) = x^3-y^3-3x^2y+3xy^2$
8. $x^3+y^3 = (x+y)(x^2-xy+y^2)$
9. $x^3-y^3 = (x-y)(x^2+xy+y^2)$
10. $x^3+y^3+z^3 = 3xyz$ if $x+y+z=0$

# Polynomials

## KEY POINTS

### Defination

A polynomial $p(x)$ in one variable $x$ of degree $n$ is an algebraic expression in $x$ of the

$p(x) = a_n x^n + a_{n-1} x^{n-1} + a_{n-2} x^{n-2} + \ldots + a_2 x^2 + a^1 x + a_0$, 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 $x^0, x^1, x^2, \ldots, x^n$ terms of the polynomial.

(iii) Each of $a_n x^n, a_{n-1} x^{n-1}, a_{n-2} x^{n-2}, \ldots, a_2 x^2, a_1 x_1\, a$ are called terms of the polynomial.

(iv) $n$ is called the degree of the polynomial where $n$ is a non-negative integers.

### Zeros of Polynomial

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.

1. A polynomial having four or more than four terms does not have particular name. These are simply called polynomials.

2. 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.

3. The degree of zero polynomial is not defined or we can not determine the degree of zero polynomial.

### Fact about Polynomial:

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

5. A non-zero constant polynomial has no-zero.

6. Every real number is a zero of the zero polynomial.

### Very-Very Short Answer type Questions (1 Mark)

1. **The coefficient of $x^2$ in the polynomial $4x^2 - 7x^2 + 2x + 1$ is**

   (a) 4                                     (b) 7

   (c) −4                                   (d) −7

2. **Which of the following is not a polynomial**

(a) $x + 1$                                     (b) $\sqrt{x} + 1$

(c) $x^2 + 1$                              (d) $\left(\dfrac{1}{x} + 1\right)x^2$

3. If $x = -1$ is a zero of $x^3 - 2x^2 + 3ax + 5$, then value of $a$ is

    (a) 2                                          (b) $\dfrac{2}{3}$

    (c) $\dfrac{3}{2}$                                   (d) $-5$

4. If $(x + 2)$ is a factor of $x^2 - kx + 14$, then value of $k$ is

    (a) $-9$                                    (b) 9

    (c) $-2$                                    (d) 14

5. When $p(x) = x^3 - 6x^2 + 2x - 4$ is divided by $x - 2$ then remainder is

    (a) 16                                      (b) 24

    (c) $-16$                                  (d) $-24$

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

7. The polynomial $x^2 - a^2$ has _____ zeroes.

8. A quadratic polynomial can have at most _____ terms.

9. $(49)^3 - (30)^3 +$ _____ $= 3 \times 49 \times 30 \times 19$

10. $x^3 - 64$ is a polynomial of degree _____ having _____ terms.

11. Check whether $x = 3$ is a zero of the polynomial $x^3 - 3x^2 + x - 3$

12. If $p + q + r = 9$, then find the value of $(3 - p)^3 + (3 - q)^3 + (3 - r)^3$.

13. Find the remainder when $x^3 + 3x^2 + 2x$ is divided by $x$.

14. If $f(x) = x^2 - 3$, then find $f(1) + f(-1)$

15. Find the sum of coefficient of $x^2$ and coefficient of $x$ in the polynomial $3x^3 - 4x^2 + 5x + 2$

## Very Short Answer Questions (2 Marks)

16. Check whether $q(x)$ is a multiple of $r(x)$ or not.

    Where $q(x) = 2x^3 - 11x^2 - 4x + 5$, $r(x) = 2x + 1$.

17. Show that $(x - 5)$ is a factor of $x^3 - 3x^2 - 4x - 30$.

18. Evaluate by using suitable identify: $(997)^2$

19. Find the zeroes of the polynomial $p(x) = x(x - 2)(x + 3)$

20. Find the quotient when $3x^2 - 7x - 6$ is divided by $(x - 3)$

21. Factorize $8x^3 + \sqrt{27}\ y^3$

22. If $p(x) = x + 9$, then find $p(x) + p(-x)$

23. Find the product without multiplying directly $106 \times 94$

24. The factors of $5x^2 - 18x + 9$ are $(ax + b)$ and $(x + b)$. Find the values of a and b.

25. Find $p\ (1) + p\ (-1) + p(10)$ if $p(x) = x^2 - 3x + 2$

26. Find $(x - y)^2$ if $\dfrac{x}{y} + \dfrac{y}{x} = 2$

27. Show that $-1$ is $a$ zero of $3x^4 - x^3 + 3x - 1$.

28. Multiply $(x + 1)(x - y)$

**Short Answer type Questins (3 Marks)**

29. Factorize: $64a^2 + 96ab + 36b^2$

30. Facrotize: $x^3 + 6x^2 + 11x + 6$

31. If $x^2 + y^2 = 49$ and $x - y = 3$, then find the value of $x^3 - y^3$.

32. Simplify: $(5a - 2b)(25a^2 + 10ab + 4ab^2) - (2a + 5b)(4a^2 - 10ab + 25b^2)$

33. Find the sum of remainders when $x^3 - 3x^2 + 4x - 4$ is divided by $(x - 1)$ and $(x + 2)$.

34. Find the product $\left( p - \dfrac{1}{p} \right)\left( p + \dfrac{1}{p} \right)\left( p^2 + \dfrac{1}{p^2} \right)\left( p^4 + \dfrac{1}{p^4} \right)$

35. Factorize: $7\sqrt{2}k^2 - 10k - 4\sqrt{2}$

36. Simplify: $(3x - 4y)^3 - (3x + 4y)^3$

37. Simplify: $(x + y + z)^2 - (x - y - z)^2$.

38. Factorize: $125x^3 + 8y^3 + z^3 - 30xyz$

39. $x + 2$ 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 $b$.

**40.** If the polynomials $ax^3 + 4x^2 + 3x - 4$ & $x^3 - 4x + a$ leave the same remainder when divided by $(x - 3)$, find the value of $a$.

**41.** If $\left(\dfrac{9}{10}\right)^3 - \left(\dfrac{2}{5}\right)^3 - \left(\dfrac{1}{2}\right)^3 = \dfrac{x}{50}$, find $x$

**42.** If $(x - 3)$ and $\left(x - \dfrac{1}{3}\right)$ are factors of the polynomial $px^2 + 3x + r$, show that $p = r$.

**Long Answer type Questions (5 Marks)**

**43.** A literacy campaign was organised by Class IX girl sudents 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.

**44.** (i) Using identity, find the value of $(-7)^3 + (5)^3 + (2)^3$.

(ii) Find dimensions of cube whose volume is given be the expression $4x^2 + 14x + 6$.

**45.** If $a + b + c = 0$, find the value of $\dfrac{(b + c)^2}{bc} + \dfrac{(c + a)^2}{ca} + \dfrac{(a + b)^2}{ab}$

**46.** Simplify: $\dfrac{(a^2 - b^2)^3 + (b^2 - c^2)^3 + (c^2 - a^2)^3}{(a - b)^3 + (b - c)^3 + (c - a)^3}$

**47.** Factorize $(2a - b - c)^3 + (2b - c - a)^3 + (2c - a - b)^3$

**48.** If the polynomail $4x^3 - 16x^2 + ax + 7$ is exactly divisible by $x - 1$, then find the value of $a$. Hence factorize the polynomial.

**49.** If $\dfrac{x}{y} + \dfrac{y}{x} = -1$ where $x \neq 0, y \neq 0$ then find the value of $x^3 - y^3$

**50.** Simplify: $\dfrac{155 \times 155 + 155 \times 55 + 55 \times 55}{155 \times 155 \times 155 - 55 \times 55 \times 55}$

# CHAPTER-2
## POLYNOMIAL

**Answer and Hints**

1. (d) $-7$

2. (b) $\sqrt{x}+1$

3. (b) $\dfrac{2}{3}$

4. (a) $-9$

5. (c) $-16$

6. $x^2 + 4y^2 + z^2 + 4xy - 4yz - 2xz$

7. Two

8. Three

9. $(-19)^3$

10. $3, 2$

11. Yes

12. $p + q + r = 9$

$(3 - p) + (3 - q) + (3 - r) = 0$

$\therefore\ (3 - p)^3 + (3 - q)^3 + (3 - r)$

$= 3(3 - p)(3 - q)(3 - r)$

13. $0$

14. $f(1) + f(-1)$

$= (-2) + (-2) = -4$

15. $(-4) + (5) = 1$

16. Since, $q\left(\dfrac{-1}{2}\right) = 1 \neq 0$

$\therefore\ r(x)$ is not a multiple of $q(x)$.

17. Put $x = 5$ in given polynomial

18. $994009$

---

**19.** $0, 2, -3$

**20.** $3x + 2$

**21.** $\left(2x + \sqrt{3y}\right)\left(4x^2 - 2\sqrt{3}xy + 3y^2\right)$

**22.** $18$

**23.** $(100 + 6)(100 - 6) = 9964$

**24.** $a = 5, b = -3$

**25.** $8$

**26.** $0$

**28.** $x^2 - xy + x - y$

**29.** $(8a + 6b)^2$

**30.** $(x + 1)(x + 2)(x + 3)$

**31.** $207$

**32.** $117a^3 - 133b^3$

**33.** $-34$

**34.** $p^8 - \dfrac{1}{p^8}$

**35.** $\left(k - \sqrt{2}\right)\left(7\sqrt{2}k + 4\right)$

**36.** $-128y^3 - 216x^2y$

**37.** $4xy + 4xz$

**38.** $(5x + 2y + z)(25x^2 + 4y^2 + z^2 - 10xy - 2yz - 5zx)$

**39.** $a = 0, b = 1$

**40.** $a = -1$

**41.** $x = 27$, {use, if $a + b + c = 0$ then $a^3 + b^3 + c^3 = 3abc$}

**43.** $3x^2 - 19x + 20$

**44.** (i) $-210$, (ii) $2, (x + 3), (2x + 1)$

**45.** $3$

**46.** $(a + b)(b + c)(c + a)$

**47.** $3\,(2a-b-c)\,(2b-c-a)\,(2c-a-b)$

**48.** $a=5,\ (x-1)\,(2x+1)\,(2x-7)$

**49.** 0

**50.** $\dfrac{(155)^2 + 155\times 55 + (55)^2}{(155)^3 - (55)^3} = \dfrac{(155)^3 - (55)^3}{(155-55)\left((155)^3 - (55)^3\right)}$

$$= \frac{1}{100} = 0.01$$

# PRACTICE TEST
## POLYNOMIALS

**Time: 1 hr.**                                               **M.M. 20**

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

2. Find the value of the polynomial $2x + 5$ at $x = -3$.                    (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 $k$                    (3)

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

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

8. Factorise $x^3 - 23x^2 + 142x - 120$ by using factor theorem.                    (4)

# CO-ORDINATE GEOMETRY

## MIND MAP

## Key Points

- Co-ordinate Geometry is the branch of Mathematics in which we study the position of any object lying in a plane, called the cartesian plane.

- In cartesian system; there are two mutually perpendicular straight lines $xx'$ and $yy'$ intersecting at origin.

- These mutually perpendicular straight lines, known as x-axis and y-axis, divides the plane into four quadrants.

- The coordinates of a point is the position of the point in cartesian plane and are determined by perpendicular distance from x-axis and y-axis.

- The perpendicular distance of a point from y-axis is called abscissa (x-coordinate) and from x-axis is called ordinate (y-coordinate)

- Any point in the cartesian plane is shown by $p(a, b)$ where $(a, b)$ are coordinates of point $p$.

| abscissa (x) | ordinate (y) | Position of point |
|---|---|---|
| positive (+) | positive (+) | Quadrant I |
| positive (+) | negative (–) | Quadrant IV |
| negative (–) | negative (–) | Quadrant III |
| negative (–) | positive (+) | Quadrant II |

- The coordinates of a point on x-axis are of the form $(x, 0)$ and on y-axis are of the form $(0, y)$.

- If x-coordinate of two or more points are same, then the line joining these points is parallel to y-axis.

- If y-coordinate of two or more points are same, then the line joining these points is parallel to $x$-axis.

- The mirror image of a point is just a reflection of this point about one of the axes. Mirror image about x-axis: abscissa remains same sign of ordinate changes.

  Mirror image about y-axis: sign of abscissa changes ordinate remains same

  Mirror image about origin: signs of both-abscissa and ordinate changes

## Very-Very Short Answer (1 marks)

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 Ist 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. **The signs of abscissa and ordinate of a point in the second quadrant are respectively.**

   (a) +, +                 (b) –, –

   (c) –, +                 (d) +, –

8. **The ordinate of a point is positive in**

   (a) I and IV quadrants     (b) I quadrant only

   (c) 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 end points of a line lies in I quadrant and III quadrant. The line may pass through**

    (a) origin                (b) negative x-axis

    (c) positive y-axis         (d) quadrant II

11. **The point whose abscissa and ordinate have different signs will lie in**

   (a) I and II quadrants

   (b) I and III quadrants

   (c) II and III quadrants

   (d) II and IV quadrants

12. **Which of the point $P(0, 3)$, $Q(1, 0)$, $R(0, -1)$, $S(-5, 0)$, $T(1, 2)$ do not lie on x-axis?**

   (a) $P$ and $R$ only

   (b) $Q$ and $S$ only

   (c) $P$, $R$ and $T$

   (d) $Q$, $S$ and $T$

13. **If the coordinates of the points are $P(-2, 3)$ and $Q(-3, 5)$ then (abscissa of $P$) – (abscissa of $Q$) is**

   (a) –5

   (b) 1

   (c) –1

   (d) –2

14. **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

15. **The pont of intersection of the coordinates axes is**

   (a) Abscissa

   (b) Ordinate

   (c) Quadrant

   (d) Origin

16. **The abscissa and ordinate of the origin are**

   (a) $(1, 0)$

   (b) $(1, 1)$

   (c) $(0, 1)$

   (d) $(0, 0)$

17. **The angle formed between the coordinate axes is**

   (a) Zero angle

   (b) Right angle

   (c) Acute angle

   (d) Obtuse angle

18. **The perpendicular distance of the point $p(-4, -3)$ from x-axis is**

   (a) –4 units

   (b) –3 units

   (c) 4 units

   (d) 3 units

19. **The perpendicular distance of the point $p(-7, 2)$ from y-axis is**

   (a) –7 units

   (b) 7 units

   (c) 2 units

   (d) –2 units

20. **The distance of the point $p(3, 4)$ from the origin is**

   (a)  3 units                      (b)  4 units

   (c)  7 units                      (d)  5 units

21. **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

22. **The mirror image of the point (0, 3) along y-axis is**

   (a)  $(0, -3)$                   (b)  $(0, 3)$

   (c)  $(3, 0)$                    (d)  $(-3, 0)$

## Fill in the blanks:

23. The coordinate axes divide the plane into four parts, each part is called _____.

24. It the coordinates of a point are $(-2, 5)$, then its ordinate is _____ and its abscissa is _____.

25. The point $(200, -111)$ lies in the _____ quadrant.

26. The abscissa of any point on the y-axis is _____.

27. The ordinate of any point on the x-axis is _____.

28. The points $(0, 0), (0, 4)$ and $(4, 0)$ form a/an _____ triangle.

29. If $(x, y)$ represents a point and $xy > 0$, then the point may lie in _____ or _____ quadrant.

30. The points with coordinates $(3, -1)$ and $(-1, 3)$ are at _____ (same/different) positions of the coordinate plane.

31. If the ordinate of points is 7 and abscissa is $-5$, then its coordinates are _____.

32. The coordinates of a point lying on x-axis having abscissa 5 are _____.

33. The co-ordinates of a point describe the point in the place _____.

34. The coordinates of a point, which lies on negative x-axis at a distance of 6 units from y-axis, are _____.

35. If the coordinates of the points are $P(0, -1)$ and $Q(2, 1)$ then (abscisa of $P$) – (abscissa of $Q$) is _____.

36. The measure of the anlge between coordinate axes is _____.

**37.** In which quadrant do the given points lie.

 (i) (3, –2)       (ii) 17, –30)

 (iii) (–2, 5)       (iv) (–50, –20)

 (v) (10, 100)      (vi) (–81, 80)

**38.** On which axis do the given points lie:

 (i) (11, 0)       (ii) (–11, 0)

 (iii) (0, – 100)     (iv) (0, 14)

**39.** The abscissa and ordinate of a point $A$ are –3 and –5 respectively then write down the coordinates of $A$.

**40.** Do $P(7, 0)$ and $Q(0, 7)$ represent the same point?

**41.** In which quadrant x coordinate is negative?

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

**43.** In which quadrant, does the point $A(x, y)$ with values $x > 0$ and $y > 0$ exists?

**44.** Write the coordinates of the fourth vertex of a square when three of its vertices are given by $(1, 2)$, $(5, 2)$ and $(5, –2)$.

**45.** If abscissa of any point is positive & ordinate is negative then in which quadrant do the point lie?

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

**47.** In which quadrant will a point lie if its both the coordinates are positive?

**48.** Write the coordinates of the point at which two coordinate axes meet.

**49.** Write the coordinates of the point which lies at a distance of x-units from x-axis and y units from y-axis.

**50.** Find the coordinates of the point which lies on x-axis at a distance of 5 units from y-axis.

**51.** Find the coordinates of the point which lies on y-axis at a distance of 9 units from x-axis in the negative direction.

**52.** In which quadrant of a cartesian plane the ordinate of a point will be positive and abscissa will be negative?

**53.** On which axis the point $A(–3, 0)$ lies?

**54.** Which axis is parallel to the line joining the points (2, 4) and (2, –5)?

**55.** Find the image of the point (2, 3) about x-axis.

**56.** Find the mirror image of the point (–5, 6) about y-axis.

**57.** In which quadrant the mirror image of (–1, –4) lie about y-axis?

**58.** A point is in II quadrant. In which quadrant will its mirror image lie along x-axis?

## Very short answer type questions (2 marks)

**59.** Find the co-ordinates of two points on x-axis and two points on y-axis which are at equal distance from the origin.

**60.** Name the quadrant in which the graph of point $A(x, y)$ lies when

    (a) $x > 0$ and $y > 0$                    (b) $x < 0$ and $y < 0$

**61.** Find the coordinates of the vertices of a rectangular figure placed in III quadrant in the cartesian plane with length $p$ unit on x-axis and breadth $q$ units on y-axis.

**62.** Write the coordinates of any two point on the line segment joining the points $A$ (4, –1) and $B$(4, 5).

## Short answer type questions (3 marks)

**63.** 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?

**64.** 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 this condition?

**65.** 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.

**66.** Name the figure obtained by joining the points $B$(5, 3), $E$(5,1), $S$(0, 1) and $T$(0, 3). Also find the area of the figure.

# CHAPTER-3
## CO-ORDINATE GEOMETRY

**Hints and Solutions**

1.  (b) y-axis
2.  (a) x-axis
3.  (c) Third quadrant
4.  (b) y-axis
5.  (d) IV quadrant
6.  (a) on x-axis
7.  (c) –, +
8.  (c) I and II quadrants
9.  (d) (0, –10)
10. (a) origin
11. (d) II and IV quadrants
12. (a) $P$ and $R$ only
13. (b) 1
14. (d) do not lie in same quadrant
15. (d) origin
16. (d) (0, 0)
17. (b) Right angle
18. (d) 3 units
19. (b) 7 units
20. (d) 5 units
21. (d) points $B$ and $C$ both
22. (b) (0, 3)
23. quadrant
24. 5, –2
25. IV quadrant
26. 0
27. 0
28. isosceles
29. I or III
30. different
31. (–5, 7)
32. (5, 0)
33. uniquely
34. (–6, 0)
35. 2
36. 90°
37. (i) & (ii) IV quadrant
    (iii) & (vi) II quadrant
    (iv) III quadrant
    (v) I quadrant
38. (i) & (ii) x-axis
    (iii) & (iv) y-axis
39. (–3, –5)
40. No because abscissa and ordinates are different for both the points.
41. II and III
42. Triangle
43. I quadrant
44. (1, –2)
45. IV quadrant
46. (–3, 5)

47. I quadrant
48. (0, 0)
49. (y, x)
50. (5, 0)
51. (0, –9)
52. II quadrant
53. x-axis
54. y-axis
55. (2, –3)
56. (5, 6)
57. IV quadrant
58. III quadrant
59. $(\pm 9, 0), (0, \pm a)$ where a is any real number
60. (i)  I quadrant

    (ii)  III quadrant
61. $(0, 0), (-p, 0), (-p, -q), (0 -q)$
62. Any two point with abscissa = 4 orginate lying $b/w$ –1 and 5.
63. Rectangle, y-axis
64. Any point on y-axis, infinite
65. $(0, 0), (10, 0), (10, 8), (0, 8)$
66. Figure : Rectangle

    Area : 10 sq. units.

## PRACTICE TEST

## COORDINATE GEOMETRY

**Time: 1 hr.**                                                          **M.M. 20**

**1.** In which quadrant, the point $(x, y)$ will lie, where $x$ is positive and $y$ is negative number? (1)

**2.** Write the coordinate of a point at a distance of 5 units from x-axis lying in II qudrant. (1)

**3.** Find the value of x and y if: (2)

   (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.** In which quadrant, do the following point lie? (3)

   (i)   $(4, -2)$                          (ii) $(-3, 7)$

   (iii)  $(-1, -2)$                        (iv) $(3, 6)$

**6.** Write the mirror image of following points along x-axis. (3)

   $(-3, 5)\ (2, 0)\ (-4, -7)$

**7.** Consider the points $O(0, 0)$, $A(4, 0)$ and $B(4, 6)$. Find the length of $OA$ and $AB$. How will you find the coordiantes of the fourth point $C$ 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 Equation in Two variables**

General Form

**ax+by+c=0**

*where*

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

*Examples*

**2x+5y=10
7x-2y+11=0
y=3x+5
etc.**

Solutions

**Values of x and y satisfying the equation**

Example

**Solutions of x+2y=7 are**
**(i) x=5, y=1    (iii) x=6, y=$\frac{1}{2}$**
**(ii) x=3, y=2    (iv) x=1, y=3**
**etc.**

Number of Solutions → **Infinite**

Graph

$$x+2y=7$$

(1,3)

(3,2)

(5,1)
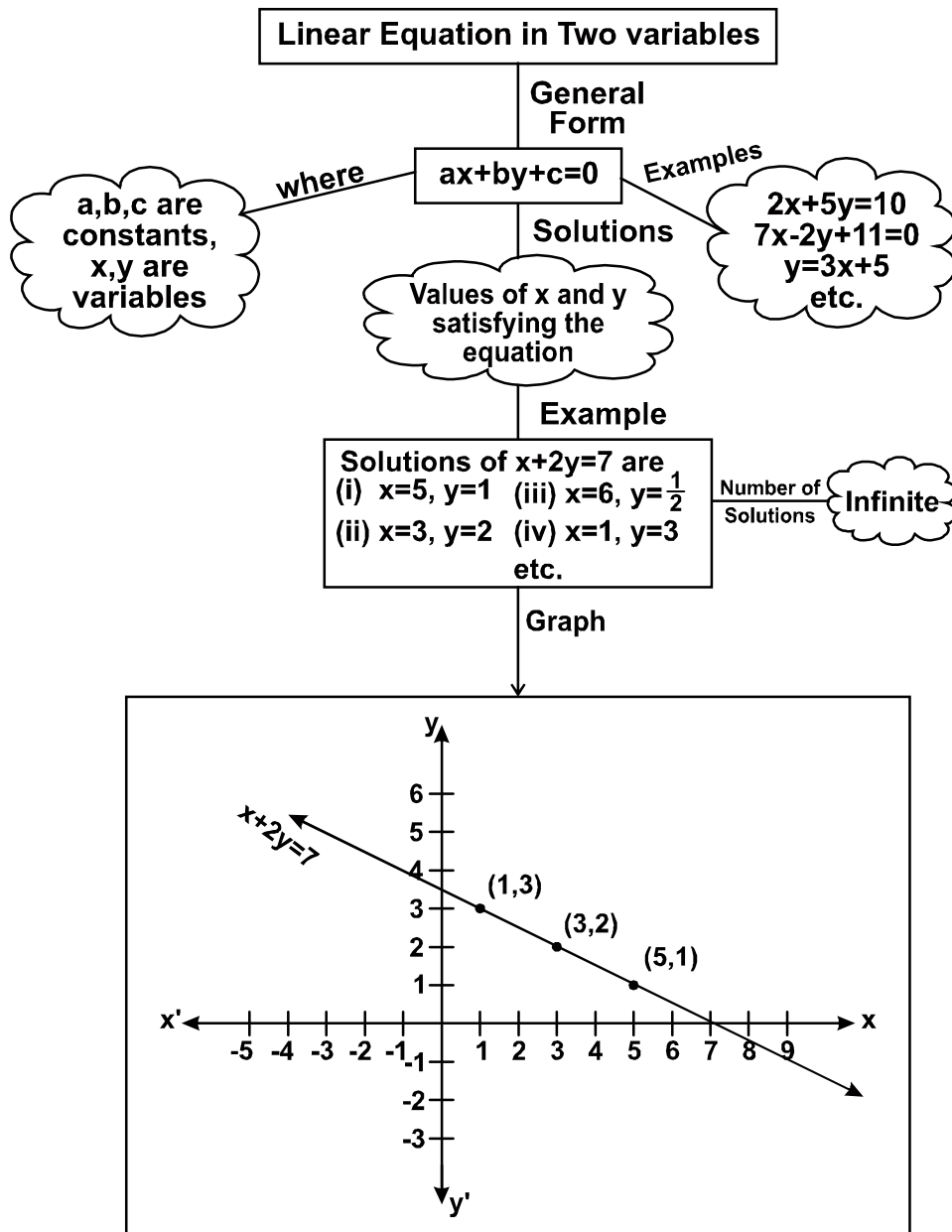
## Key points

- **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

  $$ax + b = 0 \Rightarrow x = -\frac{b}{a}$$

- Linear equation in two variables has infinitely many soulutions.

- 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
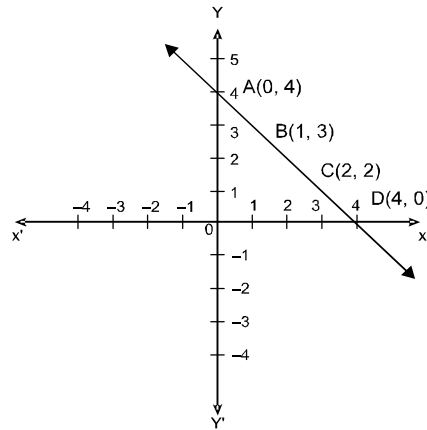
## Very-Very Short Answer type Questions (1 Mark)

1. **Which of the following is not a linear equation?**

   (a)  $3x + 3 = 5x + 2$          (b) $x^2 + 5 = 3x - 5$

   (c)  $\dfrac{7}{3}x - 5 = 4x - 3$       (d) $(x + 2)^2 = x^2 - 8$

2. **Which of the following is not a linear equation in two variables?**

   (a)  $2x + 3y = 5$            (b) $3t + 2s = 6$

   (c)  $ax^2 + by = c$           (d) $ax + by = c$

3. **A linear equation in two variables has maximum**

   (a) Only one solution          (b) Two solutions

   (c) Infinite solutions          (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) None 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. At what point, the graph of $3x + 2y = 9$, cuts the y-axis?

12. Let $y$ varies directly as $x$. If $y = 15$ when $x = 5$, then write a linear equation.

13. Write the point of intersection of the lines $x = 2$ and $y = -3$

14. What is the distance of the point $(3, -7)$ from x-axis?

15. What is the distance of the point $(-5, -4)$ from y-axis?

16. 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 $c$.

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

18. Express $y$ in the terms of $x$.

    $3y + 5x = 9$

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

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

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

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

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

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

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

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

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

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

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

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

31. On which side of x-axis, $2y - 1 = 0$ lies?

**Fill in the blanks:**

32. (a)  The equation of a line parallel to x-axis is _____ $= a$ where a is any non-zero real number.

    (b)  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 _____

36. State whether the following statements are true or false _____

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

(b) All the points $(2, 0)$, $(-3, 0)$, $(4, 2)$ lie on the x-axis

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

(d) The graph of every linear equation in two variables need not be a line.

(e) The graph of the linear equation $x + 2y = 5$ passes through the point $(0, 5)$

## Very Short Answer type Questions (2 marks)

**37.** Find any two solutions of equation

$2x + y = x + 5$

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

**39.** If the points $A(3, 5)$ and $B(1, 4)$ lines on the graph of line $ax + by = 7$, find the value of $a$.

**40.** Write the coordinates of the point where the graph of the equation $5x + 2y = 10$ intersect both the axes.

**41.** Write the equations of two lines passing though $(3, 10)$.

**42.** The cost of coloured paper is 7 more than 1/3 of the cost of white paper. Write this statements in linear equation in two variables.

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

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

**45.** How many solution of the equations $3x - 2 = x - 3$ are there on the

(i) Number line

(ii) Cartesian plane...

**46.** 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 lef of origin.

## Short answer type questions (3 marks)

**47.** If total number of legs in a herd of goats and hens is 40. Represent this situation in the form of a linear equation in two variables.

**48.** Find the value of $a$ and $b$, if the line $6ax + by = 24$ passes through, $(2, 0)$ and $(1, 2)$

**49.** Determine the point on the graph of the linear equation $2x + 5y = 19$ whose ordinate is 1½ times its abscissa.

**50.** Find the points where the graph of the following equation cuts the x-axis and y-axis $2x = 1 - 5y$.

**51.** Wirte the equation of the line parallel to x-axis at a distance of 4 units above the origin.

**52.** 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 $b$.

**53.** Find the value of 'a' if $(1, -1)$ is the solution of the equation $2x + ay = 5$. Find two more solutions of the eqution.

**54.** Find two solutions of the equation $4x + 5y = 28$. Check whether $(-2, 10)$ is solution of the given equation.

**55.** Write the equation of line passing through $(3, -3)$ & $(6, -6)$.

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

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

**58.** $F = (9/5)C + 32$. Where F is temp in fahreheit and C is temp in celsius.

    (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?

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

**60.** Draw the graph for the linear equations $-3x + 4y = 12$. If $x = 8$, find the value of y with the help of graph.

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

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

    (i) in one variable     (ii) in two variables

**63.** 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?

**64.** Draw the graph of linear equation $3x - y = 4$. From the graph find the value of $p$ and $q$ if the graph passes through $(p, -4)$ and $(3, q)$

**65.** Draw the graph of equations $2x + 3y = -5$ and $x + y = -1$ on the same graph. Find the co-ordinate of the point of intersection of two lines.

**66.** Show that the points $A(1, -1)$ $B(2, 6)$ and $C(0, -8)$ lie on the grapyh of the linear equation $7x - y = 8$.

**Long answer type questions (5 Marks)**

**67.** Write $3y = 8x$ in the form of $ax + by + c = 0$. Write $x$ terms of $y$. Find any two solutions of the equation. How many solutions you can find out?

**68.** 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.

**69.** 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?

**70.** 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.

**71.** 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.

**72.** 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.

**73.** 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.

**74.** We know that $C = 2\pi r$, taking $\pi = 22/7$, 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 EDUCATIONS IN TWO VARIABLES

**Hints and solutions/answers**

1. (b) $x^2 + 5 = 3x - 5$

2. (c) $ax^2 + by = c$

3. (c) Infinite solutions

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. $(4.5, 0)$

12. $y = 3x$

13. $(2, -3)$

14. 7 units

15. 5 units

16. $\sqrt{2}x - 5y - 4 = 0$

   $a = \sqrt{2}, b = -5, c = -4$

17. $x = \dfrac{7 - 4y}{3}$

18. $y = \dfrac{9 - 5x}{3}$

19. x-axis

20. $(0, 5)$

21. $ox + 5y = 9$

22. $y = 2$

23. No

**24.** Yes

**25.** Infinitely many solutions

**26.** $K(-1) - 2(1) = 0$

$k = -2$

**27.** $2(5) + k(0) = 10k$

$k = 1$

**28.** Parallel to y-axis

**29.** $(3, 0)$

**30.** On left side

**31.** On right side

**32.** (a) $y$

(b) $x$

**33.** Straight line

**34.** a point on number line

**35.** 1

**36.** (a) $F$    (b) $F$   (c) $T$   (d) $F$   (e) $F$

**37.** $(1, 4) (0, 5)$ (or any other possible solutions)

**38.** As $x = 2$, $y = 3$ is a sol

$5(2) + 3p(3) = 4a$

$10 + 9p = 4a$

$p = \dfrac{4a - 10}{9}$

**39.** $3a + 5b = 7$; $a + 4b = 7$

$3(7 - 4b) + 5b = 7$

$b = 2, a = -1$

**40.** Graph of $5x - 2y = 10$ will intersect x-axis when $y = 0$ ie

$5x - 2(0) = 10 \Rightarrow 5x = 10$

$x = 2$ i.e pt. $(2, 0)$

Similarly for y-axis put $x = 0$ ie

$5(0) - 2y = 10$

$y = -5$ i.e pt $(0, -5)$

**41.** $3x - y + 1 = 0$, $x + y = 13$ (or any other possible equation)

**42.** Let the cost of coloured paper be ₹ $x$

Let the cost of white paper be ₹ $y$, then $A/Q$

$x = 1/3\ y + 7$

or $3x = y + 21$

**43.** $x + y = 5$



| x | 0 | 5 | 1 |
|---|---|---|---|
| y | 5 | 0 | 4 |
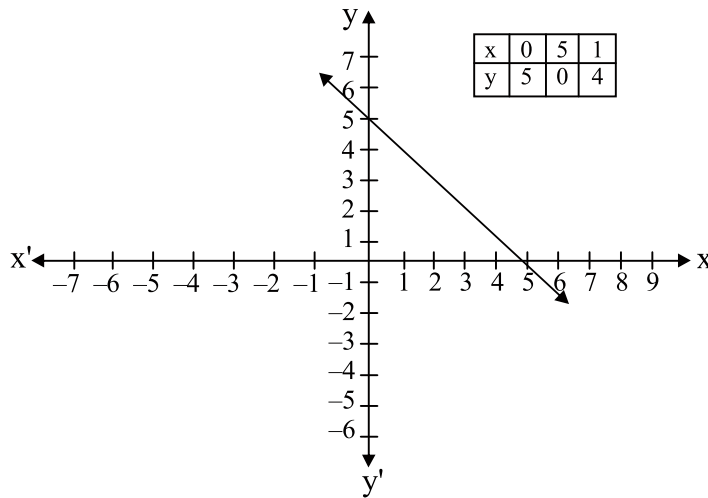
**44.** I, IV, III

**45.** (i)  $3x - 2 = x - 3$

$\Rightarrow x = -\dfrac{1}{2}$

on number line one solution ie



$x = -\dfrac{1}{2}$
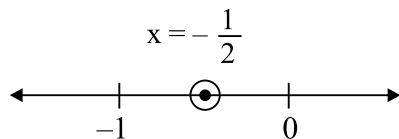
(ii) On cartesian plane infinitely many solutions ie. $1.x + 0.y = -\dfrac{1}{2}$

| x | $-\dfrac{1}{2}$ | $-\dfrac{1}{2}$ | $-\dfrac{1}{2}$ |
|---|---|---|---|
| y | $-1$ | $0$ | $1$ |
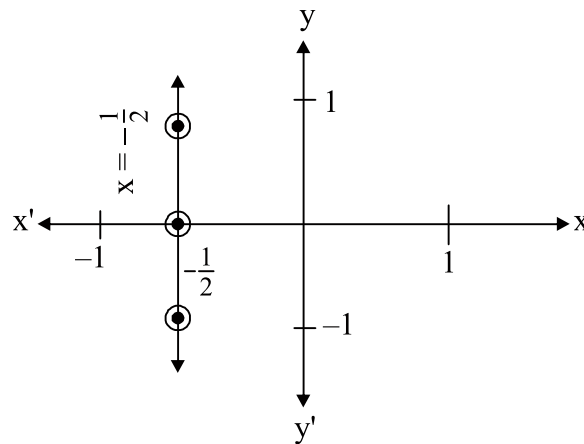


(A line parallel to y-axis)

**46.** (i)   $(1, 3)$
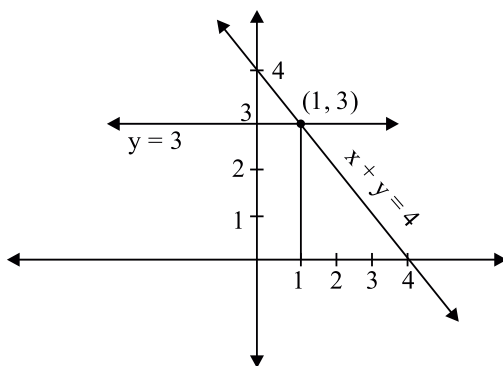
(ii) (–2, 6)
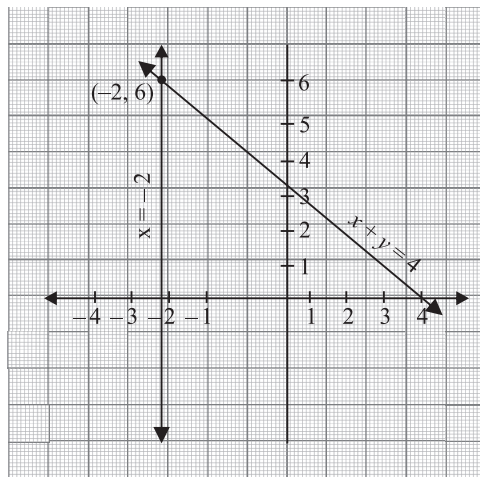


**47.** Let number of goats $= x$

Number of hens $= y$

$$4x + 2y = 40$$

or $\qquad 2x + y = 20$

**48.** $6a(2) + b(0) = 24$

$$12a = 24$$
$$a = 2$$
$$6(2)(1) + b(2) = 24$$
$$12 + 2b = 24$$
$$2b = 12$$
$$b = 6$$

**49.** Let required pt. be $(x', y')$

$$A/Q \; y' = 1\frac{1}{2}x' = \frac{3}{2}x' \qquad\qquad \text{------- (1)}$$

$(x', y')$ lies on graph of $2x + 5y = 19$

$$2x' + 5y' = 19 \qquad\qquad \text{---------- (2)}$$

from (1) & (2)

$$2x' + 5\left(\frac{3}{2}x'\right) = 19$$

$$4x' + 15x' = 38 \Rightarrow x' = 2$$

$$y' = \frac{3}{2} \times 2 = 3$$

point will be $(x', y')$ ie $(2, 3)$

**50.** cuts x-axis at $\left(\frac{1}{2}, 0\right)$

cuts y-axis at $\left(0, \frac{1}{5}\right)$

**51.** $y = 4$

**52.** $4x + 6b = 8$

$$\text{or } 2a + 3b = 4$$
$$a + 3b = 8$$
$$a = -4 \text{ and } b = 4$$

**53.** $2(1) + a(-1) = 5$

$$-a = 3$$
$$a = -3$$
$$2x - 3y = 5, \text{ any two solutions}$$

**54.** $(2, 4); (7, 0)$

[or any other possible solution]

$(-2, 10)$

$4x + 5y = 28$

| L.H.S | R.H.S. |
|---|---|
| $4(-2) + 5(10)$ | 28 |
| $= -8 + 5$ | |
| $= 42$ | |

L.H.S. $\neq$ R.H.S

$\Rightarrow$ $(-2, 10)$ is not a sol of eq $4x + 5y = 28$

**55.** $x + y = 0$

**56.** $4[3k - 2] - 7[2k] + 12 = 0$

$12k - 8 - 14k + 12 = 0$

$k = 2$

**57.** $2[m-2] + 3[2m+1] - 10 = 0$

$$2m - 4 + 6m + 3 - 10 = 0$$

$$m = \frac{11}{8}$$

**58.** (i) $F = \left(\frac{9}{5}\right)C + 32$

when $C = 35°$

$$F = \left(\frac{9}{5}\right)(35) + 32$$

$$F = 95° \text{ F}$$

(ii) 86ºF

**59.** $2x + 3y = 6$



| x | 0 | 3 | −3 |
|---|---|---|----|
| y | 2 | 0 | 4 |
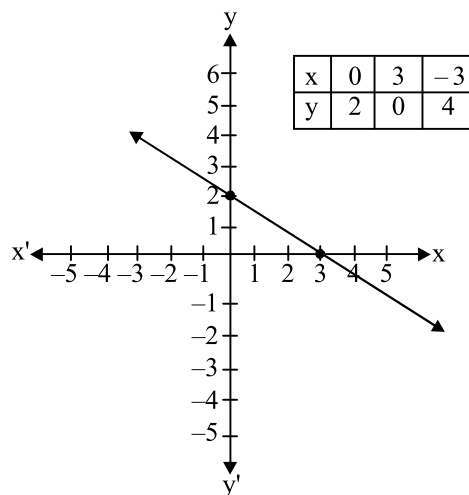
x-axis co-ordiantes (3, 0)

y-axis co-ordinates (0, 2)

**60.** $y = -3$

**62.** $x = \dfrac{-7}{5}$ or $x = -1.4$

| x | -1.4 | -1.4 | -1.4 |
|---|------|------|------|
| y | 0 | 1 | 2 |
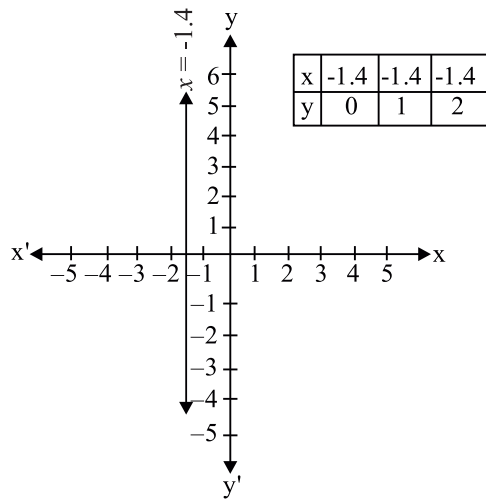
**63.** No

**64.** Graph of $3x - y = 4$ passes through $(p, -4)$

$\Rightarrow (p, -4)$ lies on line of graph of

$3x - y = 4$, when $y = -4$, $x = 0$

$\Rightarrow p = 0$

Similarly $(3, q)$ lies on this line when $x = 3, y = 5$

$\Rightarrow q = 5$

**65.** $2x + 3y = -5$

$\Rightarrow x = \dfrac{-5 - 3y}{2}$ --- (1)

| x | 2.5 | -4 | -1 |
|---|-----|----|----|
| y | 0 | 1 | -1 |

$x + y = -1$

| x | 0 | -1 | 1 |
|---|---|----|---|
| y | -1 | 0 | -2 |
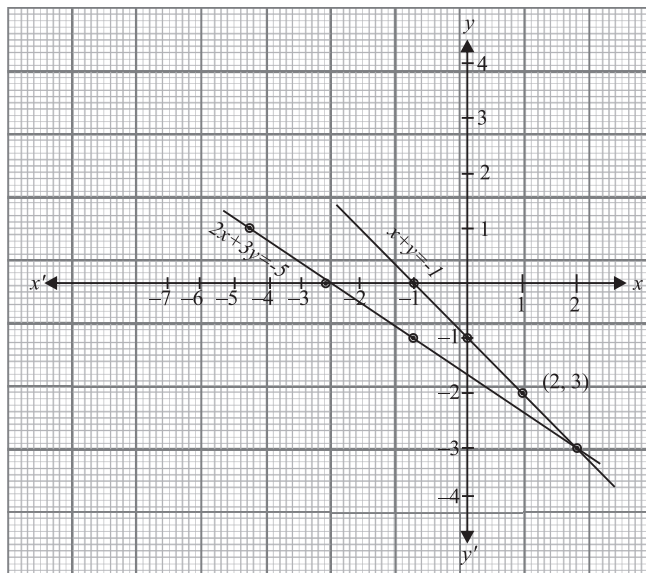
point of intersection is $(2, -3)$

**67.** $8x - 3y + 0 = 0$; $x = \dfrac{3y}{8}$

$(0, 0)$ $(3, 8)$

Infinitely many solutions.

**68.** $x + y = 25$ [where x-Rohan's collection and y-Romita's]

**69.** (i) $5x + 20 = y$

(ii) 25

**70.** (a) $x + y = 1600$

(b) Priyanka = ₹ 1200 $[\because x = 3y]$

Arti = ₹ 400

**71.** (a) $150x + 200y = 3600$

(b) Number of boys = 12

**72.** Using speed $= \dfrac{\text{distance}}{\text{time}}$

$y = 60x$

(i) 90 km $\left[\because x = 90 \text{ min} = \dfrac{90}{60} \text{hr} = \dfrac{3}{2} \text{hr}\right]$ (ii) 2 hours 30 min.

**73.** $10x + 20 = y$

$10x - y + 20 = 0$

$a = 10; b = -1; c = 20$

**74.** $y = 2\pi^x$

yes

when                        $r = 2.8$ units

                                   $c = 17.6$ units

## Practice Test

## Linear equations in two variables

**Time: 1 hr.** <span style="float:right">**M.M. 20**</span>

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

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

3. Find the value of $a$ and $b$. If the line $5bx - 3ay = 30$ passes through $(-1, 0)$ and $(0, -3)$ (2)

4. Write two linear equations passing through the points $(2, -3)$ (2)

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

6. Find the solutions of linear equation $2x + y = 4$ which represents a point on/which (3)

   (i) x-axis

   (ii) y-axis

   (iii) is at 3 unit perpendicular distance from x-axis

7. Give the geometrical representation of $2x + 5 = 0$ as a linear equation in (4)

   (a) one variable          (b) two variable

8. A taxi charges ₹ 15 for first kilometer and ₹ 8 each for every subsequent kilometer. For a distance of $x$ km, an amount of ` y is paid. Write the linear equation representing the above information and draw the graph. (4)

# Chapter-5
## INTRODUCTION TO EUCLID'S GEOMETRY
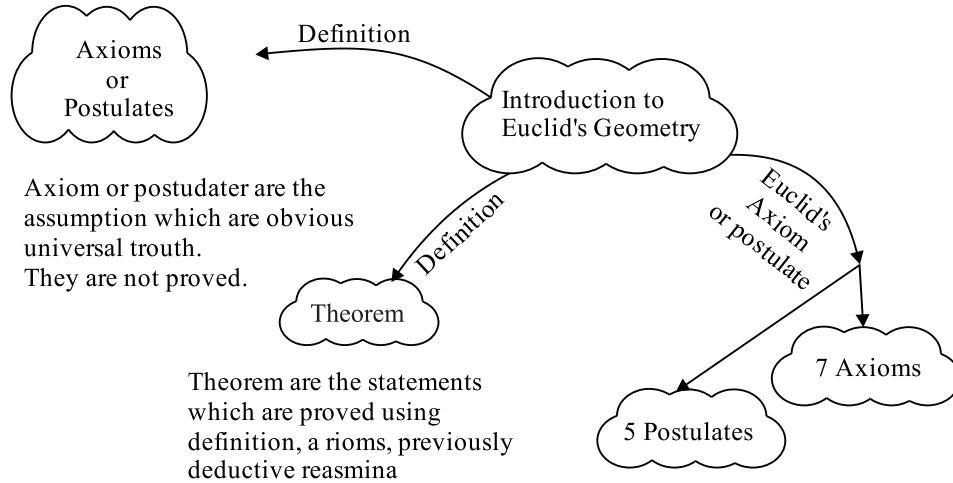


## Key points

- **Introduction:** Euclidean geometry, which is taught today is named after Euclide – 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 trught. They are not proved.

- **Theorems:** Theorems are statements which are proved using definitions, axioms, reviously proved statements and deductive reasoning.

## Some of Euclids 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 stright lne falling on two straight line makes the interior angles on the same side of it taken together less than two right angles, then the two straight lines, if produces idefinitely, meet on that side on which the sum of angles is less thn two right angles.

## Definitions

1. A <u>Point</u> is that wich has no part.

2. A <u>line</u> is breadthless length.

3. The ends of a lne are points

4. A <u>straight</u> line is a line which lies evenly with the points on it self.

5. A <u>surface</u> is that which contain length and breadth only.

6. The <u>edges</u> of a surface are lines.

7. A <u>plane surface</u> 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.

## Very Short Answer type Questions (1 Marks)

1. **Through two points:**

    (a) A unique line can be drawn
    (b) No line can be drawn
    (c) Two lines can be drawn
    (d) More than two lines can be drawn

2. **Euclid arranged all known work in the field of mathematics in his treatise called:**

    (a) Elements
    (b) Axioms
    (c) Theorems
    (d) Postulates

3. **Things which are double of the same things are:**

    (a) Halves of the same thing
    (b) Double of the same thing
    (c) Euqals
    (d) Four times of the same thing

4. **A mathematical statements whose truth has been logically established is called:**

   (a) An Axiom                      (b) A postulate

   (c) A Theorem                  (d) None of the above

5. **Two lines having a common point are called:**

   (a) parallel lines                (b) intersecting lines

   (c) coincident                   (d) None of the above

6. A proof is required for _____ (Postulate, Axioms, Theorem)

7. The number of line segments determined by three collinear points is _____ (Two, three, only one)

8. Euclid stated that if Equals are subtracted from equal then the remainders are equal in the form of _____ (an axiom, a definition, a postulate)

9. A point has _____ diamensions

10. There are _____ number of Euclid's postulates.

11. Write the number of dimensions, that a surface contain.

12. In given figure $AD = BC$ then $AC$ and $BD$ are equal or not?



        A         D         C         D
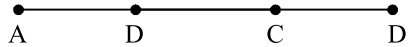
13. How many lines can pass through a single point?

14. Write Euclid's fifth postulate.

15. If $a + b = 15$ and $a + b + c = 15 + c$

    which axiom of Euclid does the statement illustrate?

## Very Short Answer type Questions (2 Marks)

16. If $x + y = 10$ and $x = z$ then show that $z + y = 10$

17. In given figure $AX = AY$, $AB = AC$ show that $BX = CY$
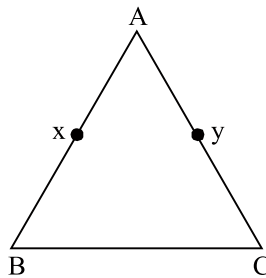
**18.** In the given figure $\angle ABC = \angle ACB$, $\angle 3 = \angle 4$ show that $\angle 1 = \angle 2$
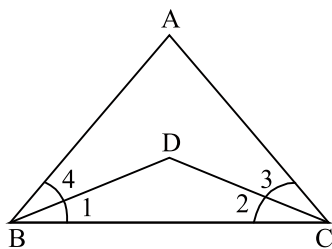


**19.** In the given figure if $AD = CB$ then prove that $AC = BD$
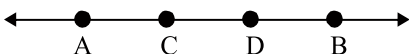


**20.** Solve the equation $x - 10 = 15$, state which axiom do you use here.

**21.** In the given figure if $AM = \dfrac{1}{2} AB$, $AN = \dfrac{1}{2} AC$ and $AM = AN$ then show that $AB = AC$
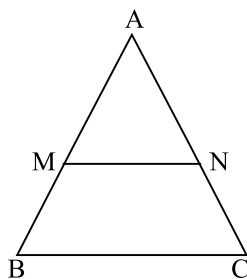


**22.** In the given figure $AC = DC$, $CB = CE$ then show that $AB = DE$
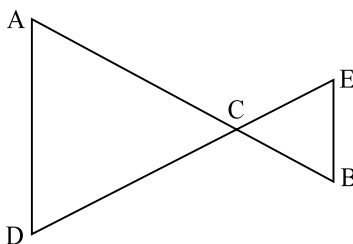


**23.** In figure, $A$ and $B$ are centres of the two intersecting circles, which intersect at c. Prove that $AB = AC = BC$
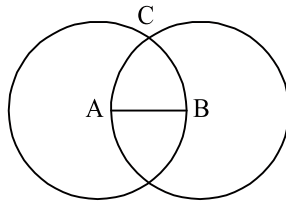
**24.** Prove that every line segment has one and only one mid point.

**25.** Kartik and Himank have the same weight. if they each gain weigth by 3 kg how will their new weight be compared? State Euclid's axiom used?

## Short Answer types Questions (3 Marks)

**26.** In the given figure $\angle 1 = \angle 2$ and $\angle 2 = \angle 3$ then show that $\angle 1 = \angle 3$
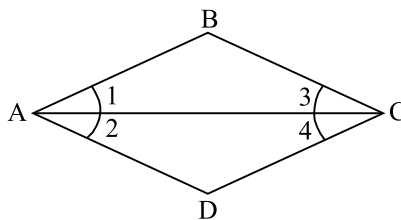


**27.** In the given figure $AB = BC$, $M$ is the mid point of $AB$ and $N$ is the mid-point of $BC$. Show that $AM = NC$
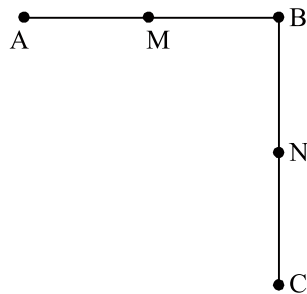


**28.** In the given figure $PR = RS$ and $RQ = RT$. Show that $PQ = ST$ and write the Euclid's axiom to supports this
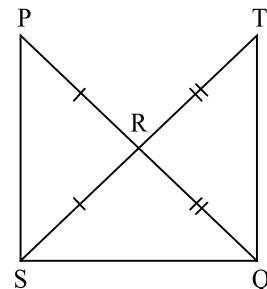
**29.** An equilateral triangle is a polygon made up of three line segments out of which two line segments are equal to the third one and all the angles are 60° each.

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

**30.** Ram and Shyam are two students of class IX. They given 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?

## Answers

**1.** (a) A unique line can be drawn

**2.** (a) Elements

**3.** (c) Equals

**4.** (a) An axiom

**5.** (b) Intersecting lines

**6.** Theorem

**7.** only one

**8.** An axiom

**9.** Zero

**10.** Five

**11.** Two

**12.** Equal

**13.** Infinite

**14.** 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 the two straight lines if produced indefinitely, meet on that side on which the sum of angle is less than two right angles.

**15.** Second axiom

**16.** Given $x + y = 10$          --- (1)

and                  $x = z$          --- (2)

on subtracting y from both sides, of eq$^n$ (1)

$$x + y - y = 10 - y \text{ [by axiom 3]}$$
$$z = 10 - y \text{ [from eq 2]}$$

on adding y both sides, we get

$$z + y = 10 - y + y \ [\text{by axiom 2}]$$
$$z + y = 10$$

**17.** $AB = AC$      --- (1)

$AX = AY$      --- (2)

According to Eclid's axiom (3), if equals are subtracted from equals them remainder are also equal

Subtracting equation (2) from equation (1)

$$AB - AX = AC - AY$$
$$BX = CY \qquad\qquad (\text{hence proved})$$

**18.** $\angle ABC = \angle ACB$      --- (1)

$$\angle 4 = \angle 3 \qquad\qquad\qquad --- (2)$$

eq$^n$ (2) – eq$^n$ (1)

$$\angle ABC - \angle 4 = \angle ACB - \angle 3 \qquad [\text{using axiom 3}]$$
$$\angle 1 = \angle 2$$

**19.** $AD = CB$

$$AC + CD = CD + DB$$

on subtracting CD from both sides

$$AC + CD - CD = CD + DB - CD \qquad\qquad (\text{using axiom 3})$$
$$AC = DB$$

**20.** $x - 10 = 15$

Adding 10 both sides

$$x - 10 + 10 = 15 + 10 \qquad\qquad [\text{by axiom 2}]$$
$$x = 25$$

**21.** Given; $AM = \dfrac{1}{2} AB$      --- (i)

$$AN = \dfrac{1}{2} AC \qquad\qquad\qquad --- (\text{ii})$$

$$AM = AN \qquad\qquad\qquad --- (\text{iii})$$

from eq$^n$s (i), (ii) & (iii), we get

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

$$AB = AC \qquad \qquad \text{[by axiom 6]}$$

**22.** $AC = DC$ \hfill --- (1)

$$CB = CE \qquad \qquad \text{--- (2)}$$

By Euclid's axiom 2

If two equals are aded to equals, then the wholes are equal.

Adding eq$^n$ (1) and eq$^n$ (2)

$$AC + CB = DC + CE$$

$$AB = DE$$

**23.** $AB = AC$ \hfill --- (1)    [Radius of the same circle]

$$BC = AB \qquad \text{--- (2)} \qquad \text{[Radius of the same circle]}$$

from eq$^n$ (1) and eqn (2)

$$AB = AC = BC \qquad \qquad \text{[ by axiom 1]}$$

**24.** We have c as the mid point of the line segment $AB$, so $AC = BC$

Let there are two mid-point $C$ & $C'$ of $AB$
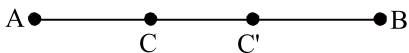


Then,         $AC = \dfrac{1}{2} AB$      $AC' = \dfrac{1}{2} AB$

$\Rightarrow$               $AC = AC'$ \hfill [by axiom 1]

which is possible only when $c$ coincider $c'$, so point c lies on $c'$.

**25.** Kartik's weight = Himank's weight

Kartik's weight + 3 kg = Himank's weight + 3kg   [by axiom 2]

Their new weight will be equals By Euclid's second axiom. If equals are added to equals the wholes are equal.

**26.** $\angle 1 = \angle 2$ \hfill --- (1)

$$\angle 2 = \angle 3 \qquad \qquad \text{--- (2)}$$

from eq$^n$ (1) & eq$^n$ (2)

$$\angle 1 = \angle 3 \qquad \text{[By axiom 1]}$$

**27.** $AB = BC$

$$AM + BM = BN + CN$$
$$2AM = 2CN$$

[M & N are mid-point of AB & BC respectively]

$$AM = CN \qquad \text{[By Euclid's axiom 6]}$$

**28.** $PR = RS$        --- (1)

$RQ = RT$        --- (2)

Adding eqn (1) & eqn (2)

$$PR + RQ = RS + RT$$
$$PQ = ST \qquad \text{[By axiom 2]}$$

**29.**
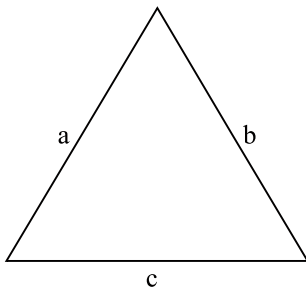


$$a = b \text{ and } b = c$$
$$\Rightarrow \qquad a = b = c \qquad \text{[By axiom 1]}$$

All sides of triangle are equal since all the angles are of 60° in an equilatural triangle so they must be equal to one another.

**30.** Ram's donation in March = Shyam's donation in March      --- (1)

Ram's donation in April = 2 × Ram's donation in March      --- (2)

Shyam's donation in April = 2 × Shyam's donation in March      --- (3)

using eqn (1), (2) & (3)

$\Rightarrow$ Ram's donation in April = Shyam's donation in April    [using axiom 3]

## Practice Test

## Introduction to Euclid's Geometry

**Time: 1 hr.**                                                   **M.M. 20**

1. How many line segments can be determined by three collinear points. (1)

2. How many linear can pass through a given point? (1)

3. State Euclid's first postulate. (2)

4. Solve the equation $x + 3 = 10$ and state the Euclid's axion used (2)

5. If a point c lies between two points $A$ and $B$ such that $AC = BC$ then prove that $AC = \dfrac{1}{2} AB$. Explain by drawing the figure. (3)

6. It is known that $x + y = 10$, then $x + y + z = 10 + z$. State the Euclid's axiom that illustrates the statements (3)

7. State Euclid's fifth postulate explain it and compare it with version of parallel lines (4)

8. In the figure $PQ = RS$, $A$ and $B$ are points on $PQ$ and $RS$ such that $AP = \dfrac{1}{3} PQ$ and $RB = \dfrac{1}{3} RS$ show that $AB = RB$. State which axiom you use here. Also give two more axioms other than the axiom used in the above situation. (4)
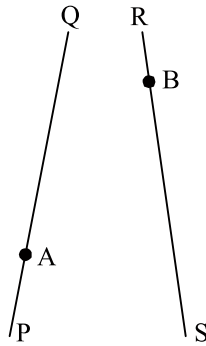
# CHAPTER-6
## LINES AND ANGLES

## MIND MAP

Obtuse

Acute

Right

Straight

Reflex

Complementary

Vertically opposite angles

Adjacent angles

Alternate interior angles

Corres- ponding angles

Supplementary

Linear Pair

Collinear points

Alternate exterior angles

Parallel lines and transversal

Pair of Angles

Line Segment

Angles

Interior angles on the same side of transversal

Intersecting & Non Intersecting Lines

Angle sum property of triangle

Non collinear points

Basic Terms

## 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.

- **Non-Collinear Points:** Three or more points which donot lie on same line.

- **Angle:** An angle is formed when two rays originate from the same end point. The rays making angle are called the arms and the end point is the vertex.
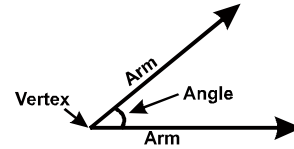
- **Acute Angle:** An angle measure between $0°$ and $90°$.

- **Right angle:** Angle exactly equal to $90°$.

- **Obtuse angle:** An angle greater than $90°$ but less than $180°$

- **Straight angle:** An angle exactly equal to $180°$

- **Reflex angle:** An angle greater than $180°$ but less than $90°$

- **Complimentary angles:** A pair of angles whose sum is $90°$

- **Supplementary angle:** A pair of angles whose sum is $180°$

- **Complete angle:** An angle whose measure is $360°$

- **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 side of common arm.

- **Linear pair of angle:** A pair of adjacent angles whose sum is $180°$
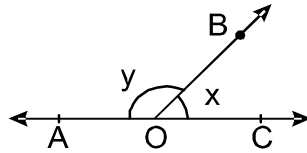
$\angle AOB$ & $\angle COB$ are forming linear pair.

- **Vertically opposite angles:** Angles formed by two intersecting lines on opposite side of the point of intersection.

$\angle x = \angle z$
$\angle y = \angle w$
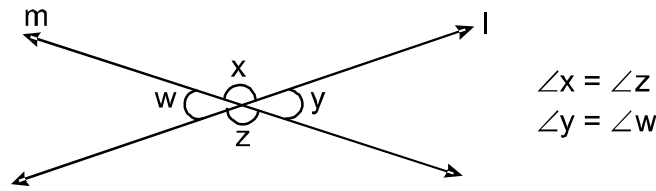
- **Intersecting lines:** Two lines are said to be intersecting when the perpendicular distance between the two lines is not same every where. They intersect at some point.

- **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 intersect. 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) $\left.\begin{array}{l} \angle 1 = \angle 3 \\ \angle 2 = \angle 4 \\ \angle 5 = \angle 7 \\ \angle 6 = \angle 8 \end{array}\right]$ Vertically opposite angle



(b) $\left.\begin{array}{l} \angle 1 = \angle 5 \\ \angle 2 = \angle 6 \\ \angle 3 = \angle 7 \\ \angle 4 = \angle 8 \end{array}\right]$ Corresponding angle

(c) $\left.\begin{array}{l} \angle 3 = \angle 5 \\ \angle 4 = \angle 6 \end{array}\right]$ Alternate Interior angle

(d) $\left.\begin{array}{l} \angle 2 = \angle 8 \\ \angle 1 = \angle 7 \end{array}\right]$ Alternate Exterior angle

(e) $\left.\begin{array}{l} \angle 3 = \angle 6 = 180° \\ \angle 4 = \angle 5 = 180° \end{array}\right]$ Angles on the same sides of a tranversal are supplementary.
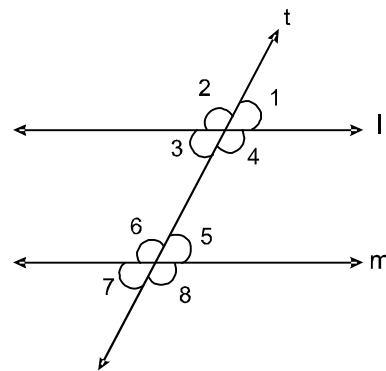
$\angle 3, \angle 6$ and $\angle 4, \angle 5$ are called co-interior angles or allied angles or consecutive interior angles.

- Sum of all interior angles of a triangle is 180°.

- Two lines which are parallel to the third line are also parallel to each other.

**Very-Very Short Answer type**

**Multiple Choice Question (1 Mark)**

1. **If an angle is equal to its complement, then the angle is**

   (a) 90°                                         (b) 0°

   (c) 48°                                         (d) 45°

2. **In the given fig. for what value of $x + y$, $ABC$ will be a staight line?**

   (a) 90°                                         (b) 180°

   (c) 360°                                        (d) 270°
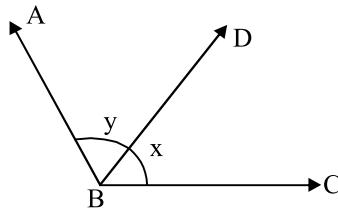


3. **In fig. $\angle AOC$ and $\angle BOC$ form a linear pair. Determine the value of $x$**

   (a) 30°                                         (b) 150°

   (c) 15°                                         (d) 75°
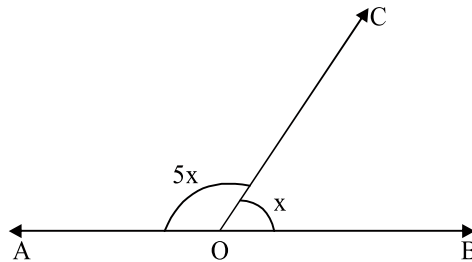


4. **Reflex angle of 110° is**

   (a) 70°                                         (b) 90°

   (c) 250°                                        (d) 190°

5. **One of the angles of a pair of suplementary angle is 10° more than its supplement, the angles are:**

   (a) 90°, 90°                                    (b) 86°, 94°

   (c) 85°, 95°                                    (d) 42.5°, 47.5°

6. **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

7. **Angles $x$ and $y$ forms a linear pair and $x - 2y = 30°$, the value of $y$ is**

   (a) 50°                          (b) 110°

   (c) 210°                        (d) 60°

8. **In the figure, $AB$ is a straight line, then the value of $(a + b)$ is**

   (a) 0°                           (b) 90°

   (c) 180°                        (d) 60°
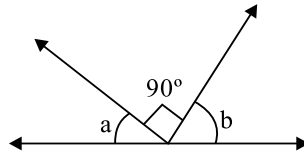


9. **If $\angle AOC = 50°$ then the value of $\angle BOD$ is _____**

   (a) 50°                          (b) 40°

   (c) 130°                        (d) 25°
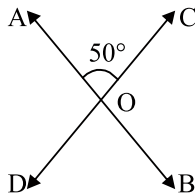


10. **If two parallel lines are intersected by a transversal, then the interior angles on the same side of transversal are**

    (a) equal                      (b) Adjacent

    (c) supplementary        (d) complementary

11. **In figure, $l \parallel m$ value of x is _____**

    (a) 70°                          (b) 35°

    (c) 210°                        (d) 110°
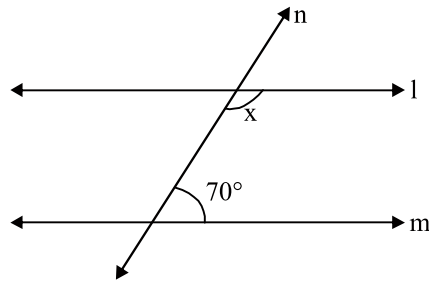
**12.** Three parallel lines intersect at _____ times

    (a) one                           (b) two

    (c) three                        (d) zero

**13.** If one angle of a linear pair is acute, then the other angle will be

    (a) right angle                 (b) obtuse angle

    (c) acute angle                 (d) straight angle

**14.** In the given figure, find the value of $y$

    (a) $18°$                          (b) $9°$

    (c) $30°$                         (d) $36°$
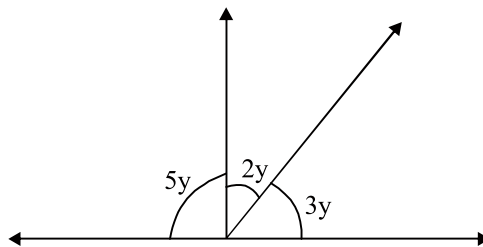


## Fill in the blanks

**15.** A ray has only _____ end point.

**16.** A line segment has a _____ length.

**17.** If two lines are non-intersecting, then they will be _____.

**18.** An angle whose measure is more than $0°$ but less than $90°$, is called an _____ angle.

**19.** A straight angle has _____ right angles.

**20.** An angle whose measure is more than 180° but less than 360° is called _____ angle.

**21.** If an angle is equal to its supplement, then its measure is _____.

**22.** In the given figure, identify group of collinear points from $(P, Q, R)$ and $(A, B, C)$
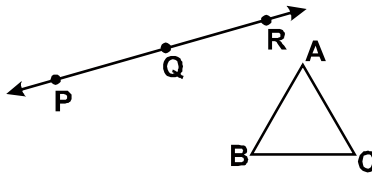


**23.** In the given figure, write the name of line segment whose one end point is B.
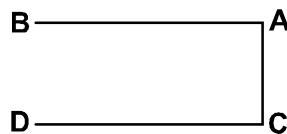


**24.** In the given figure, name the vertex of the angle.
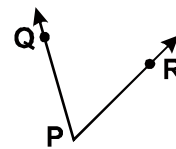


**25.** In the figure given in Q.3, name the two arms of the angle.

**26.** Which type of angle is formed in the given figure
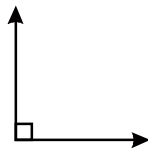


## Very Short Answer type Questions (2 Marks)

**27.** In the given figure $POQ$ is a straight line and $OM$ and $ON$ are two rays. The three adjacent angles so formed are consecutive numbers. Find the value of $x$.
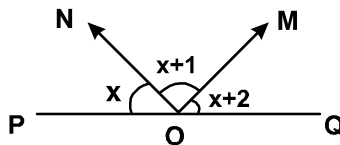


**28.** If $x$ and $y$ are linear pair and twice of $x$ is 30° less than $y$, then find the value of $x$ and $y$.
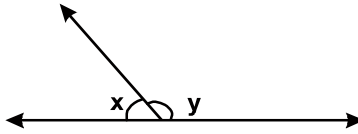
**29.** One of the angles of a pair of supplementary angles is 2° more than its suplement. Find the angles.

**30.** In the given firue *AB* and *CD* are two straight lines intessecting at *O* and *OP* is a ray. what is the meuare of *AOD*? Also find the value of *x*.
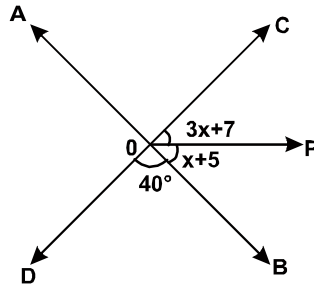


**31.** If the difference between two suplementary angles is 40°, then find smaller angle.

**32.** Find the angle which is four times more than its complement.

**33.** Find the value of *x* in the given figure.
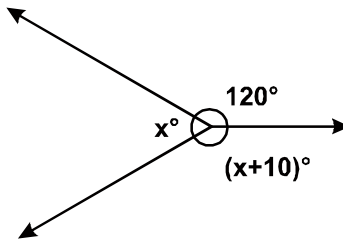


**34.** In the given figure *AB*, *CD* and *EF* are three straight lines intersect *O*. Find the measure of ∠*BOC*.
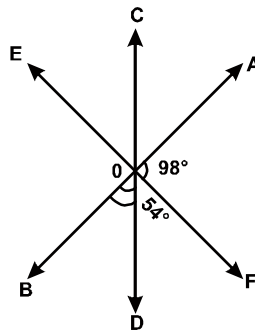
**35.** In the givne figure, $AB \parallel DC$ and $AD \parallel BC$. Prove that $\angle DAB = \angle DCB$.
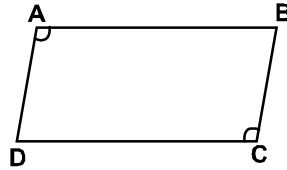


**36.** In the given figure, if $l \parallel m$ then what is the value of $x$.
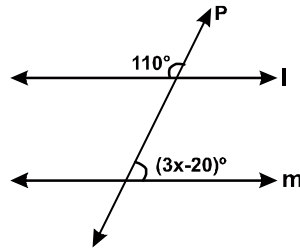


## Short Answer type Questions (3 marks)

**37.** By contributing money, 5 friends bought pizza. They want to divide equally among themselves. But one of them was given double share as he was very hungry. Find the angle of the piece of pizza each received.

**38.** Prove that if two lines intersect then vertically opposite angles are equal.

**39.** In the figure, choose the pair of lines which are parallel. Give reasons also.
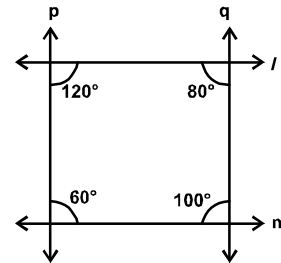


**40.** If one of the angle of two intersecting lines is right angle then prove that other three angles will also be right angles.

**41.** $AB$ and $CD$ are intersecting lines. $OD$ is bisector of $\angle BOY$. Find $x$.
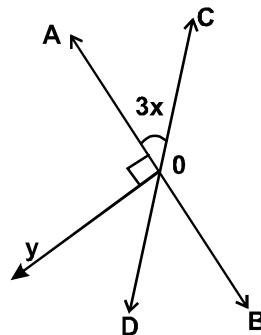
**42.** In the given figure $QP \parallel ML$, find the value of $x$
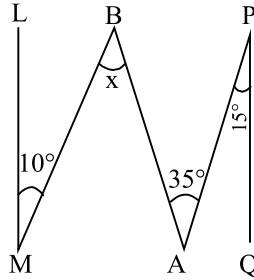


**43.** In the given figure $l \parallel m$ and $n$ is the transversal, find $x$.
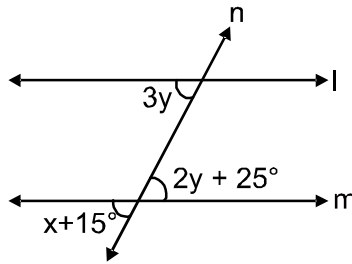


**44.** Two lines are respectively perpendicular to two parallel lines show that they are parallel to each other.

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

**46.** 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.

## Long Answer Questions (5 Marks)

**47.** In the figure, two straight lines $PQ$ and $RS$ intersect each other at point $O$. If $\angle POT = 60°$. Find the value of $a$, $b$ and $c$.
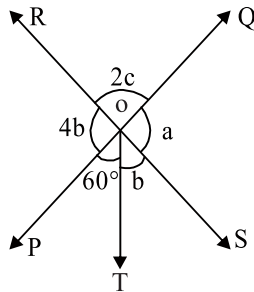
**48.** In figure, lines $m \parallel n$ and angles 1 and 2 are in the ratio 3 : 2. Find all the angles
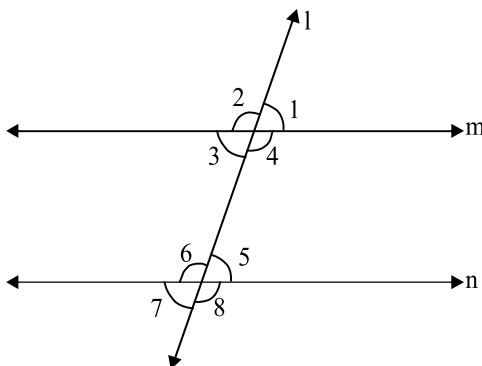


**49.** In figure $l$, $m$ and $n$ are parallel lines intersected by a transversal $p$ at $x$, $y$ and $z$ respectively. Find $\angle 1$, $\angle 2$, $\angle 3$ and $\angle 4$.
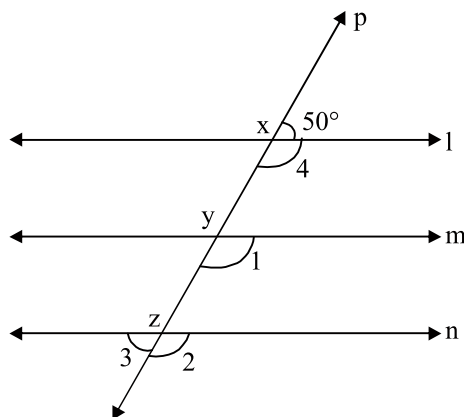


**50.** If the arms of one angle are respectively parallel to the arms of another angle, then show that the two angle are either equal or supplementary.

**51.** In the given figure, $AB \parallel CD$. Prove that $p + q - r = 180°$
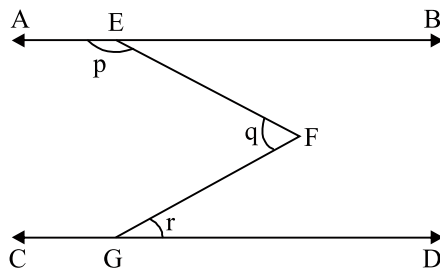
**Answer**

1. (d) 45°
2. (b) 180°
3. (a) 30°
4. (c) 250°
5. (c) 85°, 95°
6. (c) Non-collinear points
7. (a) 50°
8. (b) 90°
9. (a) 50°
10. (c) Supplementary
11. (d) 110°
12. (d) zero
13. (b) obtuse
14. (a) 18°
15. one
16. Definite
17. parallel
18. Acute
19. Two
20. Reflex
21. 90°
22. $P, Q, R$
23. $\overline{BA}$
24. $P$
25. $PQ, PR$
26. Right angle
27. 59°
28. Hint: $y - 2x = 30°$

    $x = 50°, y = 130°$

**29.** 89°, 91°

**30.** Hint: *CD* is straight line

$$\angle AOD = \angle BOC = 4x + 12°$$
$$140°, x = 32°$$

**31.** 70°

**32.** 72°

**33.** 115°

**34.** 152°

**35.** Hint: Use the property that sum of interior angles on the same side of transversal are supplementary

**36.** 30°

**37.** 4 equal pieces = 60°, one double piece = 120°

**39.** Hint: $l \parallel m$ because sum of interior angles on the same side of transversal is 180°.

**40.**
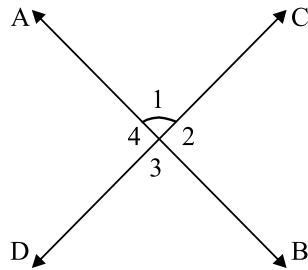


Given:             $\angle 1 = 90°$

To prove:         $\angle 2 = \angle 3 = \angle 4 = 90°$

$$\angle 1 + \angle 2 = 180° \qquad\qquad \text{[Linear Pair]}$$
$$90° + \angle 2 = 180°$$
$$\angle 2 = 90°$$
$$\angle 3 = \angle 1 = 90° \text{ (V.O.A.)}$$
$$\angle 4 = \angle 2 = 90° \text{ (V.O.A.)}$$

**41.** $x = 15°$

**42.**
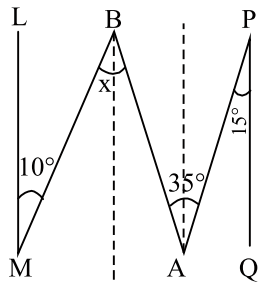


Hint: Draw $BD \parallel LM$ & $AC \parallel LM$ & $LM \parallel PQ$

$\therefore$         $BD \parallel AC \parallel LM \parallel PQ$

$\angle PAC = \angle QPA = 15°$         (Atternate Interior Angles)

$\therefore$         $\angle CAB = 20°$

$\angle CAB = \angle ABD = 20°$         (Atternate Interior Angles)

$\angle LMB = \angle MBD = 10°$         (Atternate Interior Angles)

$\therefore$         $x = \angle MBD + \angle ABD = 10° + 20°$

$x = 30°$

**43.** Hint : $3y = 2y + 25°$ $(AIA)$

$y = 25°$

$x + 15° = 3y$         (corresponding angles)

$x + 15° = 75$

$x = 60°$

**45.**
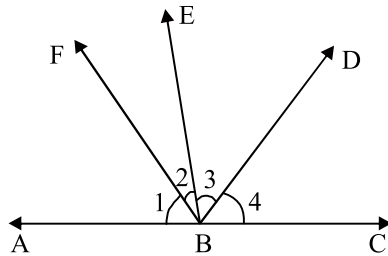


Hint: Given: $\angle ABE$ and $\angle EBC$ make linear pair $BF$ and $BD$ are bisectors of $\angle ABE$ and $\angle EBC$ respectively.

$\therefore$         $\angle 1 = \angle 2$

$\angle 3 = \angle 4$

To prove:         $\angle FBD = 90°$

Proof $\angle ABE + \angle EBC = 180°$ (linear pair)

$\Rightarrow \qquad \angle 1 + \angle 2 + \angle 3 + \angle 4 = 180°$

$$2(\angle 2 + \angle 3) = 180°$$

$$\angle 2 + \angle 3 = 90°$$

$\therefore \qquad\qquad\qquad \angle FBD = 90°$

**46.** Hint: $2x = 3\,(90 - x)$

$x = 54°$

**47.** Hint: $a = 4b$

$$a + b + 60° = 180° \text{ (Linear pair)}$$

$$5b = 120°$$

$$b = 24°$$

$$a = 4 \times 24° = 96°$$

$$60° + b = 2c \text{ (vertically opp. } \angle s)$$

$$60° + 24° = 2c$$

$$c = 42°$$

**48.** $\angle 1 = \angle 5 = \angle 3 = \angle 7 = 108°$

$\angle 2 = \angle 6 = \angle 4 = \angle 8 = 72°$

**49.** $\angle 1 = \angle 2 = \angle 4 = 130°$

$\angle 3 = 50°$

**50.** Hint: $AB \parallel DE$

$BC \parallel EF$
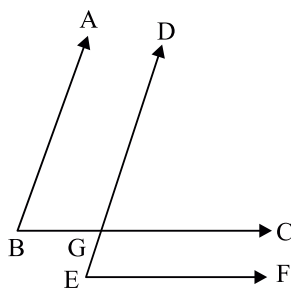


Case-1

$\angle ABC = \angle DGC \text{ (corresponding angles)}$

$\therefore \quad AB \parallel DE$

$\angle DGC = \angle DEF \qquad\qquad\qquad\text{ (corresponding angles)}$

$\therefore \quad BC \parallel EF$

$\angle ABC = \angle DEF$

Case-2
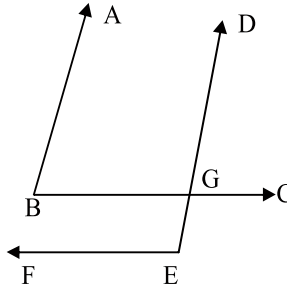


$$\angle ABC + \angle DGB = 180° \qquad \text{(interior angles)}$$
$$\angle DGB = \angle DEF \qquad \text{(corresponding angles)}$$
$$\angle ABC + \angle DEF = 180°$$

# CHAPTER-6
## LINES AND ANGLES
### PRACTICE TEST

**Time: 1 hr**                                                                  **M.M: 20**

1.  If $\angle ABC = 142°$, 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.                                                        (2)
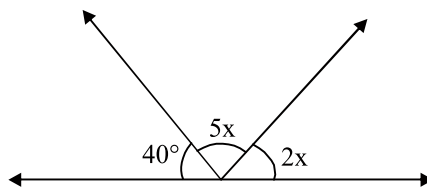


4.  If the difference between two supplementary angles is $40°$ then find the angles.   (2)

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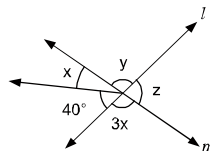


6.  Complementary angles are in ratio 5 : 4 then find the angles.                      (3)

7.  If $l \parallel m$ then find all the angles                                          (4)
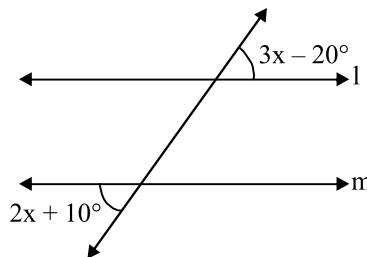


8.  If $AB \parallel CD$, find the value of $x$ and $y$                                  (4)

# Chapter-7
# <u>TRIANGLES</u>

Side – Side
SSS

Right Angle -Hypotenuse side
RHS

Congruency
criteria in triangles

Angle – Side – Angle
ASA
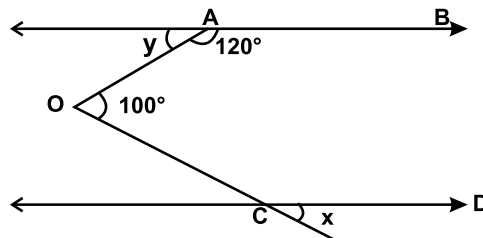
Side – Angle –Side
SAS
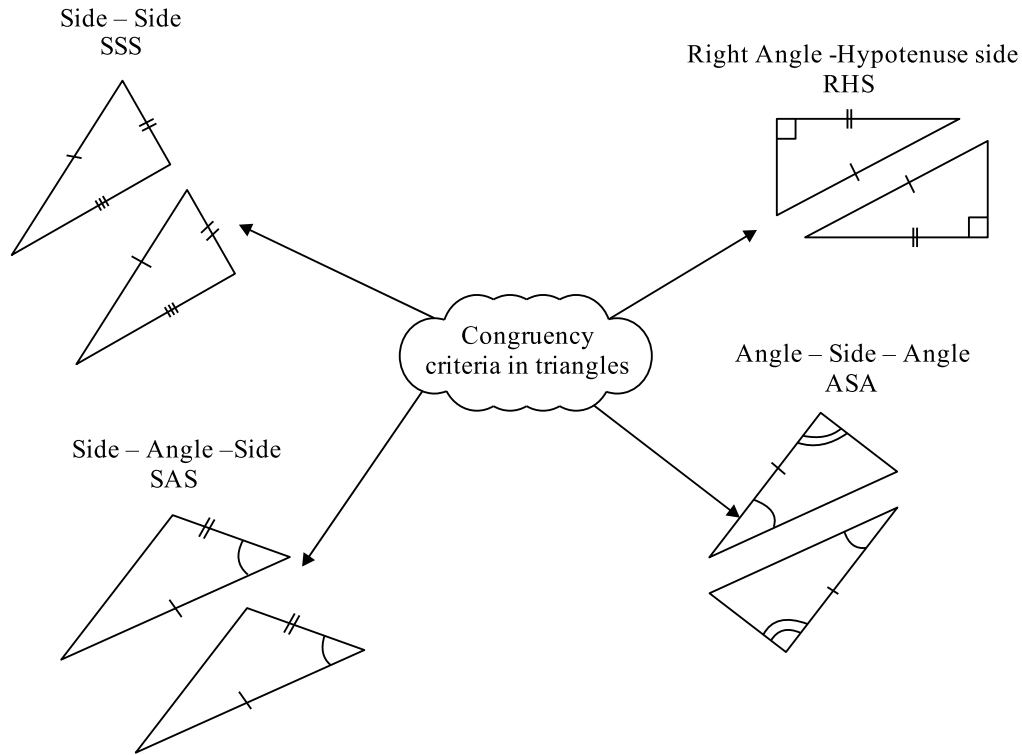
**Key points :**

**Congruence in different shapes :**

• Two figures having the same shape and size are called congruent figures.

• Two plane figurea are congruent, if each one when supermposed on the other, coers 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 condgruent.

• Two squares of the same sides are congruent.

• Two rectangles are congruent, if they have the same length and breadth.

## Congruency Criteria:

- If two triangles $ABC$ and $DEF$ are congruent under the correspondence $A \leftrightarrow D$, $B \leftrightarrow E$ and $C \leftrightarrow F$, then symolically, it is expressed as $\triangle ABC \cong \triangle DEF$.

- There are four congruent condfitions for triangles.

    **(a) Side-Angle-Side (SAS) congruent rule:** Two triangle are congruent, if two sides and the included angle of the one triangles are respectively equal to the two sides and the included angle of the 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 triangle are congruent, if the htypotenuse and one side of one triangle are respecitvely equal to the hypotenuse and one side of another triangle.

**Very-Very Short Answer Question (1 Mark)**

1. **Which of the following is not a criterion for congruency of triangles?**

    (a) SSS                      (b) RHS

    (c) AAA                     (d) SAS

2. **If $AB \cong CD$ then**

    (a) $AB < CD$             (b) $AB + CD = 0$

    (c) $AB = CD$             (d) $AB > CD$

3. **If $\triangle ABC \cong \triangle DEF$ 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) $\triangle ABC \cong \triangle PQR$                  (b) $\triangle CBA \cong \triangle PRQ$

    (c) $\triangle BAC \cong \triangle RPQ$                  (d) $\triangle PQR \cong \triangle BCA$

6. Two figures are congruent if they have the _____ shape and same _____.

7. Two circles ar congruent if they have _____ radii.

8. Two equilateral triangles are congruent. If they have _____ sides.

9. Two square are congruent if they have _____ sides.

10. If $\triangle PQR \cong \triangle LMN$ then $NL$ _____

11. In $\triangle ABC$, $AB = AC$ and $\angle B = 40°$ and $\angle C$.

12. Write correct symbolic form of congruency if $AB = QR$, $BC = PR$ and $CA = PQ$.

13. In the given figure, $AC$ is bisector of $\angle BAD$. $AB = 3$ cm and $AC = 5$ cm. Find $AD$
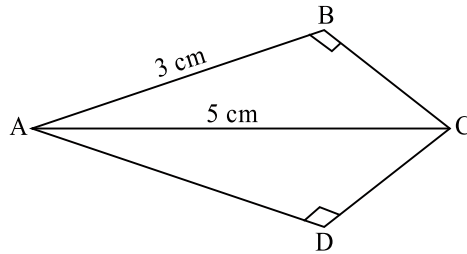


14. Find the diameter of circle $O_2$, if circle $O_2 \cong$ Circle $O_1$ and radius of circle $O_1$ is 6 cm

15. Write the congruence criteria for triangles $\triangle ABC$ and $\triangle PQR$ where $AB = QP$, $\angle B = \angle P$ and $BC = PR$.

16. For right angled triangle $\triangle ABC$, $AB = BC$, find $\angle A$.

17. Write the congruence criteria for the following triangles.
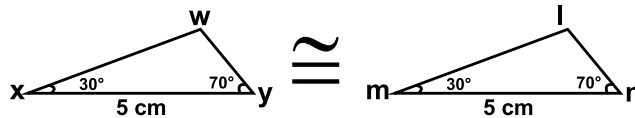


18. Name the side equal to side $NL$ if $\triangle PQR \cong \triangle LMN$.

19. Line segment $MN = 4$ cm and $TP = 4.2$ cm. Are they congruent?

20. What does it mean if two triangles ae congruent by SSS criterion?

21. In $\triangle PQR$, $\angle R = \angle P$, $QR = 4$ cm and $PR = 5$ cm. Find $PQ$.

22. In the given figure if $a = b = c$, then name the angle congruent to $\angle AOC$.
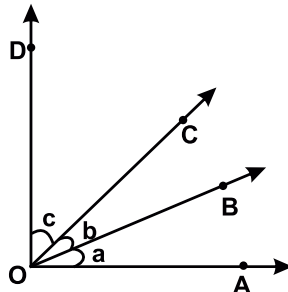


23. What does 'R' stands for in RHS congruence?

24. In $\triangle BCD$ and $\triangle WXY$, $BD = WX$ and $\angle B = \angle X$. what should be the third possibility to satisfy ASA congruency criterion?

25. What is the condition of congruency of two squares?

## Very Short Answer Questions (2 marks)

26. $\triangle ABP \cong \triangle AKST$ then

   (a) $\angle P = $ _____   (b) $KT = $ _____

27. In the folloiwng figure, which of the two triangles are congruent? Name them in symbolic form.
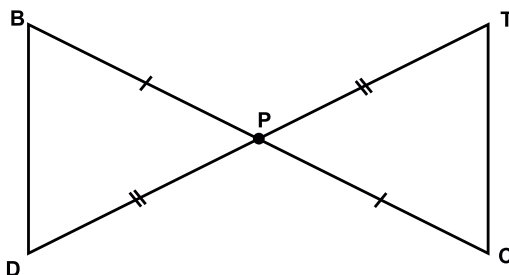


28. Explain why AAA is not a criteria for congruency of two triangles.

29. In the given, if $AB = CD$, $AD = BC$ then prove tht $\triangle ABC \cong \triangle CBA$
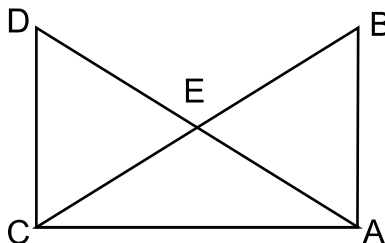
**30.** If $\triangle ABC$ is an isosceles triangle such that $AB = AC$, then prove that altitude $AD$ from $A$ on $BC$ bisects it.

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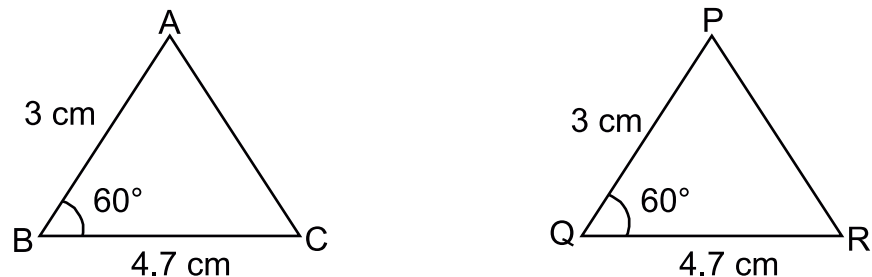


**32.** In a $\triangle PQR$, $\angle P = 110°$, $PQ = PR$. Find $\angle Q$ and $\angle R$.

**33.** In the given figure $AB = AC$ and $\angle ACD = 125°$. Find $\angle A$
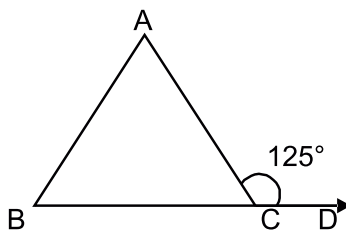


**34.** In the fiven figure, $AC$ bisects $\angle A$ and $\angle C$. If $AD = 5$ cm find $AB$.
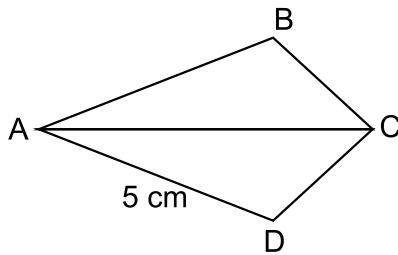


**35.** The vertex angle of an siosceles triangle is 80°. Find the measure of best angles.

## Short Answer Questions (3 Marks)

**36.** $ABC$ 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.

**37.** Prove that angles opposite to the equal sides of an isosceles triangles are equal.

**38.** In the given figure, If $AD = BD = CD$, find $\angle BAC$
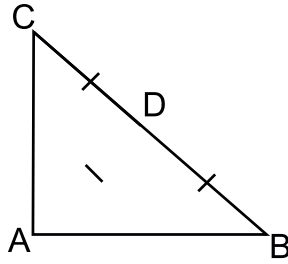


**39.** In the given figure, if $AB = BC$ and $\angle A = \angle C$ then find the value of $x$.
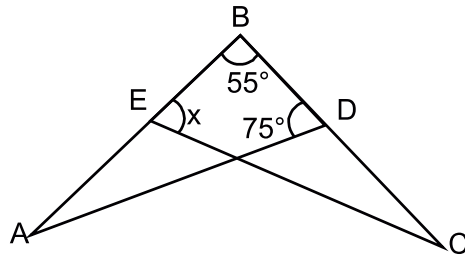


**40.** In the given figure $\angle ABC = \angle BAC$, $D$ and $E$ are points on $BC$ and $AC$ respectively such that $DB = AE$. If $AD$ and $BE$ intersect at $O$ then prove that $OA = OB$.
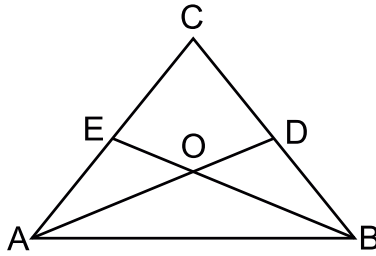


**41.** In the given figure, if $AB = AC$, $\angle BAD = \angle CAE$ then prove that $\triangle ADE$ is an isosceles triangle.
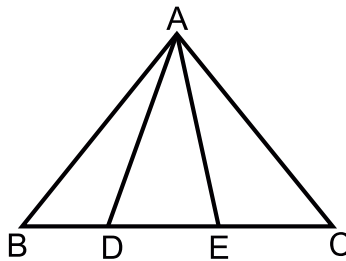
**42.** In $\triangle DEF$, $DM$ is the angle bisector of $\angle EDE$ that intersects $EF$ at $M$. If $DM = MF$, and $\angle E = 2\angle F$ then prove that $\angle EDF = 72°$

**43.** Prove that the angles of an equilateral triangle are 60° each.

## Long Answer Questions (5 Marks)

**44.** The altitudes $AF$, $BD$ and $CE$ of $\triangle ABC$ are equal. Prove that $ABC$ is an equalateral triangle.

**45.** Two sides $AB$, $BC$ and median $AM$ of one $\triangle ABC$ are respectively equal to sides $PQ$, $QR$ and medain $PN$ of $\triangle PQR$. Show that.

(i) $\triangle ABM \cong \triangle PQN$

(ii) $\triangle ABC \cong \triangle PQR$

**46.** In the given figure, $PQR$ is a triangle in which altitudes $QS$ and $RT$ to sides $PR$ and $PQ$ are equal. Show that.

(i) $\triangle PQS \cong \triangle PRT$

(ii) $PQR$ is an isosceles triangle
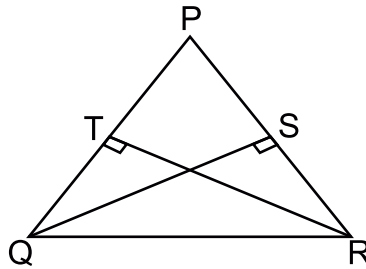


**47.** In the given figure, $AB = AD$, $\angle 1 = \angle 2$ and $\angle 3 = \angle 4$. Prove that $AP = AQ$.
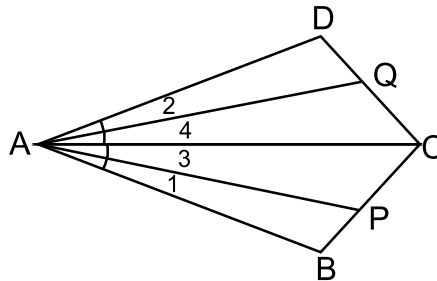


**48.** Vandana wishes to literate the poor children of the nearby slum area.. She makes flash cards for them as shown in the given figure.

(i)            (ii)           (iii)
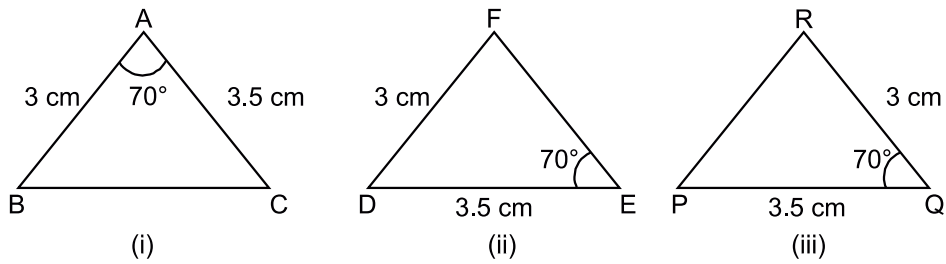
(a)   Which two flash cards are congruent.

(b)   Which criteria of congruency is satisfied here?

(c)   Write the third side of both the triangles which are quality *CPCT*.

49. In the given figure $AB = CD$, $CE = BF$ and $\angle ACE = \angle DBE$. Pove that

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

(ii)   $AE = DF$
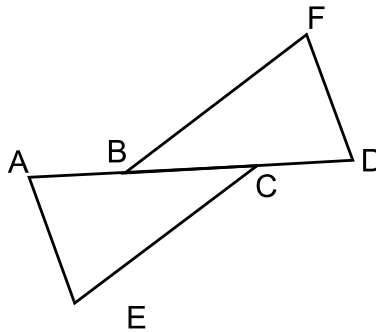


50. Show that the triangles $\triangle ABC$ and $\triangle DEF$ in the given figure are congruent. Hence find the value of $x$.
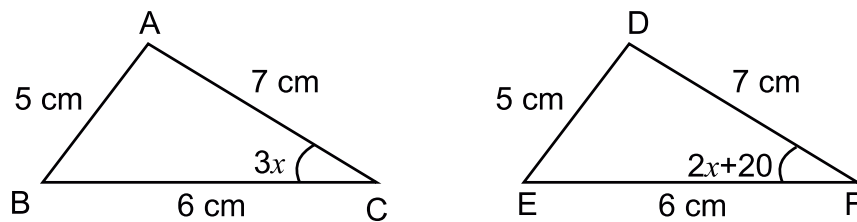
**Answer**

1. (c) AAA

2. (c) $AB = CD$

3. (c) $FE = CB$

4. (d) a right triangle

5. (b) $\triangle CBA \cong \triangle PRQ$

6. same, size

7. equal

8. equal

9. equal

10. $RP$

11. 40°

12. $\triangle ABC \cong \triangle QRP$

13. $AD = 3$cm

14. 12 cm

15. by SAS

16. $\angle A = 45°$

17. ASA

18. $NL = RP$

19. NO

20. It means all the three sides of one triangle are equal to three sides of other triangle.

21. $PQ = 4$ cm

22. $\angle BOD$

23. Right angle

24. $\angle D = \angle W$

25. Sides of squares must be equal

26. (a) $\angle T$           (b) $AP$

27. $\triangle PBD \cong \triangle PCT$ or any correct form

28. Becuase many triangles are possible with given three angles.

**29.** In $\triangle ADC$ and $\triangle CBA$

$AB = CD$ (given)

$AD = BC$ (given)

$AC = AC$ (common)

$\therefore \ \triangle ADC \cong \triangle CBA$ (by SSS congruence rule)

**30.** In $\triangle ABD$ and $\angle ADC$

$AB = AC$ (given)

$AD = AD$ (common)

$\angle ADB = \angle ADC$ (each 90°)

$\therefore \ \triangle ABD \cong \triangle ADB$ (By RHS congruence rule)

$\Rightarrow BD = DC$

**31.** SAS

**32.** $\angle Q = \angle R = 35°$

**33.** $\angle A = 70°$

**34.** $AB = 5$ cm

**35.** 50°, 50°

**36.**
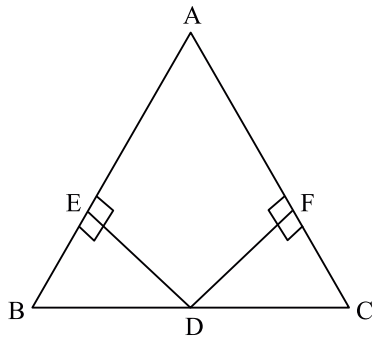


In $\triangle BDE$ and $\triangle BDF$

$BD = CD$ (given)

$DE = DF$ (given)

$\angle 1 = \angle 2$ (each 90°)

By RHS congruence rule

$\triangle BDE \cong \triangle CDF$

$\Rightarrow$ $\angle B = \angle C$ (By *CPCT*)

$\Rightarrow$ $AB = AC$ ($\because$ sides opposite to equaol angles are equal)

**37.**
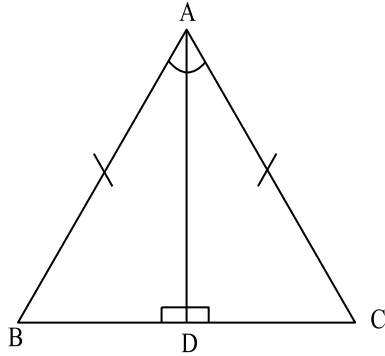


Constructions $AD \perp BC$

In $\triangle ADB$ and $\triangle ADC$

$$AB = AC \qquad \text{(given)}$$
$$AD = AD \qquad \text{(common)}$$
$$\angle ADB = \angle ADC \qquad \text{(each 90°)}$$

$\therefore$ $\triangle ADB \cong \triangle ADC$ (By RHS congruence rule)

$\Rightarrow \angle B = \angle C$ (By *CPCT*)

**38.**
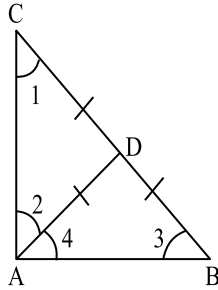


Angles opposite to equal sides are equal

In $\triangle ACD$ $\qquad \angle 1 = \angle 2$ $\qquad\qquad\qquad$ ----(1)

and In $\triangle ABD$ $\qquad \angle 4 = \angle 3$ $\qquad\qquad\qquad$ ----(2)

$$\angle A + \angle B + \angle C = 180° \qquad \text{(angles sum property)}$$
$$\angle 2 + \angle 4 + \angle 3 + \angle 1 = 180° \qquad \text{(using eq}^n \text{ 1, eq}^n \text{ 2)}$$

$$\angle 2 + \angle 4 + \angle 4 + \angle 2 = 180°$$
$$2(\angle 2 + \angle 4) = 180°$$
$$\angle 2 + \angle 4 = \frac{180°}{2} = 90°$$
$$\angle BAC = 90°$$

**39.** $\angle BAD = 180° - (55° + 75°)$ (angle sum property)

$$\angle BAD = 180° - 130° = 50°$$
$$\angle A = \angle C \,(\text{given})$$
$$\therefore \qquad \angle BCE = 50°$$

In $\triangle BCE$ $\qquad x + 55° + 50° = 180°$

$$x = 180° - 105 = 75°$$

**40.**
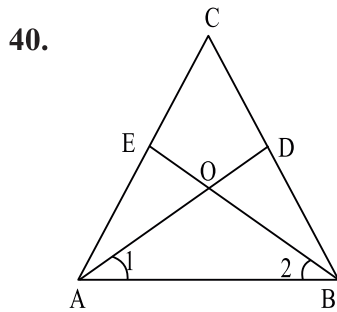


In $\triangle ABE$ and $\triangle ABD$

$$AB = AB, AE = BD$$
$$\angle EAB = \angle DBA$$
$$\therefore \qquad \triangle ABE \cong \triangle ABE \,(\text{By } SAS)$$
$$\Rightarrow \qquad \angle ABE = \angle BAD \,(\text{By } CPCT)$$

In $\angle OAB$

$$\angle 1 = \angle 2 \Rightarrow AO = OB$$

**41.** $AB = AC \Rightarrow \angle B = \angle C$

In $\triangle ABD$ and $\triangle ACE$

$$\angle BAD = \angle CAE, AB = AC, \angle B = \angle C$$
$$\therefore \qquad \triangle ABD \cong \triangle ACE \quad (\text{By } SAS)$$
$$\Rightarrow \qquad AD = AE \qquad (\text{By } CPCT)$$
$$\therefore \quad ADE \text{ is an isosceles triangles}$$

**42.** Hint: $\angle EDM = \angle FDM, \angle FDM = \angle FMD$ using angle sum porperty In$\triangle DEF$

**43.** All sides of an equilateral triangle are equal,$\therefore$ all angles will be equal (angles opposite to equal sides are equal) using equal sum property all angles are of $60°$.

**44.** In $\triangle BDC$ and $\triangle BEC$

$$BD = EC \; BC = BC, \; \angle BEC = \angle BDC \, (90°)$$

$\therefore \qquad\qquad \triangle BDC \cong \triangle BEC$ (By RHS)

$\therefore \qquad\qquad \angle B = \angle C$ similarly $\angle A = \angle B \,\&\, \angle A = \angle C$

$\Rightarrow \qquad\qquad \angle A = \angle B = \angle C$

$\Rightarrow \qquad\qquad AB = BC = AC$

Hence $ABC$ is an equilateral triangle

**45.** Hint: $\triangle ABC \cong \triangle PQN$ (By $SSS$)

$\Rightarrow \qquad\qquad \angle B = \angle Q$ (By $CPCT$)

$\therefore \qquad\qquad \triangle ABC \cong \triangle PQR$ (By $SAS$)

**46.** In $\triangle QTR$ and $\triangle RST$

$$QR = QR, \angle QTR = \angle RST, RT = SQ$$

$\therefore \qquad\qquad \triangle QTR \cong \triangle RST$ (By RHS)

$\therefore \qquad\qquad \angle Q = \angle R$ (By $CPCT$) $\Rightarrow PQ = PR$

In $\triangle PQS$ and $\triangle PTR$

$$RT = SQ, \angle PTR = \angle PSQ, PR = PQ$$

$\therefore \qquad\qquad \triangle PSQ \cong \triangle PTR$ (By RHS)

**47.** $\qquad\qquad\qquad \angle 1 = \angle 2 \qquad\qquad\qquad\qquad\qquad$ eqⁿ...(1)

$\qquad\qquad\qquad \angle 3 = \angle 4 \qquad\qquad\qquad\qquad\qquad$ eqⁿ...(2)

eqⁿ (1) + eqⁿ (2)

$\Rightarrow \qquad\qquad \angle 1 + \angle 3 = \angle 2 + \angle 4$

$\qquad\qquad\qquad \angle CAB = \angle CAD \qquad\qquad\qquad$ --- (3)

$\qquad\qquad\qquad AC = AC \qquad\qquad\qquad\qquad\quad$ --- (4)

$\qquad\qquad\qquad AB = AD \qquad\qquad\qquad\qquad\quad$ --- (5)

using (3), (4), (5)

$$\triangle ADC \cong \triangle ABC \Rightarrow \angle ADC = \angle ABC$$

In $\triangle ADQ \,\&\, \triangle ABP$

$$\angle 1 = \angle 2, AB = AP, \angle ABP = \angle ADQ$$

$$\Rightarrow \qquad\qquad \Delta ADQ \cong \Delta ABP \text{ (By } ASA)$$

$$\therefore \qquad\qquad AP = AQ \text{ (By } CPCT)$$

**48.** (a) $\Delta ABC \cong \Delta QRP$

    (b) $SAS$

    (c) $BC = RP$

**49.** Hint: $AB = CD$

    Adding $BC$ both side and the proving $\Delta ACE \cong \Delta DBF$ (By $SAS$)

**50.** $3x = 2x + 20$

    $3x - 2x = x = 20$

## Chapter-7 Triangles
## Practice Test

**Time: 1 hr.**                                              **M.M. 20**

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

2. The _____ of an isosceles triangle divides it into two congruent triangles.   (1)

3. The vertical angles of an isosceles triangle is thrice the one of its base angle. Find the base angle.   (2)

4. Find if $\triangle ABC$ is possible with $AB = 4.5$cm, $BC = 5$ cm and $AC = 9.5$ cm.   (2)

5. In the given figure, $AB = AC$ and side $BA$ is produced to $D$ such that $AB = AD$. Prove that $\angle BCD = 90°$   (3)
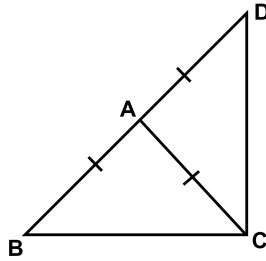


6. Prove that medians of an equilateral triangle are equal.   (3)

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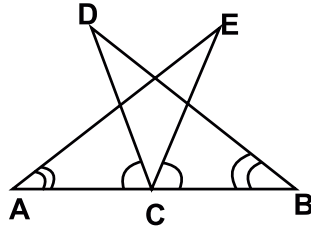


8. In the given figure $ABC$ is a right angled triangle, right angle at $C$. $M$ is the mid-point of hypotenuse is joined to $M$ and produced to a point $D$ such that $DM = CM$. $D$ is joined to $B$. Show that $CM = \dfrac{1}{2} AB$.   (4)
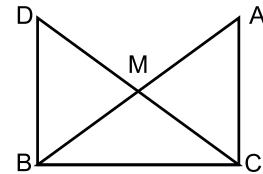
# CHAPTER-8
## QUADRILATERAL

## MIND MAP

**Quadrilateral :** A closed figure in a plane, bounded by four line segments.

**Trapezium :** A quadrilateral with one pair of opposite sides parallel i.e AB||CD.

**Parallelogram:** A quadrilateral with both pairs of opposite sides parallel. So we get AB||CD, AB=CD & AD||BC, AD=BC Also AE=CE, BE=DE, ∠BAD=∠BCD ∠ABC = ∠ADC

**Rectangle :** A parallelogram having one angle 90°. So ∠ABC=∠BCD=∠CDA =∠BAD=90° Also AC=BD

**Square :** A Parallelogram having one angle 90° and one pair of adjacent sides equal. So ∠ABC=∠BCD=∠CDA =∠BAD=90° & AB=BC=CD=AD AC=BD & AC ⊥ BD.

**Rhombus:** A Parallelogram having one pair of adjacent sides equal. So AB=BC=CD=AD Also AC⊥ BD.

## Key points

1. **Quadrilateral:** It is a closed figure bounded by four line segments. In a quadrilateral threre are.
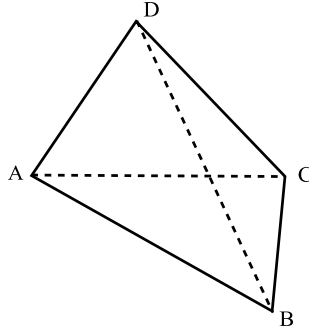


(i) Two pairs of opposite sides (no common point)

e.g. *AB* & *CD*, *BC* & *AD*

(ii) Two pairs of opposite angles $\angle A$ & $\angle C$ and $\angle B$ & $\angle D$.

(iii) Four pairs of adjacent sides *AB* & *BC*, *BC* & *CD*, *CD* & *AD* and *AD* & *AB* (one common Point)

(iv) Four pairs of adjacent angles $\angle A$ & $\angle B$, $\angle B$ & $\angle C$, $\angle C$ & $\angle D$, $\angle D$ & $\angle A$.

(v) Line segment joining opposite vertices is called diagonal of quadrilateral e.g., *AC* & *BD*.

(vi) Sum of the angles of a quadrilateral is $360°$, $\angle A + \angle B + \angle C + \angle D = 360°$.

2. **Parallelogram:** A quadrilateral is a parallelogram if.
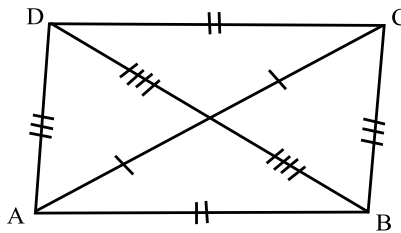


- Both the pairs of opposite sides are equal/parallel or
- Both the pairs of opposite angles are equal or
- Diagonals bisects each other or
- One pair of opposite side is equal and parallel

3. A diagonal of a parallelogram divides it into two congruent triangles. Other examples of parallelogram—



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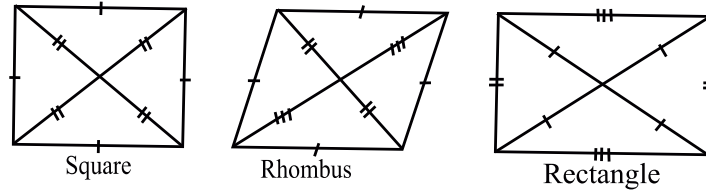
4. Theorem: A line segment joining the mid point of two sides of a triangles is parallel to the third side and is half of it. If $D$ & $E$ are mid points then $DE \parallel BC$ and $DE = \dfrac{1}{2} BC$.
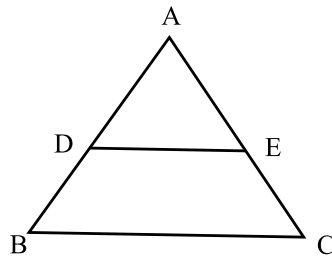


5. Converse of mid point theorem.

The line drawn through the mid point of one side of a triangle, parallel to another side bisects the third side. So, if $D$ is mid point of $AB$ and $DE \parallel BC$ then $E$ will be mid point of $AC$.

## Very-Very Short Answer type Questions (1 Marks)

1. Thre 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 $\angle ACB = 40°$ then $\angle ABD$ is
   (a) 40°                         (b) 45°
   (c) 50°                         (d) 60°

3. The bisectors of the angles of a parallelogram enclose a
   (a) Parallelegram               (b) Square
   (c) Rhombus                     (d) Retangle

4. The figure obtained by joining the midpoint of the sides of a quadrilateral taken in order is a
   (a) Square                      (b) Parallelogram
   (c) Rectangle                   (d) Rhombus

5. The diagnals *AC* and *BD* of a parallelogram *ABCD* intersect each other at point "*O*" If $\angle DAC = 32°$ and $\angle AOB = 70°$ then $\angle DBC$ is equal to:

(a) 24°  (b) 86°

(c) 38°  (d) 32°

6. The angles of quadrilateral are in thea ratio 3 : 4 : 5 : 6 The respective angles of the quadrilateral are

(a) 60°, 80°, 100°, 120°  (b) 120°, 100°, 80°, 60°

(c) 120°, 60°, 80°, 100°  (d) 80°, 120°, 100°, 60°

7. Line segment joining the mid points of two sides of a triangles is parallel to the third side and is _____ 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 Sq. cm, the area of *ABCD* is _____ Sq. cm.



(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 24 cm, the length of the shorter diagonal is _____ cm.

(a) 20  (b) 18

(c) 15  (d) 9

11. Which statements is true about all parallelogram

(a) The diaganals 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.
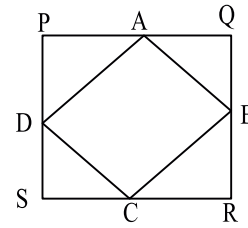
12. In the given figure *ABCD* is a rectangle. If m ∠*ADE* = 30° and m ∠*CFE* = 150°. what will be the m ∠*DEF*?
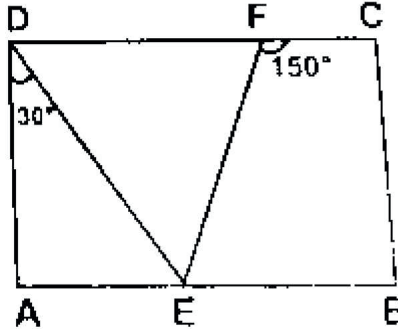


13. Given four points *A, B, C, D* such that three points *A, B* and *C* are collinear. Name the closed figure obtained by joining these point in order.

14. What is the sum of consecutive angles of parallelogram?

15. In parallelogram *ABCD*, bisectors of angles *A* and *B* intersect each other at "*O*". Find the value of angles *AOB*.
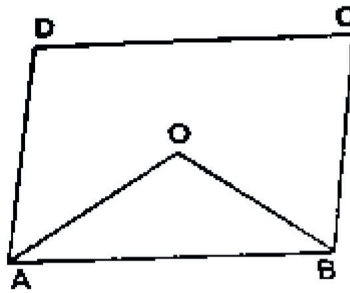


16. If an angle of a parallelogram is two-third of its adjacent angle then find the smallest angle of the parallelogram.

17. In the given figures *PQRS* is a rhombus. Find the value of *x*.
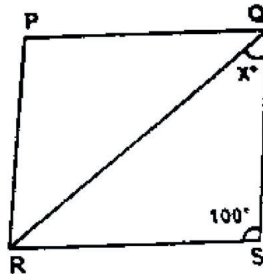


18. Two adjacent angles in a parallelogram are in the ratio 2 : 4. Find the values of these two angles.

**19.** In a rhombus $ABCD$, if $\angle A = 60°$ find $\angle B$, $\angle C$ & $\angle D$.

**20.** The angles of a quadrilateral are in the ratio $1 : 2 : 4 : 5$. Find the meausre of each angle.

**21.** If in a rhombus $LMNP$, $\angle LNM = 40°$ then what si the measure of $\angle LPM$?

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

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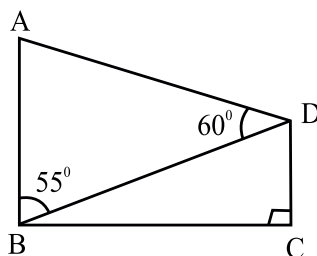


**24.** In the figure, if $D$ & $E$ are respectively the mid point of $AB$ & $AC$, what will be the length of $ED$?
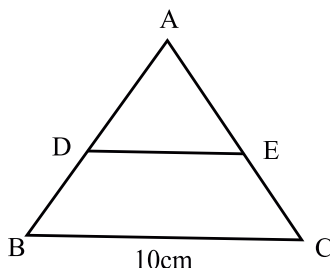


**25.** $PQRS$ is a rhombus with $\angle QPS = 50°$. Find $\angle RQS$.

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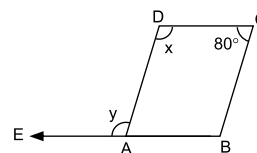


**27.** In the figure line $l \parallel m$ and $p \parallel q$, $\angle BCD = 108°$ find all four angles of quadrilateral $ABCD$.
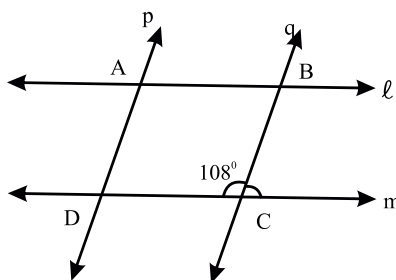
**28.** Which of the followig statements are true (t) and which are false (f)?

    (a) In a parallelogram, the diagonals are equal                           (   )

    (b) If 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 pairs of opposite sides are parallel.       (   )

## Fill in the blanks:

**29.** Opposite angles of a parallelogram are _____.

**30.** Diagonals of a rectangle _____ each otehr and are_____.

**31.** If in a rectangle $ABCD$, diagonal $AC$ bisects $\angle A$ as well as $\angle C$ then $ABCD$ is a _____.

**32.** A quadrilateral is a parallelogram if its both the pairs of opposite sides are _____.

**33.** Diagonals of a rhombus _____ each other and are _____.

**34.** Diagonals of a square are _____, _____ and _____.

## Very Short Answer type Question (2 Marks)

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

**36.** Show that opposite angles of a parallelogram are equal.

**37.** In a parallelogram $ABCD$ $\angle B$=110° determine the measure of $\angle A$ and $\angle D$.

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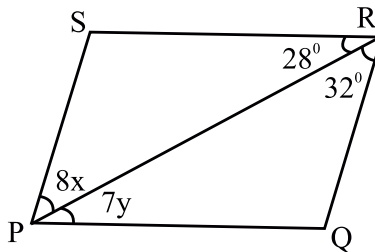


**39.** The diagonals of a parallelogram $ABCD$ interest at $O$. A line through $O$ intersects $AB$ at $X$ & $DC$ at $Y$. Prove that $OX = OY$.

**40.** 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 $BO$.

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

**42.** Diagonals of a quadrilateral $ABCD$ bisect each other if $\angle A = 35°$ determine $\angle B$.

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

**44.** 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 $OD$.

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

**46.** The angles of a quadrilateral are $(x + 20)$, $(x - 20)$. $(2x + 5)$, $(2x - 5)$. Find the value of $x$.
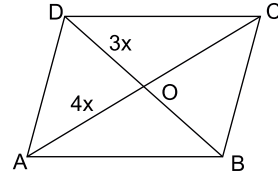
## Short Answer type Questions (3 Marks)

**47.** In the figure $P$ is the mid point of side $BC$ of a parallelogram $ABCD$ such that $\angle BAP = \angle DAP$ prove that $AD = 2CD$.
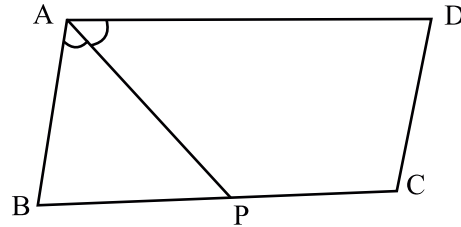
**48.** In the adjoining figure if $PQRS$ is a parallelogram where $\angle PQR = 100°$ and $\angle SPR = 40$. Find $\angle PRQ$ and $\angle SRQ$.
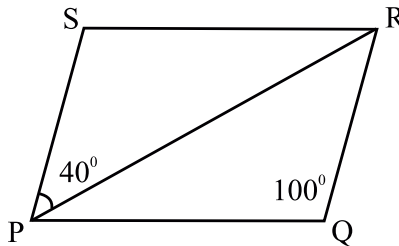
**49.** Prove that the line segment joining the mid points of two sides of a triangle is parallel to the third side.

**50.** In the given figure $L$, $M$ and $N$ are mid point of the sides $PQ$, $PR$ and $QR$ respectively of $\triangle PQR$. If $PQ = 4.4$ cm, $QR = 5.6$ cm and $PR = 4.8$ cm then find the perimeter of $\triangle LMN$.
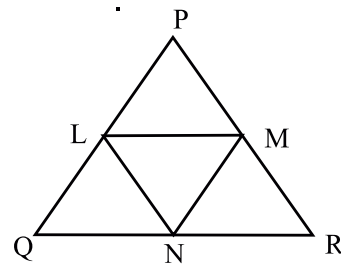
**51.** A quadrilateral is a parallelogram if one pair of opposite sides are equal and parallel. Prove it.

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

**53.** In a parallelograms $PQRS$, $M$ and $N$ are points on $PQ$ and $RS$ such that $PM = RN$. Prove that $MS \parallel NQ$.

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

**55.** The diagonals of a rectangle $ABCD$ meet at $O$. If $\angle BOC = 50°$ then find $\angle ODA$
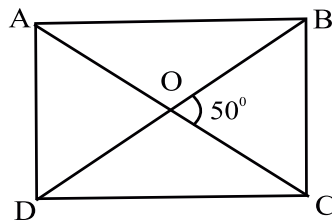


**56.** In the given figure $AD$ and $BE$ are the medians of $\triangle ABC$ and $BE \parallel DF$ prove that $CF = 1/4\ AC$.
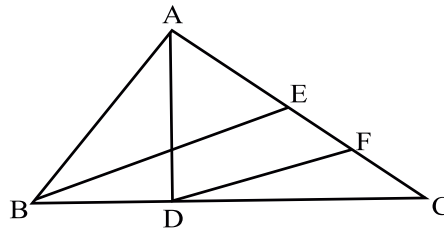


## Long Answer type Questions (5 Marks)

**57.** 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 $PQ = \dfrac{1}{2}\ (LM + ON)$.
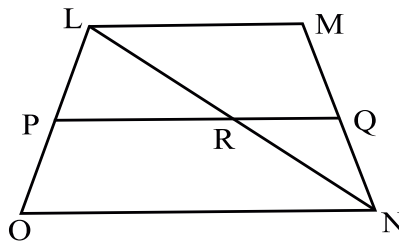
**58.** In the figure, $\triangle ABC$ is right angles at $B$. If $AB =$ 9 cm, $AC = 15$ cm. and $D$ and $E$ are the mid points of $AB$ & $AC$ respectively calculate
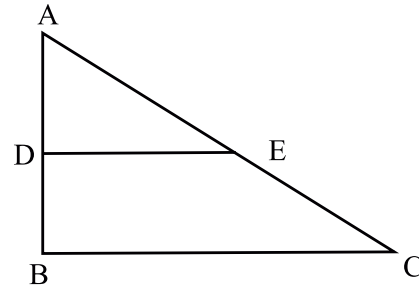
(i) The length of $BC$

(ii) The area of trapezium $BCED$

**59.** 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?
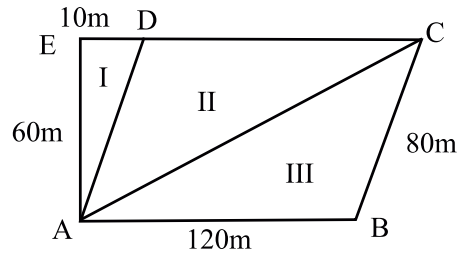
**60.** $ABCD$ is a parallelogram. Side $AB$ is produced on both sides to $E$ & $F$ as in figure such that $BE = BC$ & $AF = AD$. Show that $EC$ & $FD$ when produced meets at right angle.
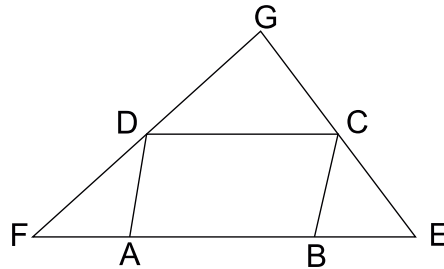
**61.** $P$ is mid point of side $CD$ of a parallelogram $ABCD$. A line through $C$ parallel to $PA$ intersects $AB$ at Q & DA produced at $R$. Prove that $DA = AR$ & $CQ = QR$.
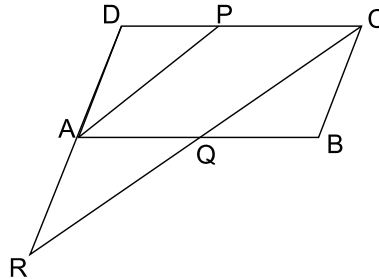
## Answers and Hints

1. (d) $120°$
2. (c) $50°$
3. (d) Rectangle
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. The opposite angles are congruent
12. $90°$
13. A triangle
14. $180°$
15. $90°$
16. $72°$
17. $40°$
18. $60°, 120°$
19. $120°, 60°, 120°$
20. $30°, 60°, 120°, 150°$
21. $100°$
22. Rectangle
23. $115°$
24. 5 cm
25. $65°$
26. $200°$
27. $108°, 72°, 108°, 72°$
28. (a) $F$    (b) $F$   (c) $T$   (d) $F$   (e) $F$   (f) $F$

**29.** Equal

**30.** Bisect, equal

**31.** rhombus

**32.** parallel or equal

**33.** Bisect, Perpendicular to each other

**34.** Equal, bisect each other, perpendicular to each other.

**37.** 70°, 110°

**38.** $x = y = 4$

**39.**
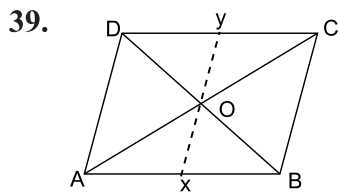


In $\triangle AOX$ & $\triangle COY$

$$OA = OC$$
$$\angle AOX = \angle COY \qquad \text{(vertically opposite)}$$
$$\angle OAX = \angle OCY \qquad \text{(Aleternate interior angles)}$$
$$\triangle AOX \cong \triangle COY \,(ASA)$$
$$OX = OY \,(CPCT)$$

**40.** $OA = \dfrac{1}{2} \, AC$ (Diagonals of a parallelogram bisect each other)

$$= \frac{1}{2} \times 7.4 = 3.7 \text{ cm}$$

Similarly $\qquad OB = \dfrac{1}{2} \, BD = 3.1 \text{ cm.}$

**41.** $5x - 3 = 4x + 12$

$x = 15°$

so angles are $5x - 3 = 5 \times 15 - 3 = 72°$

other angles will be 108°, 72°, 108°

**42.** $145°$

**43.** Let longer side be $a = 9.5$ cm and shorter side be '$b$'

Perimeter $= 2a + 2b = 30$

$$2 \times 9.5 + 2b = 30$$
$$2b = 11$$
$$b = 5.5 \text{cm}$$

**44.** $OC = \dfrac{1}{2} AC = 6.3$ cm

$$OD = \dfrac{1}{2} BD = 4.7 \text{ cm}$$

**45.** In rt $\triangle OAD$

$$AD^2 = (3x)^2 + (4)^2$$
$$AD^2 = 9x^2 + 16x^2$$
$$AD = 5x$$

Perimeter $= 20x$ units

**46.** Hint: Sum of all the angles of a quadrilateral is $360°$

$$x = 60$$

**47.** Hint:
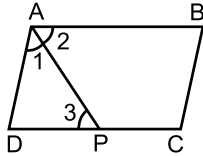


$$\angle 1 = \angle 2$$
$$\angle 2 = \angle 3 \qquad \text{[Alt. int. angles]}$$
$$\angle 1 = \angle 3$$

in $\triangle ABP$

$$\angle 1 = \angle 3$$
$$BP = AB \qquad \text{(why?)}$$

**48.** Consider $PS \parallel RQ$ and $PR$ as transversal then consider $PQ \parallel RS$ and $PR$ as transversal

$$\angle PRQ = 40°, \angle SRQ = 80°$$

**50.** $MN = \dfrac{1}{2} \, PQ = 2.2$ cm

Similarly $LM = 2.8$ cm. $LN = 2.4$ cm

Perimeter $= 7.4$ cm

**52.**
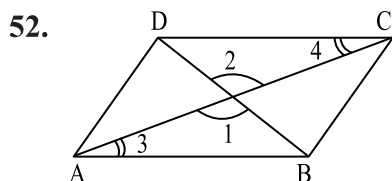


| Proof: | $OA = OC$ | (given) | |
|---|---|---|---|
| | $OB = OD$ | | |
| | $\angle 1 = \angle 2$ (V.O.A) | | |
| $\Rightarrow$ | $\Delta AOB \cong \Delta COD$ (why?) | | |
| $\Rightarrow$ | $AB = CD$ | --- (1) ($CPCD$) | |
| & | $\angle 3 = \angle 4$ | ($CPCD$) | |
| | $AB \parallel CD$ | --- (2) (Why ?) | |

from (1) & (2)

$ABCD$ is a $\parallel$ gm

**53.**
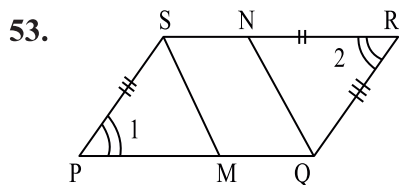


Proof: In $\Delta PMS$ & $\Delta RNQ$

| $PS = QR$ | (opp. sides of a $\parallel$ gm) |
|---|---|
| $PM = RN$ | (given) |
| $\angle 1 = \angle 2$ | (opp angles of a $\parallel$ gm) |
| $\Delta PMS \cong \Delta RNQ$ | |

**54.**
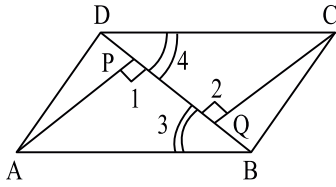


In $\triangle APC$ & $\triangle CQD$

$$\angle 1 = \angle 2 \ \& \ \angle 3 = \angle 4$$
$$AB = CD$$
$$\Rightarrow \qquad \triangle APB = \triangle CQD \quad [\text{By } AAS]$$

**55.**
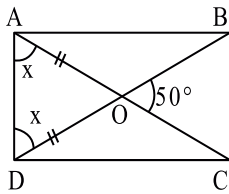


$$\angle BOC = \angle AOD = 50°$$

In $\triangle AOD$

$$x + x + 50 = 180° \qquad [\text{why}]$$
$$2x = 180 - 50$$
$$x = 65° = \angle ODA$$

**56.** Hint-In $\triangle ABC$

$$EC = \frac{1}{2} \ AC \ [\text{BE is median}]$$

In $\triangle BEC$

$$CR = \frac{1}{2} \ EC$$

**58.** 12 cm, 40.5 cm²

**59.** Hint:

(iii) Area of Trapezium $ABCE =$

$$\frac{1}{2} \ (130 + 120) \times 60$$

---

Ans.    (i) 300 m²

(ii) Yes

(iii) 7500m²

**60.** In parallelogram *ABCD*
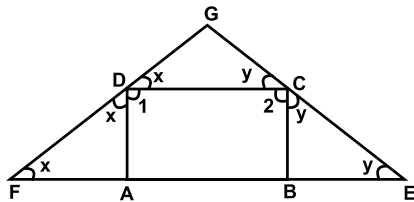


$$\angle 1 + \angle 2 = 180°$$    --- (1)

$$x + x + \angle 1 = 180°$$    [Why?]

$$x = 90 - \frac{1}{2}(\angle 1)$$    --------(2)

similarly    $$y = 90° - \frac{1}{2}(\angle 2)$$    --------(3)

In $\Delta DGC$, $\angle DGC + x + y = 180°$

**61.** *APCQ* is a parallelogram

*Q* is mid point of *AB*

in $\Delta AQR$ & $\Delta BQC$

$$\angle AQR = \angle BQC$$
$$\angle QAR = \angle QBC$$
$$AQ = BQ$$
$$\Delta AQR \cong \Delta BQC$$

## Quadrilaterals

**Time: 1 Hr.**                                                        **M.M. 20**

1.  The angles of Quadrilateral $ABCD$ are in the ratio $2:3:5:8$. Find the measure of smallest angle. (1)

2.  Two opposite angles of a Parallelogram are $(5x-3)°$ and $(4x+12)°$. Find the measure of each angle of the parallelogram. (1)

3.  In a $\triangle PQR$, median $PS$ is produced to a point $T$ such that $PS = ST$. Prove that $PQTR$ is a parallelogram. (2)

4.  In the fig. $PQRS$ is a rhombus in which the diagonal $PR$ is produced to $T$. If $\angle SRT = 152°$, find $x$ & $y$. (2)
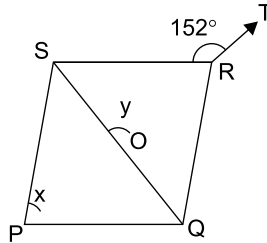


5.  $ABCD$ is a square. A line $BM$ interesects $CD$ at $M$ and the diagonal $AC$ at $O$ such that $\angle AOB = 70°$, find $a$ (3)
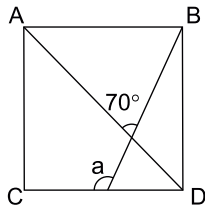


6.  $AD$ is median of $\triangle ABC$ & $E$ is the mid point of $AD$. $BE$ is produced to meet $AC$ in $F$. Prove that $AF = 1/3\ AC$. (3)

7.  Show that the bisectors of angles of a parallelogram form a rentangle. (4)

8.  Show that the quadrilateral formed by joining the mid point of the sides of a square is also a square. (4)

# CIRCLES

## MIND-MAP

**Terms related to Circle**
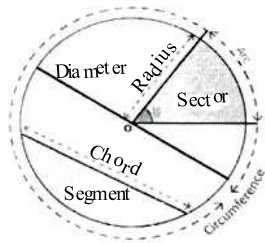


**Sections formed between any two points on circumference**



Minor Arc

P    Q

O

Major Arc
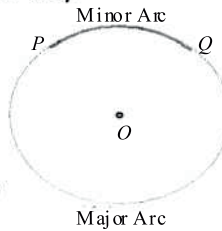
**Sections formed between chord & arc**



Minor Segment

P    Q

O

Major Segment
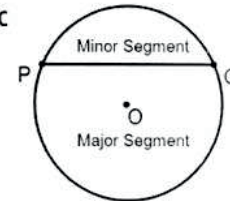
**Sections formed between radii and arc**



Major Sector

O

Minor Sector

A    B
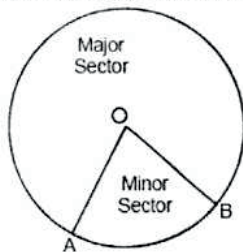
**Cyclic Quadrilateral :** A quadrilateral having its all four vertices on the circumference of a circle



**Some theorems on circle**
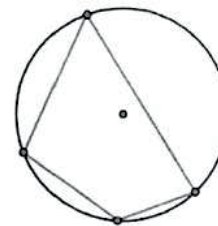
Equal chords of a circle subtends equal angles at the centre of a circle.

The perpendicular from the centre of a circle bisects the chord.

Equal chords of a circle are equidistant from the centre of a circle.

The sum of either pair of opposite angles of a cyclic quadrilateral is $180^0$.

The angle subtended by an arc at the centre is double the angle subtended by it on the remaining part of the circle.

## 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.

**Theorem :** Equal chords of a circle subtends equal angles at centre.

If $AB = CD$ then

$\angle AOB = \angle COD$
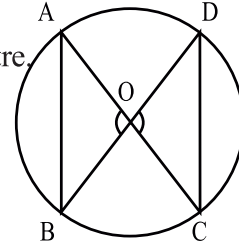


**Converse :** If angles subtended by chord at centre are equal, then chords are equal.

**Theorem :** The perpendicular from centre to a chord of a circle, bisects the chord.

If $OM \perp AB$ then

$AB = BM$
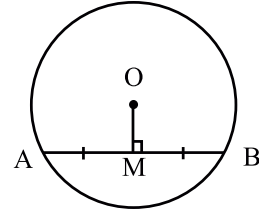


**Converse :** The line joining the mid-point of the chord to the centre of a circle is pendicular to the chord.

**Property :** If two chords of a circle are equal then corresponding arcs are equal.
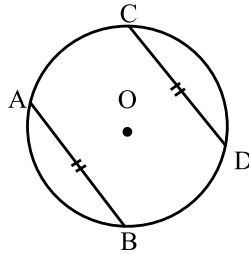


**Converse :** If arcs of a circle are equal then corresponding chords are also equal.

**Theorem :** Equal chords of a circle are equidistant from centre.
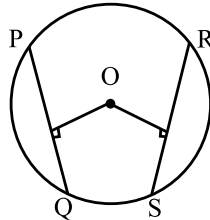


**Converse :** Chords equidistant from centre are equal in length.

**Property :** Congruent arcs or equal arcs of a circle subtend equal angle at the centre.

$\Rightarrow \angle AOB = \angle COD$
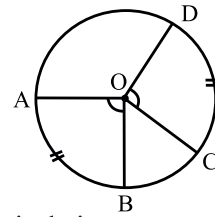
**Theorem :** The angle subtended by an arc at the centre of circle is twice the angle which is subtended at remaining part of the circle.

$\Rightarrow \angle AOB = 2\angle APB$
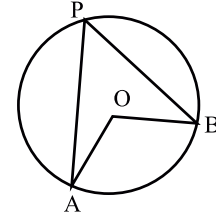
- Any two angles in the same segment of the circle are equal.

$\angle APB = \angle AQB$
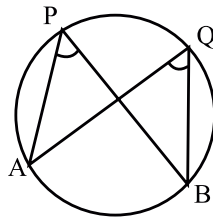
- Angle in a semicircle is a right angle.

$\Rightarrow \angle APB = 90^\circ$
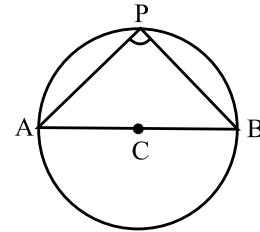
**Theorem :** In a cyclic quadrilateral, the sum of opposite angles is 180°.

$\angle A + \angle C = 180^\circ$

$\angle B + \angle D = 180^\circ$
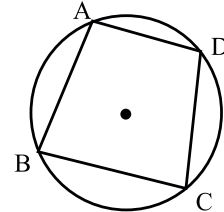
**Converse :** If sum of the opposite angles of a quadrilateral is 180° then the quadrilateral is cyclic.

**Very-Very Short Answers (1 Mark)**

1. Angle in the same segment of a circle are

    (a) Equal

    (b) Complementary

    (c) Supplementary

    (d) Vertically Opposite Angles

2. In fig, if $OA = 5$ cm, $AB = 8$ cm and $OD$ is perpendicular to $AB$. Then $CD$ is equal to:

    (a) 2 cm

    (b) 3 cm

    (c) 4 cm

    (d) 5 cm
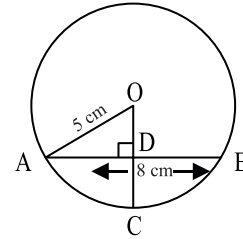


3. The radius of a circle is 13 cm and the length of one of its chords is 10cm. The distance of the chord from the centre is.

    (a) 11.5 cm

    (b) 12 cm

    (c) $\sqrt{69}$ cm

    (d) 23 cm

4. In fig. if $\angle ABC = 20°$, then $\angle AOC$ is equal to

    (a) 20°

    (b) 40°

    (c) 60°

    (d) 10°
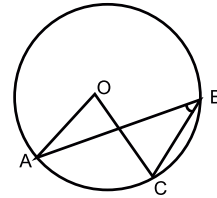


5. $AB$ and $BC$ are chords of a circle such that $AB = 12$ cm, $BC = 16$ cm and $AB$ is perpendicular to $BC$. The radius of the circle passing through the point $A$, $B$ and $C$ is:

    (a) 6 cm

    (b) 8 cm

    (c) 10 cm

    (d) 12 cm

6. 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 $\angle ACD = 25°$, then $\angle AOD$?

    (a) 50°

    (b) 75°

    (c) 90°

    (d) 100°
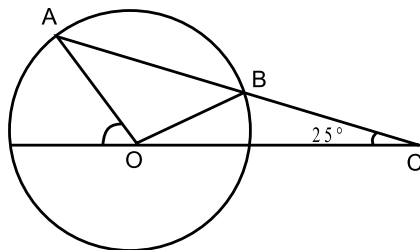
7. For the points $A$, $B$, $C$ and $D$ to be concyclic, $\angle BAD$ and $\angle BAC$ should be equal to:

    (a) 180°                              (b) 90°

    (c) 45°                                (d) 100°

8. $AD$ is a diameter of a circle and $AB$ is a chord. If $AD = 34$ cm, $AB = 30$ cm the distance of $AB$ from the centre of the circle is:

    (a) 17 cm                            (b) 15 cm

    (c) 4 cm                              (d) 8 cm

9. In the given figure; $\angle DAB = 60°$ and $\angle ABD = 50°$ then $\angle ACB = ?$

    (a) 50°                              (b) 60°

    (c) 70°                              (d) 80°
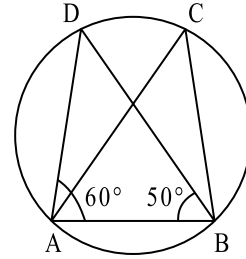
10. In fig. $\angle AOB = 90°$ and $\angle ACD = 30°$, then $\angle CAO$ is equal to:
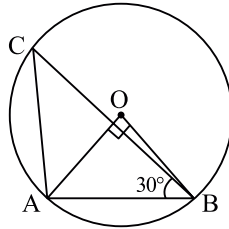
    (a) 30°                              (b) 45°

    (c) 90°                              (d) 60°

11. In the given figure $O$ is the centre of a circle and $\angle BAC = 40°$, then $\angle OBC = ?$

    (a) 40°                              (b) 50°

    (c) 80°                              (d) 20°

12. An equilateral triangle of side 9 cm is inscribed in a cricle. The radius of the circle is:
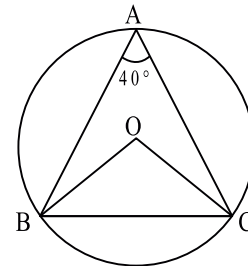
    (a) 3 cm                             (b) $3\sqrt{2}$ cm

    (c) $3\sqrt{3}$ cm                          (d) 6 cm

**13.** In fig. *BC* is a diameter of the circle and $\angle BAO = 60°$, then $\angle ADC$ is equal to:

(a) 30°    (b) 60°

(c) 120°   (d) 45°
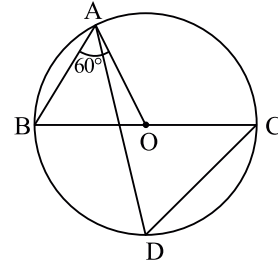
**14.** In the given figure, the measure of $\angle BCD$ is

(a) 80°    (b) 30°

(c) 70°    (d) 100°
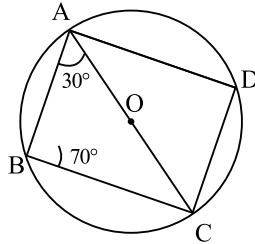
**15.** In the given figure *ABCD* and *ABEF* are cyclic quadrilaterals. If $\angle BCD = 110°$ then $\angle BEF = ?$

(a) 110°   (b) 55°

(c) 90°    (d) 70°
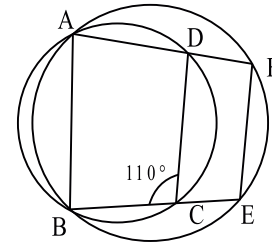
**16.** *ABCD* is a cyclic quadrilateral such that *AB* is a diameter of the circle circumcribing it and $\angle ADC = 140°$, then $\angle BAC$ is equal to:

(a) 80°    (b) 30°

(c) 50°    (d) 40°

**17.** 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

**18.** In the given figures, $\angle ECB = 40°$ and $\angle CEB = 105°$, then $\angle EAD = ?$

(a) 35°

(b) 20°

(c) 50°

(d) 40°
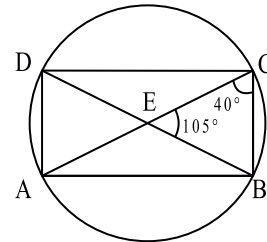
**19.** In the following figure, $BC =$ radius $OB$. Find the value of $\angle OCB$.

    (a)  69°                                    (b) 46°

    (c)  92°                                     (d) 23°
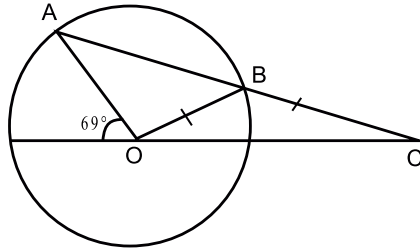
**20.** In the given figure, $AOB$ is the diameter of the circle and $AC = BC$. Find $\angle CAB$.

    (a)  60°

    (b)  46°

    (c)  45°

    (d)  70°
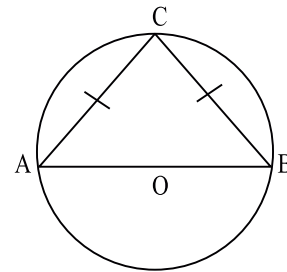
**21.** A segment of a cirlce is the region between an arc and a _____ of the circle.

**22.** An arc of a circle is called a _____ if the ends of the arc lie on the ends of a diameter.

**23.** The degree measure of a semi circle is _____.

**24.** A circle divides the plane into _____ parts.

**25.** The diameter is the _____ chord of the circle.

**26.** Circles having the same centre and different radii are called _____ circle.

**27.** Angle in a semicircle is a _____ angle.

**28.** If two chords of a circle are equal then the corresponding arcs are _____.

**29.** If the sum of a pair of opposite angles of a quadrilateral is 180°, then quadrilateral is _____.

**30.** A round pizza is cut into 4 equal pieces. Each piece represent a _____.

**31.** $AD$ is a diameter of a circle and $AB$ is a chord. If $AD = 34$ cm, $AB = 30$ cm then find $BD$.

**32.** Given two concentric circles with centre $O$. A line cut the circle at $A, B, C$ and $D$ respectivley. If $AB = 10$ cm, then find the length of $CD$.

**33.** Find $y$ in given figure
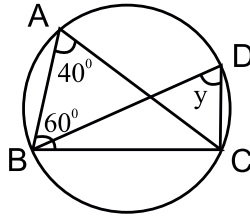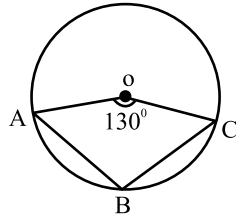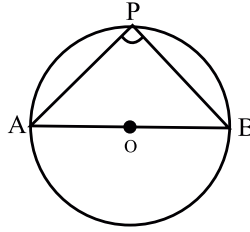


**34.** Find $x$
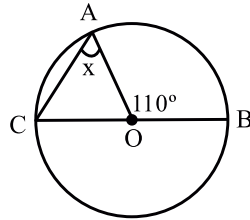


**35.** Find $x$
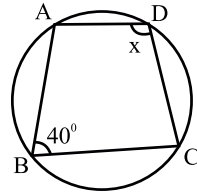


**36.** In given figure $OC$ is perpendicular segment drawn from centre $O$ on chord $AB$. If $OB = 5$ cm and $OC = 3$ cm then find length of $AB$.
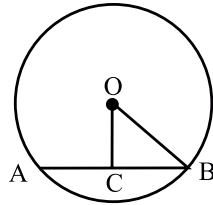


**37.** In given figure $O$ is centre of circle. If $\angle AOC = 130°$ then find $\angle ABC$.
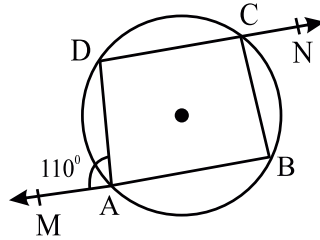
**38.** In given figure $AOB$ is diameter of circle & $P$ is any point on the circle. Find $\angle APB$.



**39.** Prove that the cyclic parallelogram is a rectangle.

**40.** 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 are and also at a point on the major arc.

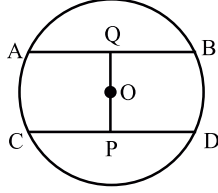**41.** In the following figure, find the value of $\angle BCN$.



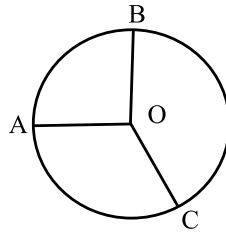**42.** In the given figure, find the value of reflex angle $POR$.
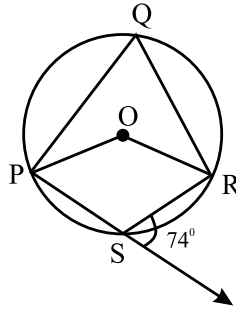


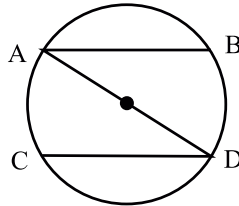**43.** Find the value of $x$ in figure if $O$ is centre of circle and $\angle OAB = 50°$
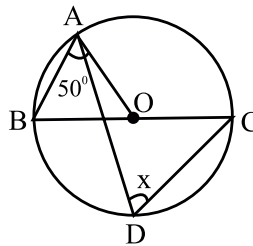
**44.** In the given figure, $O$ is centre of the circle with radius 5 cm, $OP \perp CD$, $OQ \perp AB$, $AB \parallel CD$, $AB = 6$ cm and $CD = 8$ cm. Determine $PQ$.
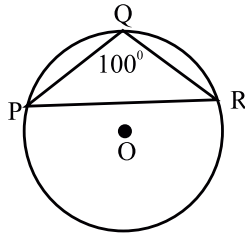


**45.** In the given figure, $O$ is the centre of a circle and $\angle AOB = 90°$, $\angle BOC = 120°$. What is measure of $ABC$?
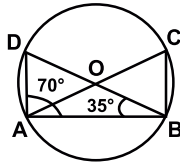


**46.** In the given figure $AB$ and $CD$ are parallel chords and length of arc $AC = 14$ cm. What is length of arc $BD$?
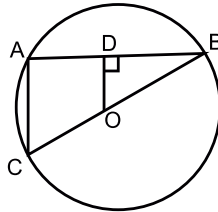


**47.** In given figure $\angle PQR = 100°$ where $P$, $Q$ & $R$ are points on the circle with centre $O$. Find $\angle OPR$.
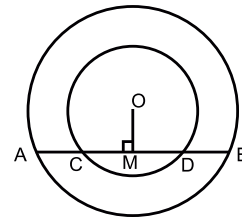
**48.** In the given figure $O$ is centre of circle. If $\angle ABD = 35°$ and $\angle BAD = 70°$, find $\angle ACB$.
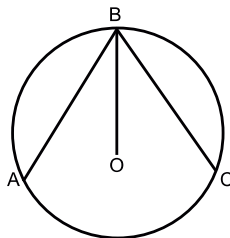


**49.** In fig. $OD$ is perpendicular to the chord $AB$ of a circle whose centre is $O$ and $BC$ is a diameter. Show that $CA = 2\, OD$.
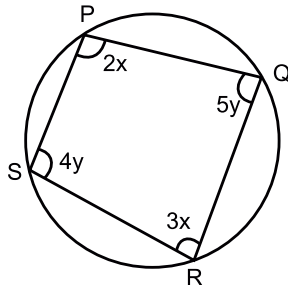


**50.** Two concentric circles with centre $O$ where $AB$ is chord of outer circle which intersects the inner circle at $C$ and $D$ are shown in figure. If $AB = 12$ cm and $CD = 8$ cm, find $AD$.



**51.** In figure, $AB = BC$ and $O$ is the centre of the circle. prove that $BO$ bisects $\angle ABC$.
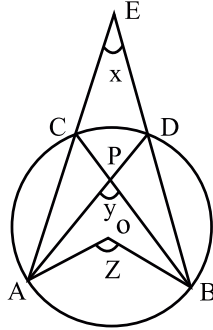


**52.** In figures, $PQRS$ is a cyclic quadrilateral. Find the value of $x$ and $y$.

## Short answer type questions (3 marks)

**53.** In the given figure, $O$ is the centre of a circle. Prove that $\angle x + \angle y = \angle z$.



**54.** If two non parallel sides of a trapezium are equal then prove that it is cyclic quadrilateral.

**55.** In the given figure. determine $a$, $b$ & c if $\angle BCD = 43°$ and $\angle BAF = 62°$.
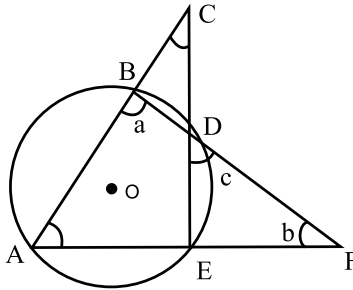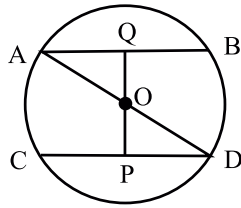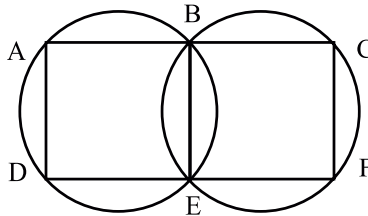


**56.** In the figure, $P$ is the centre of a circle. Prove that $\angle XPZ = 2 (\angle XZY + \angle YXZ)$
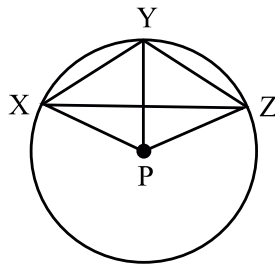


**57.** In the given figure $AD$ is diameter of the circle whose centre is $O$ and $AB \parallel CD$. Prove that $AB = CD$.

**58.** In an equilateral triangle, prove that the centroid and the circum centre coincide.

**59.** In the given figures *A, B, C* and *D, E, F* are two sets of collinear points. Prove that *AD* ‖ *CF*.



**60.** In given figure, *O* is centre of circle and *DAB* = 50°. Calculate the value of *x* and *y*.
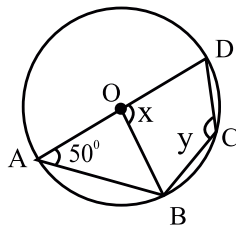


**61.** If two equal chords of a circle intersect within the circle, then prove that the segment of one chord is equal to corresponding segment of other chord.

**62.** Prove that if a pair of opposite angles of a quadrilateral are supplementary, then the quadrilateral is cyclic.

**63.** The bisector of angle *A, B* and *C* of a $\triangle ABC$ intersect its circum circle at *D, E* and *F* respectively. Prove that the angles of a triangle *DEF* are $90° - \dfrac{1}{2} A$, $90° - \dfrac{1}{2} B$, $90° - \dfrac{1}{2} C$ respectively.

**64.** Find the sum of the angles in the four segments exterior to a cyclic quadrilateral.

**65.** Let the vertex *B* of a triangle *ABC* be located outside a circle and let the side of the triangle intercepts equal chords *AD* and *CE* with the circle. Prove that ∠*ABC* is

equal to half the difference of the angle subtended by the chords *AC* and *DE* at the centre.

$$\angle ABC = \frac{1}{2}(\angle DOE - \angle AOC)$$
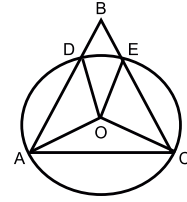


66. In the adjoining figure *AC* is diameter of a circle with centre *O* and chord $BD \perp AC$, intersecting each other at *E*. Find out the values of *p, q, r* in terms of *x* if $\angle AOD = x°$, $\angle BAC = p°$, $\angle ACD = q°$.
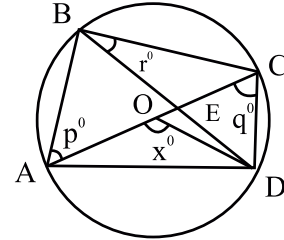


67. In the given figure *OPQR* is a square. A circle drawn with centre *O* cuts the squares in *X* and *Y*. Prove that $QX = QY$.
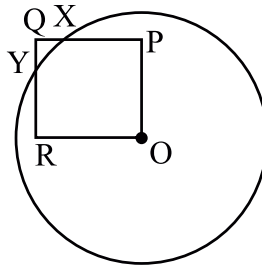


68. Prove that the opposite angles of a cyclic quadrilateral are supplementary.

69. In the given figure, *AB* is a diameter of a circle (*O, r*) and chord *CD* = radius *OC*. *AC* and *BD* when produced meet at *P*. Prove that *APB* is 60°
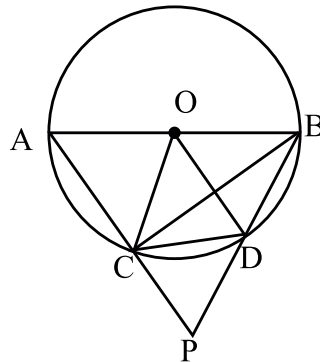
**70.** In the given figure, $AB$ is chord of a circle with centre $O$ and $AB$ is produced to $C$ such that $BC = OB$. Also, $CO$ is joined and produced to meet the circle in $D$. If $\angle ACD = y°$ and $\angle AOD = x°$ then prove that $x = 3y$.
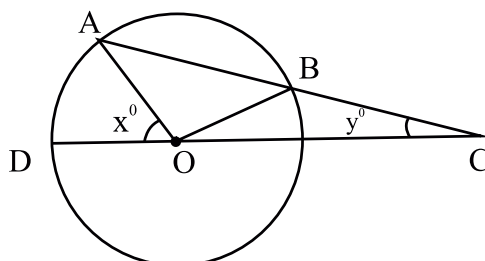


**71.** Two circles whose centres are $O$ and $O'$ intersect at $P$. Through $P$, a line l parallel to $OO'$, intersecting the circle at $C$ and $D$ is drawn. Prove that $CD = 2OO'$.
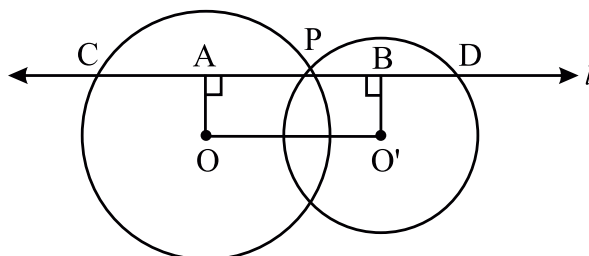


**72.** $AB$ and $CD$ are two parallel chords of a circle which are on opposite sides of the centre $O$ such that $AB = 10$ cm, $CD = 24$ cm and the distance between $AB$ and $CD$ is 17 cm. Find the radius of the circle.
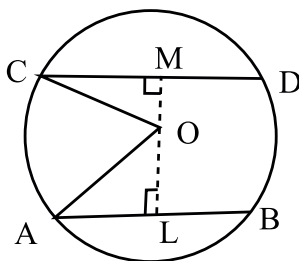


**Long Answer type Questions (4 marks)**

**73.** $AB$ and $AC$ are two chords of a circle of radius $r$ such that $AB = 2AC$. If $p$ and $q$ are the distance of $AB$ and $AC$ from the centre, prove that $4q^2 = p^2 + 3r^2$

**74.** In figure, $O$ is the centre of the circle, $\angle BCO = 30°$, $AE \perp BC$ and $DO \perp AE$. Find $x$ and $y$.
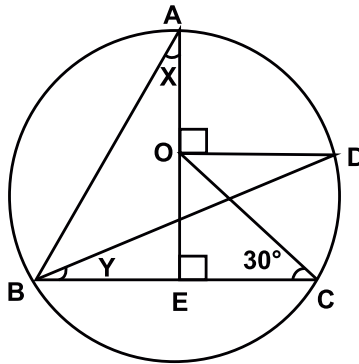
75. In figure, $O$ is the centre of the circle, $BD = OD$ and $CD \perp AB$. Find $\angle CAB$.
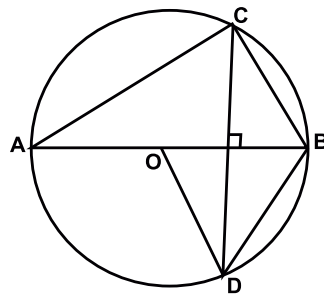


76. Prove that the angle subtended by an arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

77. Show that if two chords of a circle bisect one another they must be diameters.

78. Prove that the quadrilateral formed by angle bisectors of a cylcic quadrilateral is also cyclic.

## Circles Answers

1. (a) equal
2. (a) 2 cm
3. (b) 12 cm
4. (b) 40°
5. (c) 10 cm
6. (b) 75°
7. (b) 90°
8. (d) 8 cm
9. (c) 70°
10. (d) 60°
11. (b) 50°
12. (c) $3\sqrt{3}$ cm
13. (b) 60°
14. (a) 80°
15. (a) 110°
16. (c) 50°
17. (b) 10 cm
18. (a) 35°
19. (d) 23°
20. (c) 45°
21. chord
22. semi-circle
23. 90°
24. three
25. longest
26. concentric
27. right
28. equal

29. cyclic
30. sector
31. 16 cm
32. $CD = 10$ cm
33. $y = 40°$
34. 35°
35. 140°
36. $AB = 8$ cm
37. $\angle ABC = 115°$
38. $\angle APB = 90°$
40. Angle by minor arc $= 30°$
    angle by major arc $= 150°$
41. $\angle DAM + \angle DAB = 180°$
    $\angle DAB = 70°$
    $\angle DAB + \angle DCB = 180°$
    $\angle DCB = 110°$
    $\angle BCN + \angle DCB = 180°$
    $\angle BCN = 70°$
42. $\angle PSR + \angle RST = 180°$
    $\angle PSR = 106°$
    reflex$\angle POR = 2\angle PSR = 212°$
43. $\angle AOB = 80°$
    $\angle AOB + \angle AOC = 180°$
    $\angle AOC = 100°$
    $\angle ADC = \dfrac{1}{2} \angle AOC$
44. $AQ = \dfrac{1}{2} AB$
    $AQ = 3$ cm
    $(OA)^2 = (AQ)^2 + (OQ)^2$

$OQ = 4$ cm

sim $OP = 3$ cm

$PQ = 7$ cm

**45.** $\angle AOB + \angle BOC + \angle AOC = 360°$

$\angle AOC = 150°$

$\angle ABC = \dfrac{1}{2} \angle AOC = 75°$

**46.** $BD = 14$ cm

**47.** $\angle OPR = 10°$

**48.** $\angle ABD + 70° + 35° = 180°$

$\angle ADB = 75°$

$ACB = ADB = 75°$

**49.** $OD \parallel AC$

$OD = \dfrac{1}{2} CA$

$CA = 2\,OD$

**50.** $AM = 6$ cm

$MD = 4$ cm

$AD = (6 + 4)$ cm $= 10$ cm

**51.** $\Delta's\ AOB \cong \Delta COB$ (by SSS)

$\Rightarrow \angle OBA = \angle OBC$

$\Rightarrow BO,$ bisects $\angle ABC$

**52.** $2x + 3x = 180° \Rightarrow x = 36°$

$4y + 5y = 180°$

$y = 20°$

**53.** $\angle ACB = \angle ADB$

$\angle z = 2\angle ACB$

$\angle z = \angle ACB + \angle ADB$

$\angle y = \angle ACB + \angle CAD$

$\angle z = \angle y - \angle DAC + \angle ADB$

$\angle ADB - \angle DAC = \angle x$

$\angle x + \angle y = \angle z$

**55.** $a = 105°, b = 13°, c = 62°$

**56.** $\angle XPY = 2\angle XZY$

$\angle YPZ = 2\angle YXZ$

$\angle XPZ = 2\,(\angle XZY + \angle YXZ)$

**57.** $\Delta AOQ \cong \Delta POD$

$\Rightarrow OQ = OP$ by $CPCT$

$\Rightarrow AB = CD$

**58.** $\Delta BEC \cong \Delta BFC$

$\Rightarrow BE = CF$

sim $\Delta CAF \cong \Delta CAD$

$CF = AD$

$AD = BE = CF$
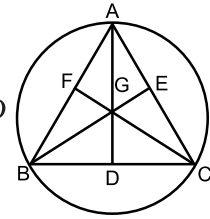


$\dfrac{2}{3} AD = \dfrac{2}{3} BE = \dfrac{2}{3} CF$

$GA = GB = GC$

Hence centroid and circumcentre are coincident

**59.** $\angle DAB + \angle BED = 180°$

$\angle BED = \angle BCF$

$\angle DAB + \angle BCF = 180°$

Hence $AD \parallel CF$

**60.** $\angle AOB = 80°$

$x = 100°$

$y = 130°$

**64.**



$\angle 1 + \angle P = 180°$

$\angle 2 + \angle Q = 180°$

$\angle 3 + \angle R = 180°$

$\angle 1 + \angle P + \angle 2 + \angle Q + \angle 3 + \angle R = 3 \times 180°$

$\Rightarrow \angle P + \angle Q + \angle R + \angle S = 6 \times 90°$

**66.** $P = 90°$

$q = 1/2x$

$r = 90° - 1/2x$

**67.** $QR = QP$

$\Delta ORY \cong \Delta OPX$

$\therefore \quad RY = PX$

$\Rightarrow QR - RY = QP - PX$

$\Rightarrow QY = QX$
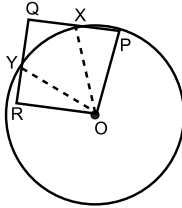
**70.** $\angle BOC = y$

$\angle ABO = 2y, \angle OAB = 2y$

$(2y) + (2y) + (180 - x - y) = 180°$

$x = 3y$

**71.** $CA = AP$

$\Rightarrow CP = 2AP$

$BP = BD$

$\Rightarrow PD = 2\,PB$

$CD = 2\,AP + 2\,PB$

$CD = 2OO'$

**72.** $OA^2 = OL^2 + AL^2$

$r^2 = x^2 + 5^2 \qquad \text{---(1)}$

$OC^2 = OM^2 + CM^2$

$r^2 = (17 - x)^2 + (12)^2 \qquad \text{---(2)}$

from 1 & 2

$34x = 408$

$x = 12$ cm

$\therefore \ r = 13$ cm

(where $OL = x$, $OM = 17 - x$)

**73.**
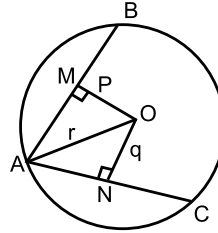


$\left(\dfrac{AB}{2}\right)^2 = r^2 - P^2$

$\quad AB^2 = 4r^2 - 4P^2$

Sim. $AC^2 = 4r^2 - 4q^2$

As $\quad AB = 2AC^2$

$\Rightarrow \quad AB^2 = 4AC^2$

$\quad 4r^2 - 4p^2 = 4\,(4r^2 - 4q^2)^2$

$\quad 4q^2 = p^2 + 3r^2$

**74.** $\angle EOC = 180° - 30° - 90° = 60°$

$\angle COD = 180° - 60° - 90° = 30°$

$2y = 30° \quad \Rightarrow \quad y = 15°$

$\angle ABD = \dfrac{1}{2} \times 90° = 45°$

$\angle ABC = 60°$

In $\Delta ABE$,

$60° + x + 90° = 180°$

$x = 30°$

$x = 30°.\ y = 15°$

**75.** Since $OB = OD = BD$

$\therefore \ \angle BOD = 60° \Rightarrow \angle AOD = 120°$

Now $\angle ACD = 60° \Rightarrow \angle CBA = 60°$

Hence $CAB = 30°$

(Angle sum property)

## Circles

**Time : 1 hr.**                                                      **M.M. 20**

1. In fig, $\angle DAB = 60°$ and $\angle ABD = 50°$. Find $\angle ACB$.                    (1)
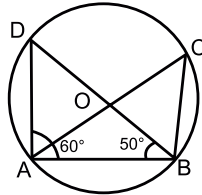


2. A circle passes through $A$, $B$, $C$ and $D$ as shown in figure. If $\angle BAD = 93°$ find $x$.                    (1)
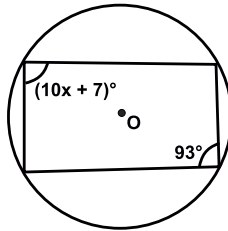


3. The chord of a circle is equal to its radius. Find the angle subtended by this chord at the minor arc of the circle.                    (2)

4. Prove that equal chords of a circle subtend equal angles at the centre.                    (2)

5. Prove that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°.                    (3)

6. In the given figure, find x where O is the centre of the circle.                    (3)
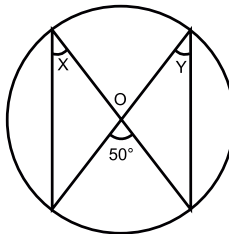


7. Prove that the angle subtended by an arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.                    (4)

**8.** In figure, $AB$ is a chord of a circle with centre $O$ and $AB$ is produced to $C$. Also, $CO$ is joined and produced to meet the circle in $D$. If $\angle ACD = y°$, $\angle AOD = x°$ and $x = 3y$, then prove that $BC = OB$. (4)
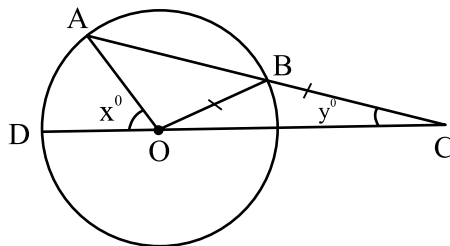
# HERON'S FORMULA

**Mind Map**
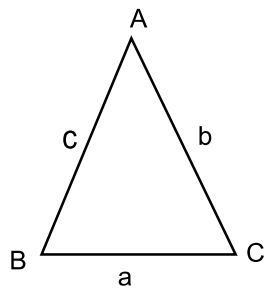
Heron's Formula

Semi-Perimeter $= \dfrac{a+b+c}{2} = S$

Area of Triangle $= \sqrt{S(S-a)\,(S-b)\,(S-c)}$

Perimeter and Area of Triangles

**(a) Right angle Triangle**
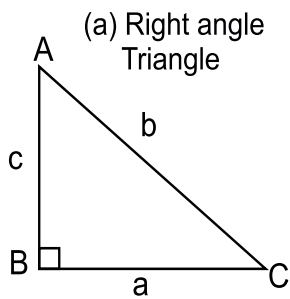
$b^2 = a^2 + c^2$

(Pythagorus Theorem)

Perimeter $= a+b+c$

Area $= \frac{1}{2} \times a \times c$

$= \frac{1}{2} \times$ base $\times$ height

**(b) Isosceles Right Triangle**
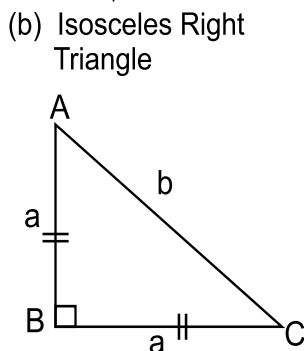
$b^2 = 2a^2$

(Pythagorus Theorem)

Perimeter $= 2a + b$

Area $= \frac{1}{2} a^2$

**(c) Equilateral Triangle**
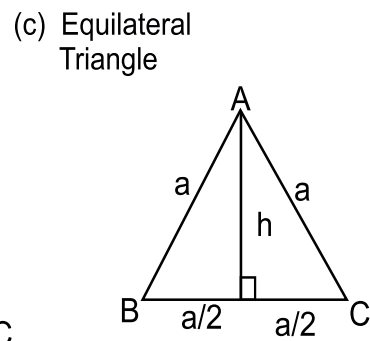
Perimeter $= 3a$

Height $= \dfrac{\sqrt{3}}{2} a$

Area $= \frac{1}{2} \times a \times h$

$= \frac{1}{2}$ ax $\frac{\sqrt{3}}{2} a$

$= \frac{\sqrt{3}}{4} a^2$

**Keys points**

- Triangle

   (a)  Equilateral Triangle: In this triangle all three sides are equal. If the length of each side is 'a' then

   (i)   Perimeter $= 3a$ units

   (ii)  Altitude $= \dfrac{\sqrt{3}}{2}a$ units

   (iii) Area $= \dfrac{\sqrt{3}}{4}a^2$ or $\dfrac{\sqrt{3}}{4}$ (side)$^2$ sq. units
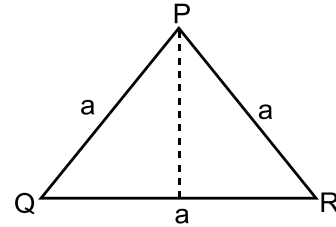
   (b)  Right Angled Triangle: If one of the angles of a triangle is 90°.

   (i)   Hypotenuse $k = \sqrt{b^2 + h^2}$ units

   (ii)  Perimeter $= (b + h + k)$ units

   (iii) Area $= 1/2 \times b \times h$ sq. units

   Area of triangle (General Formula)

   $= \dfrac{1}{2} \times$ base $\times$ Corresponding Altitude

   $= \dfrac{1}{2} \times b \times h$ sq. units
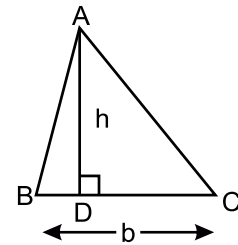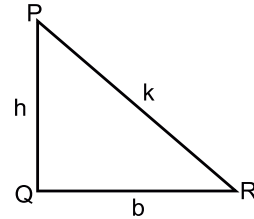
**Heron's Formula**

- If in $\Delta ABC$, sides BC, AC and AB are respectively equals to a, b and c units.

   (i)   Perimeter $= (a + b + c)$ units

   (ii)  Semi Perimeter (S) $= \dfrac{a + b + c}{2}$ units

   (iii) Area of Triangle $(\Delta ABC) = \sqrt{s\,(s-a)\,(s-b)\,(s-c)}$ sq. units
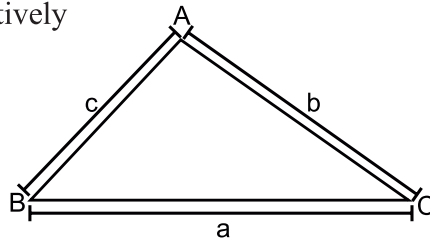
   Note: Heron's formula is applicable to all types of triangles.

**Very-Very Short Answer type Questions (1 mark)**

1. The altitude of an equilateral triangle is 9 cm then the area of triangle is

   (a) $18\sqrt{3}$ cm$^2$                   (b) $24\sqrt{3}$ cm$^2$

   (c) $25\sqrt{3}$ cm$^2$                   (d) $27\sqrt{3}$ cm$^2$

2. The sides of a triangle are 3 cm, 4 cm and 5 cm. The area of triangle will be.

   (a) 6 cm$^2$                            (b) 8 cm$^2$

   (c) 5 cm$^2$                            (d) 6 cm$^2$

3. An isosceles right triangle has area 8 cm$^2$. The length of the hypotenuse is

   (a) $\sqrt{24}$ cm                      (b) $\sqrt{32}$ cm

   (c) $\sqrt{48}$ cm                      (d) $\sqrt{16}$ cm

4. The area of an equilateral triangle is $36\sqrt{3}$ cm$^2$ then length of each side of triangle will be

   (a) 144 cm                             (b) 60 cm

   (c) 36 cm                              (d) None of these

5. The base of a triangular field is three times its height. If area of field is 13.5 hectares then its base is

   (a) 900 m                              (b) 600 m

   (c) 1200 m                             (d) None of these

6. The perimeter of an isosceles triangle is 32 cm. The ratio of equal sides to the base is 3 : 2. The sides of triangle will be

   (a) 8 cm, 8 cm, 12 cm                  (b) 8 cm, 8 cm, 8 cm

   (c) 8 cm, 12 cm, 12cm                  (d) 12 cm, 12 cm, 12 cm

7. The height corresponding to the longest side of the triangle whose sides are 42 cm, 34 cm and 20 cm in length is

   (a) 15 cm                              (b) 36 cm

   (c) 16 cm                              (d) 23 cm

8. For an isosceles triangle having base b and each of equal side a, its perimeter will be _____.

9. Two sides of a triangle are 8 cm and 11 cm and perimeter of it is 32 cm. The length of third side will be _____.

10. The formula used to find the area of scalence triangle is called _____.

11. The sides of a triangle are in ratio 2 : 1 : 3 and its perimeter is 24 cm. The length of the longest side of triangle will be _____.

12. The perimeter of an equilateral triangle is 60 cm. Its area will be _____.

13. Find the area of a triangle whose base and altitude are 6 cm and 3 cm respectively.

14. The area of a triangle of base 35 cm is 420 sq. cm. Find its altitude.

15. Find the area of a triangle whose base is 15 cm long and the corresponding height is 9.8 cm.

16. Find the area of an equilateral triangle with side $2\sqrt{3}$ cm.

17. Find the area of an equilateral triangle of side 'a' units.

18. Find the area of an isosceles triangle each of whose equal sides is 13 cm and base is 24 cm.

19. The height of an equilateral triangle is 6 cm. Find its side.

20. Find the semi-perimeter of an equialteral triangle of side 2a units.

## Very Short Answer type Question (2 Marks)

21. Find the area of an equilateral triangle whose sides are 4 cm each.

22. If sum of two sides of a triangle is 17 cm and its perimeter is 30 cm, then what is the length of third side?

23. If each side of a triangle is double then how many times the perimeter of triangle increased?

24. If area of a triangle is 50 cm² and one of its sides is 10 cm then find the length of corresponding altitude.

25. The sides of a triangle are 11 cm, 60 cm and 61 cm. Find the altitude to the smallest side.

26. The ratio between the side of a triangle are 3 : 5 : 7 and its perimeter is 300 cm. Find the sides of triangle.

27. Find the area of isosceles triangle whose non equal side is of 12 cm and its corresponding altitude is 7.5 cm.

## Short Answer type Questions (3 Marks)

**28.** The sides of a triangular field are 51 m, 37 m and 20 m. Find the number of flower beds that can be prepared if each bed is to occupy 9 m² of area.

**29.** Show that the area of an equilateral triangle is $\dfrac{\sqrt{3}}{4}x^2$, where side is $x$.

**30.** The sides of a triangle are $x, x+1, 2x-1$ and its area is $x\sqrt{10}$ sq. units. Find the value of $x$.

**31.** The perimeter of a triangle is 50 cm. One side of a triangle is 4 cm longer than the smaller side and the third side is 6 cm less than twice the smaller side. Find the area of the triangle.

**32.** Find the area of shaded region in the figure.

How may triangle flower beds of 6 m² can be made from this area?

[use $\sqrt{105} = 10.25$]
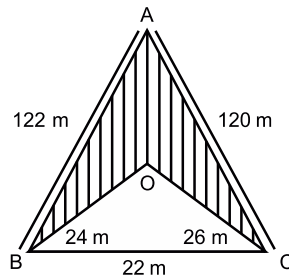


**33.** The side of a triangular sheet are 5 cm, 12 cm and 13 cm. Find the cost of painting on the sheet at the rate of ₹30 per cm².

**34.** 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.

## Long Answer Questions (5 Marks)

**35.** Find the ratio between the area of triangle $\triangle ABC$ and $\triangle DEF$.
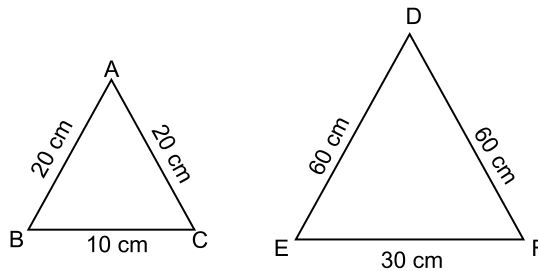
**36.** If perimeter of a triangle is $x$ cm and its sides are $p, q$ and $r$ cm. What will be the area of triangle? Use the Heron's formula.

**37.** If every side of a equilateral triangle is doubled, then find the percentage increase in the area of the triangle.

**38.** While selling clothes for making flags, a shopkeeper claims to sell each piece of cloth in the shape of an equilateral triangle of each side 12 cm while actually he was selling the same in the shape of an isosceles triangle with side 12 cm, 10 cm and 10 cm. How much cloth was he saving in selling each flag?

**39.** 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$\sqrt{10} = 3.15$]
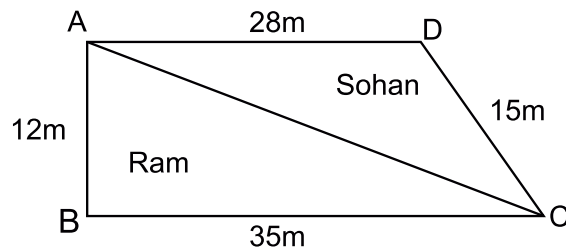


**40.** A triangle hoarding of dimensions 11 m, 6 m and 15 m is used for commercial activities. The hoarding yield an earning of ₹ 5000 per m² per month.

Calculate the total earning by the hoarding in a month. [Use$\sqrt{2} = 1.41$]

## Answers

1. (d) $27\sqrt{3}$ cm²

2. (a) 6 cm²

3. (b) $\sqrt{32}$ cm

4. (d) None of these

5. Hint : Lets height = a

   Base : 3a

   $1/2 \times 3a^2 = 13.5$ Base = 9 m, Hectare = 900 m

6. (c) 8 cm, 12 cm, 12 cm

7. (c) Hint : $S = \dfrac{42 + 34 + 20}{2}$

$$S = 48$$

$$\text{Area of } (\Delta) = \sqrt{48 \times 6 \times 14 \times 28} = 336 \text{ cm}^2$$

longest side = 42 cm

$$\frac{1}{2} \times b \times h = 336$$

$$h = 16 \text{ cm}$$

8. $2a + b$ units

9. 13 cm

10. Heron's formula

11. 12 cm

12. $100\sqrt{3}$ cm²

13. 9 cm²

14. 24 cm

15. 73.5 cm²

16. $3\sqrt{3}$ cm²

**17.** $\dfrac{\sqrt{3}}{4}a^2$ units$^2$

**18.** 50 cm

**19.** $4\sqrt{3}$ cm

**20.** 3a units

**21.** $4\sqrt{3}$ cm$^2$

**22.** 13 cm

Hint: $\qquad s' = \dfrac{2(a+b+c)}{2} = 2S$

$$\Delta = \sqrt{2S(2S - 2a)(2S - 2b)(2S - 2c)}$$

**23.** 4 times

**24.** 10 cm

**25.** 60 cm

**26.** 60 cm, 100 cm, 140 cm

**27.** 45 cm$^2$

**28.** Hint: No of flower beds $= \dfrac{\text{Area of field}}{\text{Area of 1 Flower Bed}}$

   34

**30.** Hint : $S = \dfrac{4x}{2} = 2x$ ;

$$\Delta = \sqrt{2x\,(x)\,(x-1)\,(1)}$$

$$x\sqrt{10} = x\sqrt{2\,(x-1)}$$

$$2\,(x-1) = 10$$

$$x = 6$$

**31.** Hint: Let the length of smallest side $= x$ m

$\therefore$ Other two sides will be $x + 4$ and $2x - 6$

$\therefore$ Perimeter of triangle $= x + x + 4 + 2x - 6$

$$50 = 4x - 2$$
$$x = 13$$

∴    sides are 13, 17, 20 m

**Ans.** = 109.6 m²

32.  1047 m², 179

33.  ₹ 900

34.  Hint:

Let given side '$a$' = 20

hypotenuse = $b$

other side = $c$

$$a^2 = b^2 - c^2$$
$$a^2 = (b - c)(b + c)$$
$$20^2 = 8 \times (b + c)$$

$$\frac{400}{8} = b + c$$

$$b + c = 50$$

$$\frac{b - c = 8}{2b = 58} \qquad \text{(given)}$$

$$b = 29$$

∴ $\qquad\qquad c = 21$

$$a = 20, b = 29, c = 21$$

Area = 210 cm²

35.  1 : 9

36.  $\sqrt{\dfrac{x}{2}\left(\dfrac{x}{2} - p\right)\left(\dfrac{x}{2} - q\right)\left(\dfrac{x}{2} - r\right)}$

37.  300% Hint: Increase in area of triangle

= Area of new triangle – Area of given triangle

Percentage Increase = $\dfrac{\text{Increased Area}}{\text{Initial Area}} \times 100$

**38.** Hint: Area of equilateral piece

$$= \frac{\sqrt{3}}{4} \times 12^2 = 36\sqrt{3} = 62.352 \text{ cm}^2$$

Area of isosceles piece = 48 cm²

Difference = 14.352 cm²

**39.** Ram, 210 m²

**40.** ₹ 141000

## CHAPTER-12
## HERON'S FORMULA
## PRACTICE TEST

**Time: 1 hr**                                                            **M.M: 20**

1. If $(s - a) = 5$ cm, $(s - b) = 10$ cm, $(s - c) = 1$ cm. Find $s$.    (1)

2. The sides of triangle are 35 cm, 54 cm and 61 cm. Find the length of its longest altitude.    (1)

3. Find the area of isosceles triangle whose equal sides are of length 15 cm each & the third side is 12 cm.    (2)

4. If each side of triangle is doubled, then find the ratio of area of new triangle thus formed & the given triangle.    (2)

5. A triangular park $ABC$ has sides 120m, 80m and 50m. A gardner has planted some trees inside the park leaving 5 m width along each side of park. Find the area in which he planted the trees.    (3)

6. The sides of a triangle are in the ratio 25 : 17 : 12 and its perimeter is 540 cm. Find the area of the triangle.    (3)

7. The length of sides of a triangle are 7 cm, 12 cm & 13 cm. Find the length of perpendicular from opposite vertex to the side whose length is 12 cm.    (4)

8. The cost of fencing a field @ ₹ 5 per metre is ₹ 1920. If semi perimeter is 48 cm, find its area & all sides.

# SURFACE AREAS AND VOLUMES

## MIND MAP

**Surface Areas**

**and**

**Volumes**

### Cone

Radius : r units
Height : h units
Slant Height : $\ell$ units

| T.S.A. | $\pi r \ell + \pi r^2$ $\pi r(\ell + r)$ | sq. units |
|---|---|---|
| C.S.A. | $\pi r \ell$ | sq. units |
| Volume | $\dfrac{1}{3}\pi r^2 h$ | cubic units |
| Slant Height | $\sqrt{r^2 + h^2}$ | units |

### Sphere

Radius (Sphere) = r

| T.S.A. | $4\pi r^2$ | sq. units |
|---|---|---|
| C.S.A. | $4\pi r^2$ | sq. units |
| Volume | $\dfrac{4}{3}\pi r^3$ | cubic units |

### Hemisphere

Total Surface Area = $2\pi r^2 + \pi r^2$
$= 3\pi r^2$ sq. units

Curved Surface Area = $2\pi r^2$ sq. units

Volume = $\dfrac{2}{3}\pi r^3$ cubic units
(Half of that of a sphere)
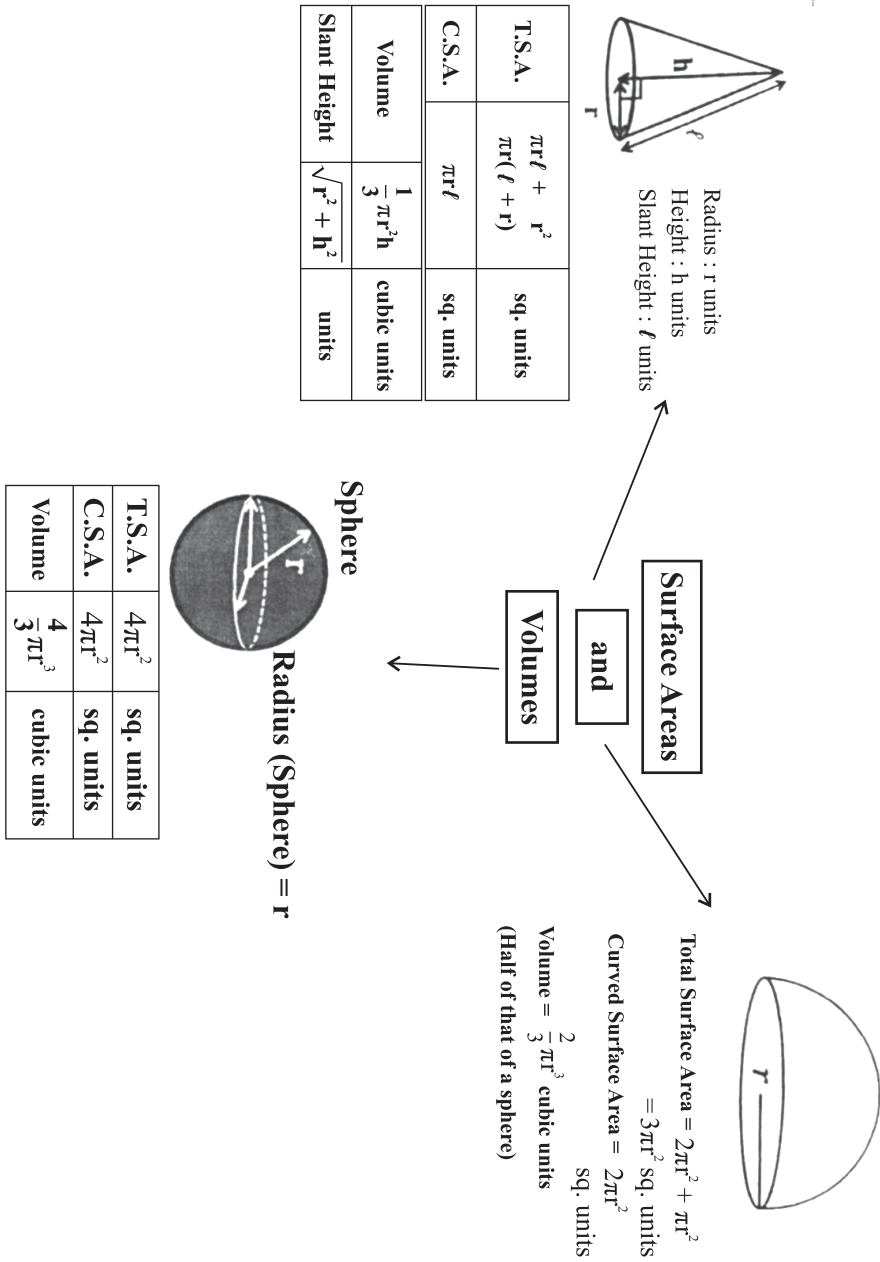
**Very-very Short Answer Questions (1 Mark)**

1. If the voume 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. The height fo cone of diamter 10 cm and slant height 13 cm, is

   (a) 12 cm
   (b) 13 cm
   (c) $\sqrt{69}$ cm
   (d) $\sqrt{194}$ cm

4. 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) $\frac{8\pi r^3}{3}$

5. 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%

6. The radius of the sphere is 7 cm the surface area of the sphere is _____.

7. If the radius of a sphere is doubled then the ratio of their volume is _____.

8. The diameter of sphere whose surface area in 55.44 m² in _____.

9. Total surface aera of a cone whose radius as $P/2$ and slant height as $2l$ is _____.

10. Volume of a cone is $= \frac{1}{3}\pi$ (radius)² × _____.

11. The radius of a hemispherical balloon increase from 6 cm to 12 cm as air is being pumped into it. Find the radious of the surface area os the balloon in the two cases.

12. If the radius of a sphere is $2r$, then find its volume.

13. The radius of a sphere is 21 cm. What is the surface area of the sphere?

**Very Short Answer type Answer (2 Marks)**

14. Three spheres of radii 3 cm, 4 cm and 5 cm are melted togetehr to form a single sphere. Find the radius of new sphere.

15. What is the volume of the largest cone that can be inscribed completely in a hollow hemispehere of radius 7 cm?

16. Which is false? Write the correct answer.

   (a) Volume of the hollow sphere $= \dfrac{4}{3} \pi (R^3 - r^3)$

   (b) Volume of a hemisphere $= \dfrac{2}{3} \pi r^3$

   (c) Total surface area of a hemisphere $= 3\pi r^2$

   (d) Curved surface area of a hemisphere $= \pi r^2$

17. 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. Find the radius of the sphere.

18. Find the area of canvas required for a conical tent of height 24 m and base radius 7 m.

19. Find the ratio of total surface area of a sphere and a hemisphere of same radius.

20. If the radius and slant height of a cone are $r/2$ and $2l$ then find its total surface area.

21. A cone and a hemisphere have equal base and equal volumes. Find the ratio of their heights.

   **Short Answer type Questions (3 Marks)**

22. A hemispherical bowl is to be painted from inside at the rate of ₹ 20. per 100 m². The total cost of painting is ₹ 30.80. Find the inner surface area of the bowl.

23. 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%.

24. The diameter of a hemisphere is decreased by 30%. What will be the percentage change in its total surface area?

25. The volume of a sphere is 4851 cm3. How much should its radius be reduced so that its volume becomes $\dfrac{4312}{3}$ cm³?

26. A semicircular sheet of paper of diameter 14 cm is bent to form an open conical cup. Find the capacity of the cup.

**Long Answer type Questions (5 Marks)**

27. A right ciruclar cone is 5.4 cm high and radius of its base is 2 cm. It is melted and recast into another right circular one with radius of base as 1.5 cm. Find the

28. Twenty Seven solid iron spheres each of radius r and surface area S are melted to form sphere with sruface areas'. Find the

    (i)   radius R of the new sphere.

    (ii)  Ratio of S and S'.

29. The diameter of a metallic ball is 4.2 cm. What is the mass of the ball, if the density of the metal is 8.9 g per cm³.

30. A toy in the form of a cone mounted on a hemisphere of diameter 7 cm. the total height of the toy is 14.5 cm. Find the volume and the total surface are of the toy.

    (Take $\pi = \dfrac{22}{7}$ )

31. If h, c and v respectively, are the height, the curved surface and volume of the cone, prove that $3\pi vh^3 - c^2h^2 + 9v^2 = 0$

32. The volumes of the two spheres are in the ratio 64 : 27. Find the ratio of their surface areas.

# Answers

1. (b) units

2. (b) $3\pi r^2$

3. (a) 12 cm

4. (a) $\dfrac{32}{3}\pi r^3$

5. 33.1%

6. 616 cm$^2$

7. 1 : 8

8. 2.1 m

9. $\dfrac{\pi P^2}{4} + \pi Pl$

10. height

11. 1 : 4

12. $\dfrac{32}{2}\pi r^3$

13. 5544 cm$^2$

14. 6 cm

15. $\dfrac{1}{3}\pi r^2 h$

$$\dfrac{1}{3} \times \dfrac{22}{7} \times 7 \times 7 \times 7 = \dfrac{22 \times 49}{3} = \dfrac{1078}{3} \text{ cm}^3$$

16. (d) Curved surface area of a hemisphere $= \pi r^2$

17. 2.1 cm

18. 550 m$^2$

19. 4 : 3

20. $\pi r\,(1 + r/4)$

21. 2 : 1

**22.** $154 \ m^2$

**23.** $r_1 = 10 \ cm$

$$v_1 = \frac{4}{3} \pi (10)^3$$

$r_2 = 11 \ cm$

$$v_2 = \frac{4}{3} \pi (11)^3$$

$$\frac{v_2 - v_1}{v_1} \times 100\% = \frac{331}{1000} \times 100\% = 3.31\%$$

**24.** $r = 0.7r$

% decrease in total surface area

$$= \frac{3\pi \, r^2 - 3\pi \, r^2}{3\pi r^2} \times 100 = \frac{3\pi \left[ r^2 - (0.7)^2 \, r^2 \right]}{ }$$

$$= \frac{r^2 - 0.49r^2}{r^2} \times 100 = 0.51 \times 100$$

51% decrease

**25.** $v' = \dfrac{4}{3}\pi r^3 = \dfrac{4312}{3} \quad v^0 = 4851 = \dfrac{4}{3}\pi r^3$

$$r'^3 = 7^3, \qquad\qquad r^3 = \left( \frac{21}{2} \right)^3$$

$$r' = 7 \ cm \qquad\qquad r = \frac{21}{2} = 10.5 \ cm$$

$r_0 - r' = 10.5 - 7 \ cm$

$= 3.5 \ cm$

**26.** circum ference of the base of the conical cup

= length of the are of the semicircle $79.2 \ cm^3$

---

**27.** $\pi (2)^2 \times 5.4 = \pi (1.5)^2 \times h$

$$\frac{2 \times 2 \times 5.4}{1.5 \times 1.5} = h$$

$$\frac{21.6}{2.25} = h$$

$h = 9.6$ cm

**28.** (1) $R = 3r$

(2) $S : S' = 1 : 9$

**29.** 345.39 g

**30.** 231 cm³, 204.05 cm²

**31.** Let $r$ and $l$ denotes respectively the radius of the base and slant height of the cones, then

$$l = \sqrt{r^2 + h^2} \; , \; v = \frac{1}{3}\pi r^2 h \; , \; c = \pi r l$$

$\therefore \; 3\pi v h^3 - c^2 h^2 + 9v^2$

$$= 3\pi \times \frac{1}{3}\pi r^2 h \times h^3 - (\pi r l)^2 \; h^2 + 9\left(\frac{1}{3}\pi r^2 h\right)^2$$

$= \pi^2 r^2 h^4 - \pi^2 r^2 l^2 h^2 + \pi^2 r^4 h^2$

$= \pi^2 r^2 h^4 - \pi^2 r^2 h^2 \; (r^2 + h^2) + \pi^2 r^2 h^2$

$= \pi^2 r^2 h^4 - \pi^2 r^4 h^2 - \pi^2 r^2 h^4 + \pi^2 r^4 h^2 = 0$

**32.**

$$\frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \frac{64}{27} = \frac{(4)^3}{(3)^3}$$

$$\left(\frac{r_1}{r_2}\right)^3 = \left(\frac{4}{3}\right)^3$$

$r_1 : r_2 = 4 : 3$

Ratios of their surface areas

$$= \frac{4\pi r_1^2}{4\pi r_2^2} = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{4}{3}\right)^2$$

$16 : 9$

## Practice Test (Ch.-13)
## Surface Areas and Volume

**Time : 1hr**                                                               **M.M. : 20**

1. The volume of a sphere is $310.4 \text{ cm}^3$. Find its radius. (1)

2. Three spheres of radii 3cm, 4cm, 5cm are melted to form a new sphere. Find the radius of the new sphere. (1)

3. The ratio of radius and slant height of a cone is 4:7 if the curved surface area of cone is $192 \text{ cm}^2$ then find its radius. (2)

4. A semicircular sheet of paper of diameter 14 cm is bend to form a comical cup. Find the capacity of the cup. (2)

5. The seed of a corn has dimensions 1.8 cm x 0.8 cm x 0.2 cm. The height of the corn-tube is 13.7 cm and its radius is 4.2 cm. Assuring that the corn seeds are of same size, find the number of seeds on the corn-tube. (3)

6. The radius of a sphere is 5cm. If the radius is increased by 20% then how much percentage increase will be in the volume? (3)

7. Ajay prepared a dish and kept it in a hemi spherical bowl of 30cm 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? (4)

8. If there are two cones one of which has surface area double of the other, slant height of the second cone is double of the first. Cone then find the ratio of their radii? (4)

# STATISTICS

## MIND MAP
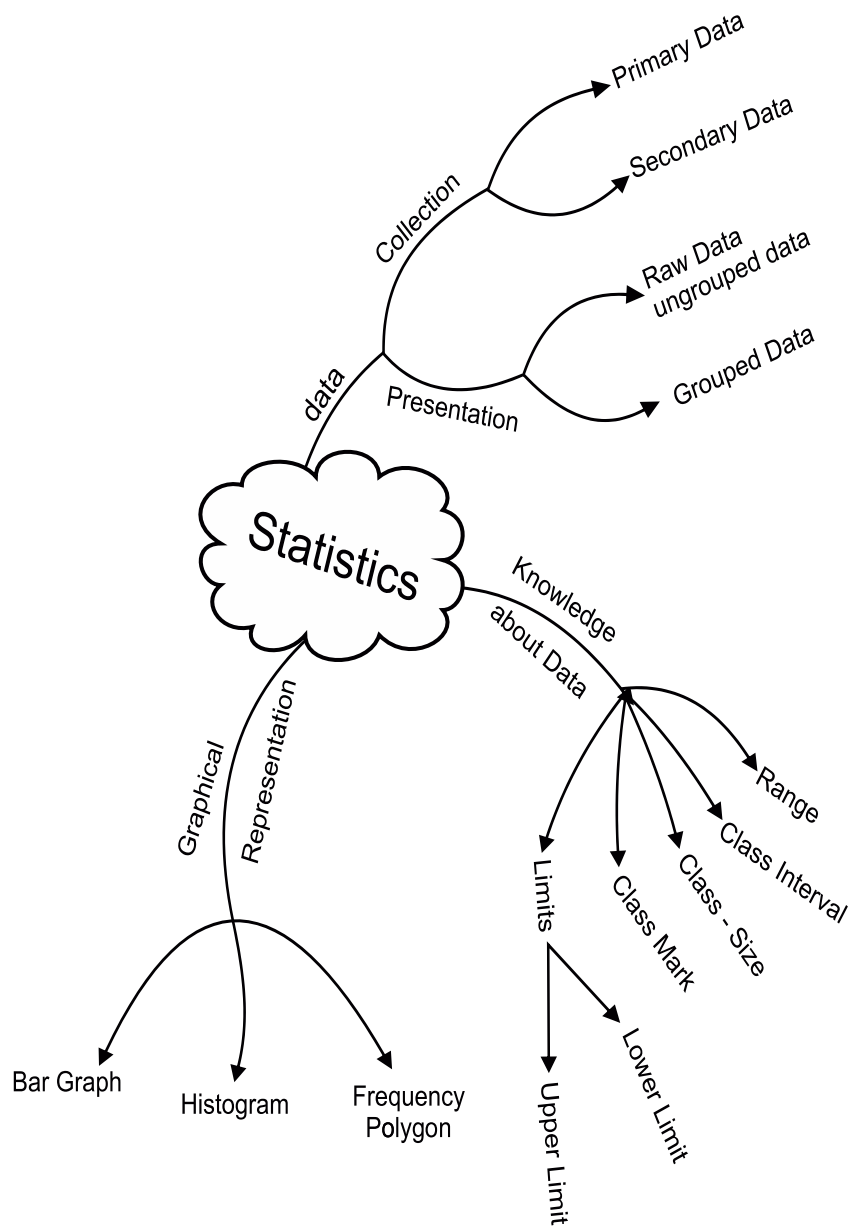
**Key points**

*   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 $= \dfrac{\text{Lower class limit} + \text{upper class limit}}{2}$

## Very-very Small Answer type Questions (1 Mark)

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 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)
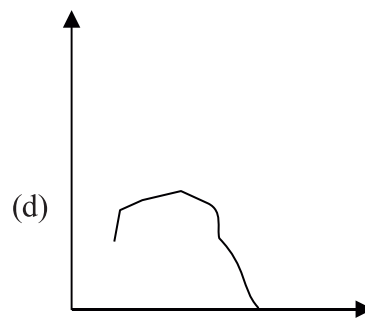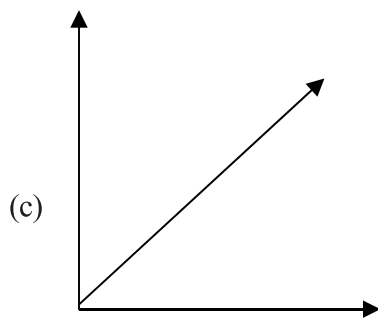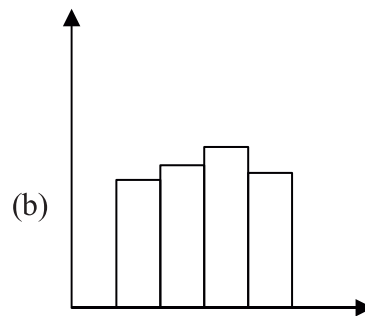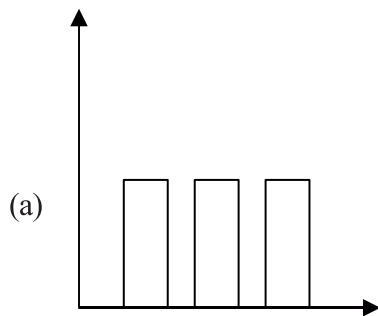
**5.** In a Histogram when we join midpoints of the tops of the rectangles (bars) we get:

(a) Bar Graph        (b) line graph

(c) Frequency Poluygon        (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 difference between the highest and lowest values of the data is called _____ of that observations

**11.** The marks of 5 students in a subject out of 50 are 32, 48, 50, 27 and 37, the range is _____.

**12.** A set of data contains 64 as the highest value and its range is 13, the lowest value of the data is _____.

**13.** The mid point of a class is called _____.

**14.** The class mark of the class interval 4.7-6.3 is _____.

**15.** Class size of class intervals 5.5-15.5, 15.5-25.5, 25.5-35.5 is _____.

**16.** If class mark of a class-interval is 18.5. The class size is 5, find the class limit of the corresponding class interval.

**17.** In a continuous frequency distribution, class mark of a class is 15 and lower limit is 13. Find its upper limit.

**18.** The class marks of a continuous distribution are 3.05, 3.15, 3.25, 3.35, 3.45, and 3.55. Find the class interval corresponding to the class mark 3.35

**19.** The weight (in kg) of 25 students are given below 35, 38, 36, 37, 38, 35, 37, 36, 35, 38, 36, 36, 35,  35, 38, 37, 35, 36, 38, 38, 35, 35, 36, 38, 37

Complete the following frequency table:

Weights : 35      36      37      38

Frequency : ____ ____   ____   ____

**20.** The class marks of a distribution are 104, 114, 124, 134. determine the class size and the class limits.

**21.** Following data gives the number of children in 30 families.

2, 1, 0, 3, 4, 2, 4, 3, 0, 1, 2, 4, 5, 3, 2, 2, 2, 1, 1, 1, 0,2, 0, 3, 2, 1, 0, 4, 5, 1

represent it in the form of a fequency distribution.

**22.** The following are the runs made by 18 players in one day cricket match:

3, 7, 16, 27, 46, 122, 73, 24, 7, 3, 0, 8, 46, 3, 99, 45, 28, 79

Form a frequency table for above data with equal class intervals one of these being 0-25 (excluding 25)

23. Time taken in seconds by 25 students in an examination to solve certain questions 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.

24. Draw the histogram from the following data

| Class | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 |
|---|---|---|---|---|---|
| Frequency | 8 | 15 | 20 | 12 | 16 |

25. Given below is a cumulative frequency distribution table showing the marks scored by 50 students of a class.

| Marks | Number of students |
|---|---|
| Below 20 | 17 |
| Below 40 | 22 |
| Below 60 | 29 |
| Below 80 | 37 |
| Below 100 | 50 |

Form a frequency table from the above data.

26. Given below are the seats won by different political parties in a state assembly election.

| Political Party | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| Seat won | 75 | 55 | 37 | 29 | 10 | 37 | 50 |

Draw a bar graph for above data.

27. Given below is the data of students who participated in different activities.

| Activity | sports | Meditation | Yoga | Walking |
|---|---|---|---|---|
| No. of Girls | 42 | 35 | 100 | 120 |
| No. of Boys | 90 | 64 | 130 | 86 |

Draw double bar graph.

**28.** Draw histogram to represent the data given below.

| Age (in years) | No of children |
|---|---|
| 1-2 | 5 |
| 2-3 | 4 |
| 3-5 | 10 |
| 5-7 | 12 |
| 7-10 | 9 |
| 10-15 | 10 |
| 15-17 | 8 |

**29.** Construct a histogram from the following distribution of total marks obtained by 40 students of IX class in a test.

| Class Marks (mid point) | 5 | 15 | 25 | 35 | 45 | 55 |
|---|---|---|---|---|---|---|
| No. of Students | 3 | 7 | 6 | 14 | 8 | 2 |

**30.** For the following data, draw a frequency polygon.

| Marks obtained | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 |
|---|---|---|---|---|---|
| No- of Students | 6 | 8 | 3 | 9 | 4 |

**31.** Draw a frequency polygon for the following data

| Marks | Frequency |
|---|---|
| 0-10 | 03 |
| 10-20 | 09 |
| 20-30 | 18 |
| 30-40 | 16 |
| 40-50 | 12 |
| 50-60 | 02 |

**32.** 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 receipient?

**33.** A doctor suggests two ways for treatment of a particular disease one by taking medicine only and other by doing meditation and yoga.

| Age group | No. of patients taking medicines | No. of patients doing meditation & yoga |
|---|---|---|
| 20-30 | 20 | 05 |
| 30-40 | 30 | 12 |
| 40-50 | 42 | 20 |
| 50-60 | 40 | 30 |
| 60-70 | 30 | 20 |

Represent the data of both the ways of treatment on the same graph by two frequency polygons.

**34.** The following table shows number of voluntary blood donors per day in voluntary blood donation camp organized in Delhi.

| Days | No. of Donars |
|---|---|
| Sunday | 100 |
| Monday | 80 |
| Tuesday | 110 |
| Wednesday | 80 |
| Thursday | 60 |
| Friday | 70 |
| Saturday | 120 |

(i) Draw a bar graph showing above information.

(ii) On which day donation was maximum and on which day it was minimum?

**Answer**

1. (b) Data

2. (d) Secondary data and Primary data

3. (c) We use calss intervals in histogram instead of variables.

4. (b)

5. (c) Frequency polygon

6. (c) class mark

7. (d) 17

8. (b) 6-11

9. (b) $2x - y$

10. Range

11. 23

12. 51

13. class mark

14. 5.5

15. 10

16. 16-21

17. 28

18. 3.3-3.4

19. Weight        35      36      37      38

    Frequency   8       6       4       7

20. class size = 10

    class limits = 99-109, 109-119, 119-129, 129-139

21.

| No. of Children | Tally Marks | No. of Families |
|---|---|---|
| 0 | ‖‖ | 5 |
| 1 | ‖‖ ‖ | 7 |
| 2 | ‖‖ ‖‖ | 8 |
| 3 | ‖‖‖ | 4 |
| 4 | ‖‖‖ | 4 |
| 5 | ‖ | 2 |

**22.**

| Class-Internal | Tally Marks | Frequency |
|---|---|---|
| 0–25 | ||||  |||| | 9 |
| 25–50 | ||||| | 5 |
| 50–75 | | | 1 |
| 75–100 | || | 2 |
| 100–125 | | | 1 |

**23.**

| Class-Internal | Tally Marks | Frequency |
|---|---|---|
| 15–25 | ||| | 3 |
| 25–35 | ||||| | | 6 |
| 35–45 | |||| | 4 |
| 45–55 | |||| ||| | 8 |
| 55–65 | |||| | 4 |

**24.**



**25.**
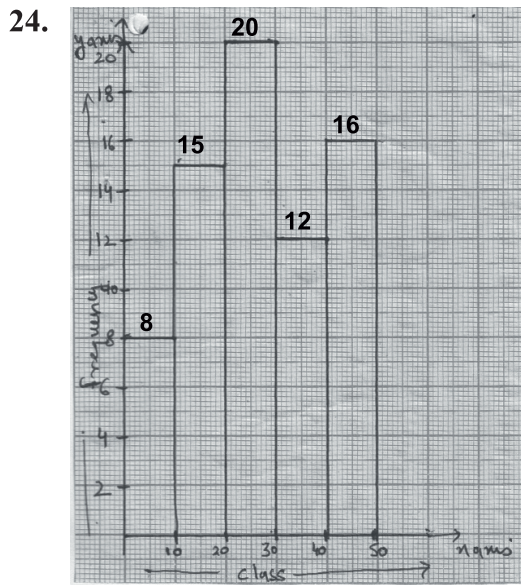
| Class-Internal | Frequency |
|---|---|
| 0-20 | 17 |
| 20-40 | 5 |
| 40-60 | 7 |
| 60-80 | 8 |
| 80-100 | 13 |

**26.**
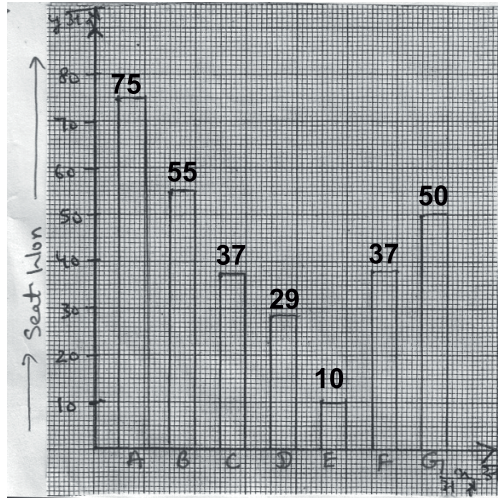
**Practice Paper**

Time : 1 Hr.                                                                    M.M. 20

1. Write class limits of the following class marks:                              (1)

   47, 52, 57, 62, 67, 72, 77

2. Class-mark of class interval 8-15 is _____                               (1)

3. Following data gives the number of children in 20 families:                   (2)

   1, 2, 0, 3, 2, 1, 0, 4, 3, 2, 2, 0, 1, 2, 3, 2, 2, 0, 4, 3

   Represent it in the form of a frequency distribution.

4. The class marks of a distribution are 25, 35, 45, 55, 65. Determine the class size and the class limits.                                                              (2)

5. Time taken in seconds by 25 students in an examination to solve certain question in given below.(3)

   18, 22, 17, 25, 27, 33, 35, 19, 21, 20, 17, 16, 25, 27, 33, 34, 38, 42, 43, 41, 37, 22, 19, 44, 36

   By taking class intervals of size 10, make a frequency distribution table.

6. Given below is a cumulative frequency distribution table showing the marks scored by 50 students of a class                                                    (3)

   | Marks | Below 20 | Below 40 | Below60 | Below80 | Below 100 |
   |---|---|---|---|---|---|
   | No. of students | 17 | 22 | 29 | 37 | 50 |

   Form a frequency table from the above data.

7. Draw the histogram from the following data                                    (4)

   | Age (in yrs) | 18-20 | 20-22 | 22-24 | 24-26 | 26-28 | 28-30 |
   |---|---|---|---|---|---|---|
   | No. of persons | 5 | 4 | 6 | 9 | 7 | 2 |

8. Given below is the data of students who participated in different activities.   (4)

   | Activity | Sports | Meditation | Yoga | Walking |
   |---|---|---|---|---|
   | No. of girls | 25 | 32 | 17 | 27 |
   | No. of boys | 35 | 18 | 22 | 25 |

   Draw double bar graph.

# CASE STUDY BASED PROBLEM

## Case Study-I

1. To eco-club of a school decided to develop a garden of the school and planted three types of plants *A, B* and *C* number of plant *A* is twice that of plant *B* and number of plant *B* is same as number of plant *C*. If total number of plant is 100.



   (i) Write the Correct representation of the above situation in linear equation is.

   (ii) If number of plants of type *A* is 50, then number of plant *B* is

   (iii) If number of plants of type *A* and *B* together is 75, then find the number of plant of type *C*

   (iv) Find the number of plants of type *C*

2. The RWA of a locality is running a lending library to develop the habits of reading books among society. to run this liberay they changes a fixed amount of ₹ 10 for first five days for a book and ₹ for each day there after.
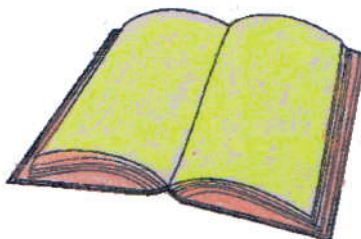


   (i) If you borrow the book for 7 days what amount you will have to pay.

   (ii) If you borrow two books and you paid total amount as ₹ 40, then find the number of days for which book was borrowed.

(iii) Find the linear equation to represent the condition by taking x as total number for days ($x \geq 5$) and total amount be paid as ₹ $y$.

(iv) In the linear equation (correct option from part *iii*), if x = 7 then find the value of *y*.

3. During covid - 19 door to door survey, A froneline health worker recorded the temperature of the family of five members, Their name and age is given below.

| Name | Age ( in years) |
|---|---|
| Uma | 65 |
| Raj kumar | 40 |
| Savita | 37 |
| Rohan | 14 |
| Jyoti | 10 |

The linear eqcation that convert temperature from Fahrenheit (F°) to celsium (C°) is given by

$$C = \frac{5F - 160}{9}$$

(i) If temperture of Uma is 97.7°, then find her temperature in $C°$

(ii) If temperature of Raj kumar is $37°C$, is then his temperature in $F$.

(iii) Taking $C$ on x-axis and F an y-axis, if graph of given linear equation is drawn, then from which quadrant it will to pass?

(iv) If normal temperature of a human body lies between $36.5°C$, and $37.5°C$ then in Fahrenheit temperature will lie in which range?

4. Rashmi was making a toy butterfly with sticks for her younger sister. She arranged the sticks as shows in figure. *AB* and *CD* are two sticks intersecting (joined) at *O* and a third stick *OP* is also joined to hold the toy butterfly.

Based on the above information, answer the following question-
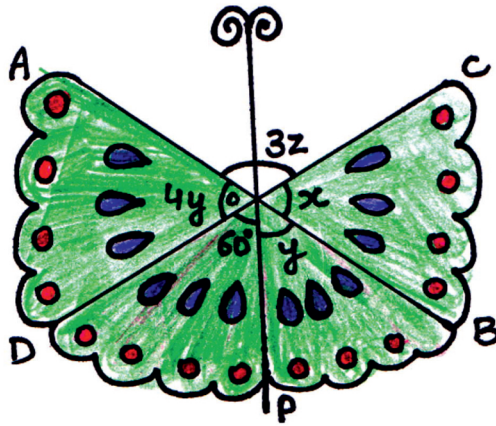


(i)   At what angle does Rashmi inclined the two sticks $AB$ and $CD$?

(ii)  If the two sticks of lengths 10 cm each are joined at the mid point, then find the value of $OA$

(iii) Find the value of $y$ and $z$ in the figure.

<center>or</center>

Find the value of $x$ and also find $x + 4y$

5.   Once four students of class IX are selected in Eco club of the school for plantation work. They are shreya, Khushi, Vaibhav and Sushant. Shreya and Vaibhav planted a row of rose plants as shows in figure with line $AB$. Now Khushi and Sushant want to plant as shown in figure with line $AB$. Now Khushi and Sushant want to plant another row of sunflower plants parallel to rose plants row. Also there is a pipeline $PQ$ passing through $AB$ & $CD$. Based on the above information, answer the following questions-
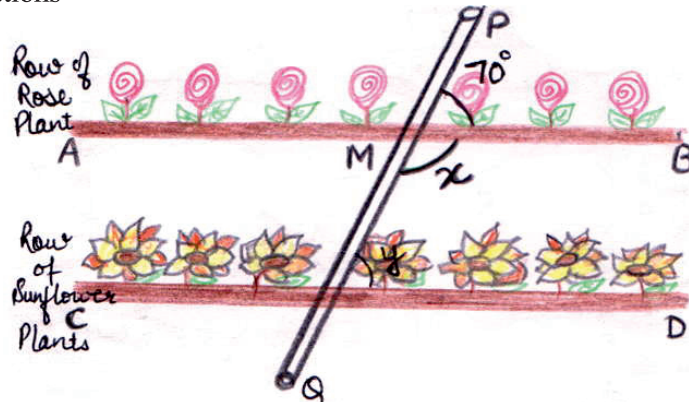
(i) At what angle with *PQ* should Khushi and Sushant plant row *CD* to make it parallel to row *AB*.

(ii) Which type of angle is formed by pair of *x* and *y*

(iii) What will be the value of *x* and *y*?

<center>or</center>

What will be the sum of angle between AB and CD marked as *x* and *y*. What will be the value $2x + y = ?$

6. Two cars are moving on two parallel roads represented as *AB* and *CD*, respectively in the given figure. First car reached at point *E* and takes a turn towards its right at an angle of 50°. At the same time, second car reaches at point *F* and takes a turn towads its left at an angle of 60°. They both meet at a point G. Based on the above information and given figute, answer the following questions (without considering the width of the roads)
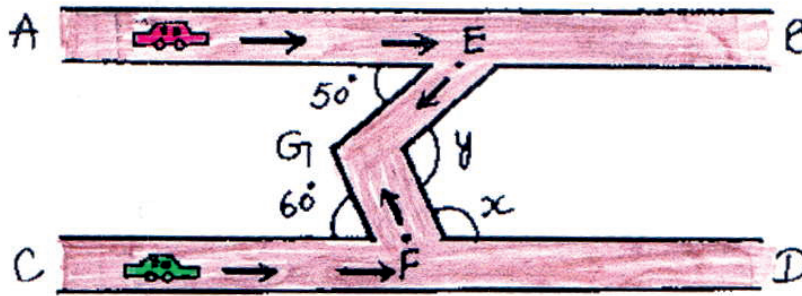


(i) What will be the measures of angle x marked in the figure?

(ii) What will be measure of *EGF* marked as y ?

(iii) What will be the measures of reflex ∠*EGF* ? If *EF* is joined, what type of traingles will *EGF* made ?

<center>or</center>

If Δ*EGF* would have been an issosceles triangle with *EG* = *GF*, then what would be the measures of ∠*GFC* considering ∠*AEG* as 50° ?

7. The Egyptian puramids are anicent structures located in Egypt. The pyramid of khufu is the larger - Egyptian pyramid. It is one of the seven wonders of the Ancient world still in existence.
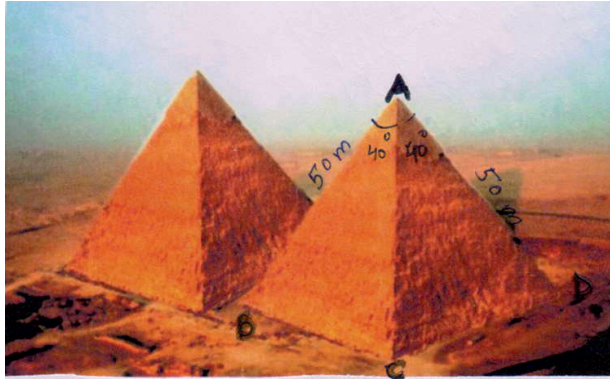
A pyramid is a structure whose outer surface are triangular and converge to a single step at the top. The base of pyramid can be triangle quadrilaleral or any polygon. Geeta a mathematics student visit Egypt and observes the pyramid (shows in the figure)

Based on the above information answer the following questions:

(i)  Name the triangle which is congruent to $\angle ABC$.

(ii)  By which property traingles are congruent?

(iii)  Which side BC will be equal to?

8.  Sanjana and Anshu are two friends, both of them are fond of eating chips. One they were eating triangles chips and suddenly Sanjana noticed that all the chips look alike and she recalled the chapter of traingler that had been taught by the teacher in school.
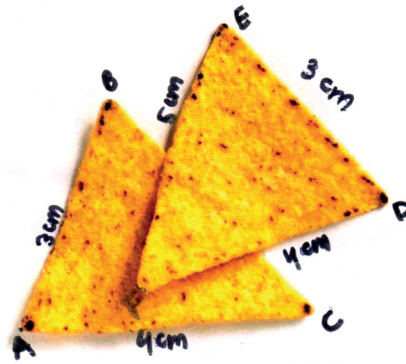


She decided to measure the sides of the chips and she founds out that all chips were of same measurement 3 cm, 4 cm, and 4 cm. As shown in figure.

Based on the informantion given above answer the following question :

(i)  Which type of triangle were the chips?

(ii)  Were the triangles chips congrnent if yes by which property was used ?

(iii)  $BC =$ _____

(iv)  $\angle A =$ _____

**9.** Rohita wants to print her dress a pattern shows in the figure
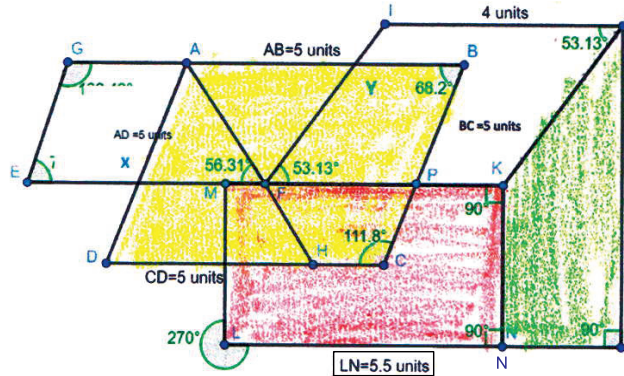


(i) Rohita wants to order a block of shape *ABCD*. What shapes should Rohita mention to the carpenter for a wooden block for printing*ABCD*?

(ii) She wants to colour two pairs of parallel lines with same shade. Write any two such pairs

(iii) Rohita needs to know the measure of∠*AFY* to constuct ∠*AFY*. What should be ∠*AFY*?

**10.** Class IXC wants to decorate the display board of their class. They are using following concepts for cutting paper shapes for decoration-

(1) A quadrilateral is called a parallelogram if -Both the pairs of opposite sides are equal.

(2) In a parallelgram.– (a) opposite angles are equal (b) Adjacent angles are equal supplimentary

(3) In a parrllelgram (a) diagonals bisect each other

(i) To decorate the border of the board they want to cut shapes like parallelogram *ABCD*, using sheets of different colors. What should length of *CD* and *BC*_____?
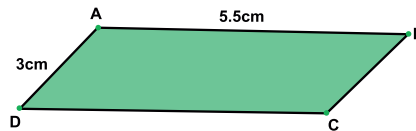


(ii) To cut parallelogram*ABCD* they fixed ∠*D* = 60°. What should be ∠*B* to get parallelgram ABCD?
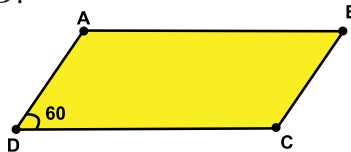
(iii) What should be $\angle A$ to get parallelgram *ABCD*?
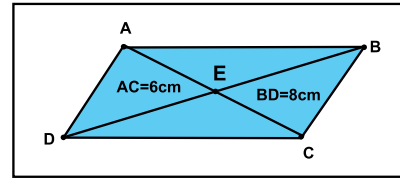
(iv) Some of the parallelograms were cut to get triangles such as *AEF,AED,CED & BEC* to design flowers at the corner of the board. If *BD* is kept 8 cm long and *AC* is 6 cm then what should be length *AE*?



11. (1) A parallelgram is called a Rectangle if one its angle is 90°. It makes all the angles of the rectangle 90°. Its diagonals of the rectangle become equal and bisect each other.

(2) A parrallelogram is called a square if one of its angles is 90°. and one pair of adjacent sides are equal. it makes all the angles of the square as 90°. and all the sides equal. The diagonals of a square become equal and bisect each other at 90°.

Sahil is using above learnings to design a wall-hanging. He is using wires to structure a frame and then is going to wrap up wool aroung the wires.

(i) The first frame he structured from wires is rectangle *ABCD*, as shown in figure. if the diagonal wire is 7 cm and side is 6 cm then what should be length of BC to get required rectangle?
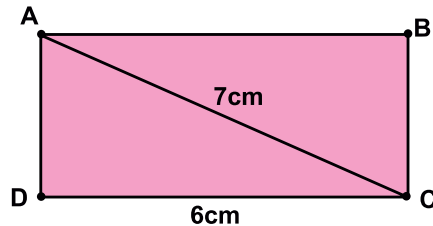


(ii) What should be length of wire *BD*?

(iii) The second frame is square *EFGH*. He has a left out piece of wire having length 8 cm. He wants to take this piece as diagonal of *EFGH* i.e., GE = 8 What should be the length of wire HF?

(iv) What should be the length of wire OF?
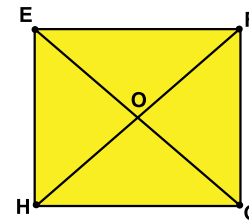


12. A farmer has a circular garden as shown in the picture. He has different types of trees, plants and flower plants in his garden. In the garden, there are two mango trees *A* and *B* at a distance of A*B* = 10 m. Similarly, the garden has two Litchi trees at the same distance of 10 m as shown at *C* and *D*. *AB* subtends $\angle AOB = 80°$ at the

center $O$. The pependicular distance of $AC$ from centre is 5 cm and the radius of the garden is 13 m.
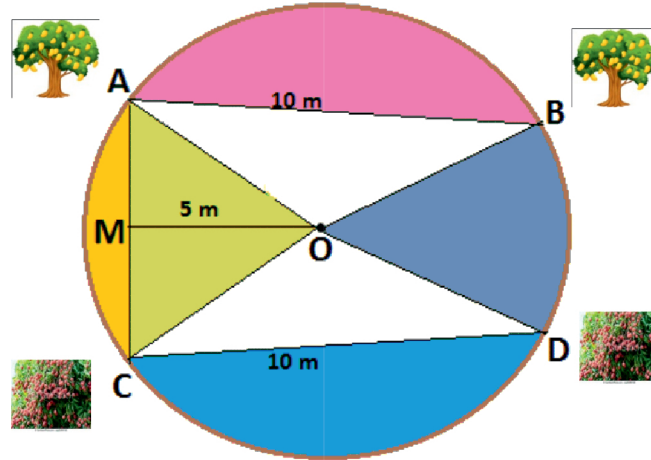


(i) What is the value of $\angle COD$?

(ii) What is the distance between mango tree $A$ and Litchi tree $C$?

(iii) If $\angle BOD = 70°$ then show that $\angle CAB = 75°$.

(iv) What is the value of $\angle OCD$?

13. A circular park of radius 20m is situated in a colony. Three boys Ankur, Syed and David are sitting at equal distance on its boundary each having a toy telephone in hand to talk to each other as shown in figure. $AP$, $BQ$ and $CR$ are the medians of triangle $ABC$.
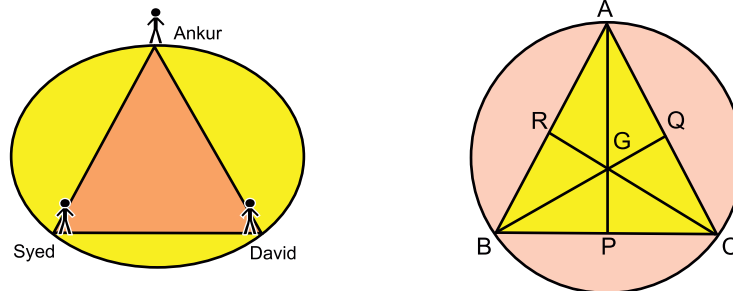


(i) What is the length of $AG$?

(ii) What is the length of $AP$?

(iii) Find the measure of angle $BGC$ and $\angle ABQ$.

(iv) Find length $AB$.

**14.** Three girls Reshma, Salma and Mandeep are playing a game by standing on a circle of radius 5m at R, S and M respectively as shown in figure. Reshma throws a ball to Salma, Salma to Mandeep and Mandeep to Reshma. the distance between Reshma and Salma and between Salma and Mandeep is 6 cm.*O* is the centre of the circle.
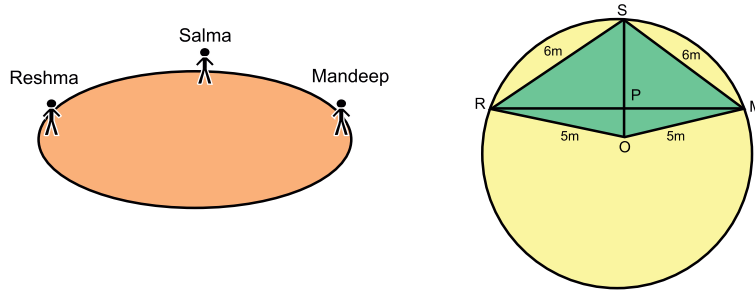


(i) Find the ratio $\angle MOS : \angle MRS$

(ii) Find the length of perpendicular from *O* to the chord *SM*

(iii) Find *OP*

(iv) What is the distance between Reshma and Mandeep ?

**15.** During a practical activity in mathmatics lab, students were using circular geoboard. The angle subtended by $\overline{BC}$ at the centre is $(2a + 50°)$.
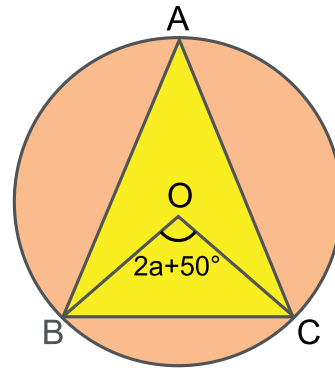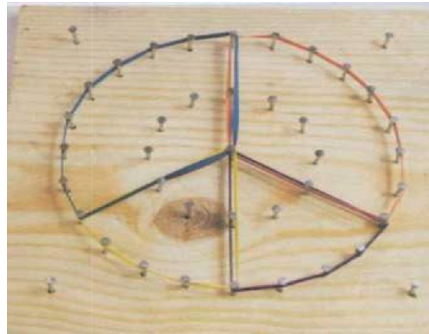


(i) What is the measure of $\angle BAC$ ?

(ii) If a = 30°, then find the measure of $\angle BAC$.

(iii) If a = 50°, then find reflex $\angle BOC$.

(iv) The radius of the circle is 10 cm and a = 50º, find the length of BC.

(v) Find the perpendicular distance of BC from O if diameter of circle is 10 cm and BC = 12 cm.

16. Sarla devi has a triangular field with sides 240m, 200m, and 360m. Where she grew wheat. In another triangular field with sides 240m, 320m and 400m adjacent to the previous field, she wanted to grow potatoes in one part and onions in the other part.
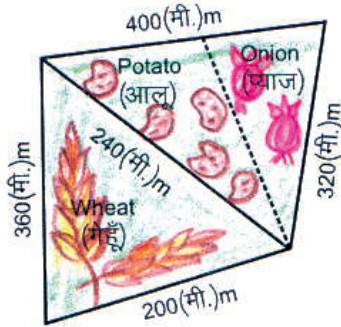


Based on the above information, answer the question:

(i) What is the area of the wheat field?

(ii) What is the area of the field used for growing potatoes ?

(iii) What is the area of the field used for growing potatoes? Find the ratio of the areas of the fields used for growing potatoes and onions

Or

What will be the total area of land she has and express the area in hectare also.

17. During summer vacations, Rohit was getting bored due to lockdown in his city. Because of the COVID pandemic, he couldn't go out to play with his friends. His mother suggested him to start making some orgami craft material. He learnt origami craft through internet and made a puppy as shown in figure.
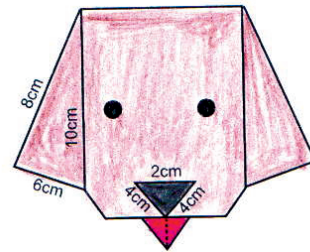


Based on the above information and measurement of different parts of the figure, answer the following questions:

(i) What is the area of one ears of the puppy? (both ears are similiar)

(ii) What is the area of the paper used to make nose of the puppy?

(iii) If the tongue of the puppy is in the shape of equilateral triangle, with side 2 cm each, then what is the area of the paper used to make tongue? What will be the length of the middle line of the tongue as shown in figure?

or

If the total area of paper used to make the puppy is 96 cm², then find the area of paper used to make the face (except ears, nose and tongue) of the puppy?

18. A triangular filed has vertices *A, B* and *C*, THe length of the sides are 130m, 140m, and 150m. The farmer wants to fence his field all around learing a space 5 m wide its with gate on one side. The cost of fencing it with larbed wire is `20 per metre. After fencing farmer cultivates corrot in the field.
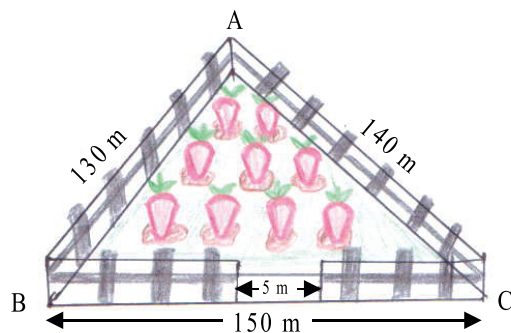


(i) Find the semi perimeter of the triangular field
(ii) Find the perimeter of the field
(iii) Find the cost of fencing

or

Find the Total area of the field

## Chapter-13: Surface Area and Volume

19. Juhi a young girl found a spherical shaped coconut. She consumed the water of the coconut and used her cretivity by decorating the outer spherial covering of the coconut and sold it. If the radius of the coconut was 2.1 cm. (considering the thickness of coconut negligible and coconut fully filled with water) then, Based on the above situation on answer the following question:-

(i) What will be the surface area of spherical cocount.

(ii) If Juhi could decorate only half coconut using poper then when would be area of required paper?

(iii) If the price for decorating coconut is Rs 5 per sq cm then what would be price of decorating the whole account?

(iv) What was the volume of coconut water Juhi consumed?

**20.** Traffic cone are used outdoor during road work in various situations such as traffic redirection, advance warming of hazards or the prevention of traffic.

A traffic come has the radius of 2.1 cm and height 20 cm. Answer the following questions based on the above data:-

(i) What is the slant height of the traffic cone?

(ii) What will be the total surface area of the Traffic cone?

(iii) Find the price of painting the curved surface of 20 such traffic cone. If the price of painting per sq.m is Rs 8?

(iv) What will be the volume of each traffic cone?

**21.** Kaushal a $9^{th}$ student loves chocolates on his birthday his mother gifts him a chocolate baking tray. The tray has 6 hemispherical cavities each of diameter 8.4 cm. Kaushal prepares the chocolates on his birthday using this tray and share there hemispherical chocolates with him friends.

On the basis above information answer the following question:-

(i) Find the radius of the hemispherical chocolate.

(ii) Find the volume of each hemisperical chocolate.

(iii) Kaushal wants to cover each chocolate with paper. How much paper will be required for whole tray of chocolates?

(iv) If Neha eats two third of the choclates (Assuming the tray is full chocolate. How much volume of chocolates does she eat?

22. In a classroom of class IX, an activity on real numbers in done with the students. A student has to pick a card and has to answer the questions written on it. The cards picked up by first 5 students and their questions written on it are given below. Find out its correct option/ answer.

(i) Which type of number is $\sqrt{10}$ ?

(ii) $\dfrac{1}{3}$ is an a/an_____.

(iii) For what value of "p" $\dfrac{251}{2^3 \times p^2}$ is an non-terminating recurring decimal. Which type of number has decimal expansion as non-terminating recurring.

<div align="center">Or</div>

$(256)^{0.16} \times (256)^{0.09} = $ _____.

23. A building has 13 floors above and 4 floors below the ground (basement). Stairs run to the lowest ground of the basement to the top of the building. Ramesh is standing on the ground. If that point is considered "0" and after every 4 steps of stairs, either above or below, he counts "1". Also, below the ground he counts negative numbers.

Represent his position by number in each of the following cases-
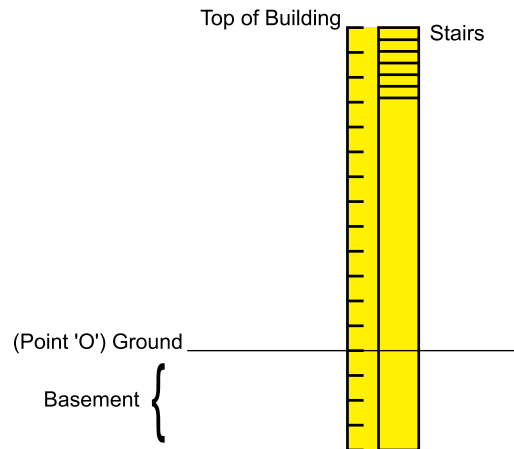


(i) What would he count if he has climbed 16 stairs above.

(ii) If has gone three steps below the ground then at what number he will be ?

(iii) If he has climbed seven steps above the ground and then goes down 10 stairs what is the number of his position?

Or

Find : $\dfrac{2}{4} - \left(\dfrac{-5}{4}\right)$ and name the numbers used to represent his location position.

24. A school wants to plant in a row as distance shown in the figure Height of each tree is considered equal and is taken as 1 unit. Distance $OA$ is also 1 unit. First Tree is planted at point $B$ & second at C.

Consider point "$O$" as the zero of the line and $OB = OQ$, then



[Neglect width of the tree]
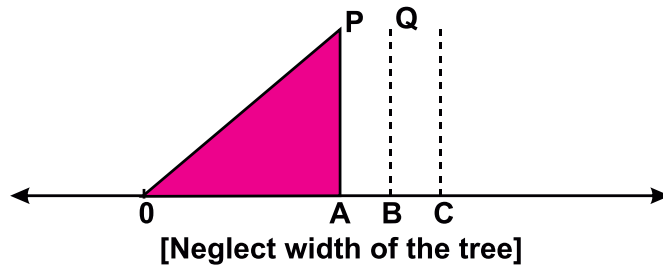
(i) Find the distance OB

(ii) Find the distance OC

(iii) Simplify $\dfrac{1}{OB}$ , what type of number it is?

Or

Making denominator of $\dfrac{OB}{OC}$ rational, what will we get?

25. A tree plantation campaign is organised in a government school. Under this campaign, the students in class IX are $(x + 1)$ and each student planted equal number of trees. The trees are arranged in rows and columms. The number of rows are $(2x + 1)$.

(i)    Find the number of trees planted by each student

(ii)   If total 2079 trees are planted then find the value of $x$ ?

(iii)  Find the factors of the polynomical $2x^2+x^2-2x-1$

<div align="center">Or</div>

Find the zeroes of $2x^3 + x^2 - 2x - 1$.

26.  Mahesh wants to paint a wall of his room. He decides to paints the wall in two colours, pink and white, divided diagonally. The length and breath of the wall are $(x+4)$ and $(3x+2)$ respectively. The diagonal of the wall is $x^2+3x$.
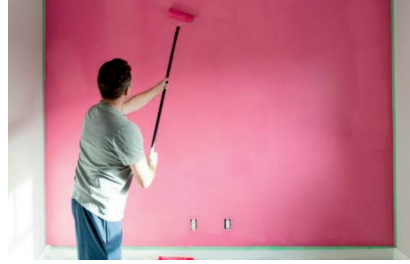
(i)    The area of the wall is _____ polynomial.

(ii)   What is the area of the wall?

(iii)  Mahesh wished to draw flowers in the squared area of the wall. By how much length. should be reduced?

<div align="center">Or</div>

If $x=2$, then find the area to be painted pink?

27.  One day, whole going to the office, Suchitra has to go to her son's school to attend PTM. Then she worked in the office and left early as some guests are ariving at her house in the evening. She went to the bank after the office and then to the shop to purchase some groceries to welcome the guests. The route of Suchitra has been shown in the Cartesian plane in the figure below. The location of Suchitra's house in cartesian plane is $(0,-4)$.
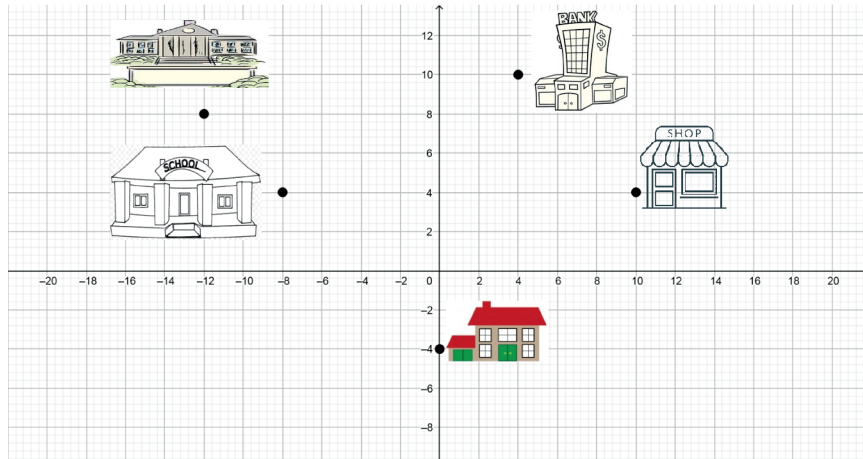
(i) Write the coordinates of Suchitra's house?

(ii) Name the building having same ordinate.

(iii) Write the coordinates of shop and bank. Find (ordinate of shop) – (abscisses of bank).

(iv) Which buildings are in quadrant II? Write their coordinates.

28. To make the student aware of personal health and hygiene, a race was organized on rectangle playground *ABCD* of a school. The lines were drawn with chalk powder at a distance of 1 m each and 100 flower pots were placed at a distance of 1 m from each other along *AD*. Meeta ran $\frac{1}{4}$ th of the distance *AD* on the third line and posted a red flag. Mayank ran $\frac{1}{5}$ th of the distance *AD* on the seventh line and posted a green flag.
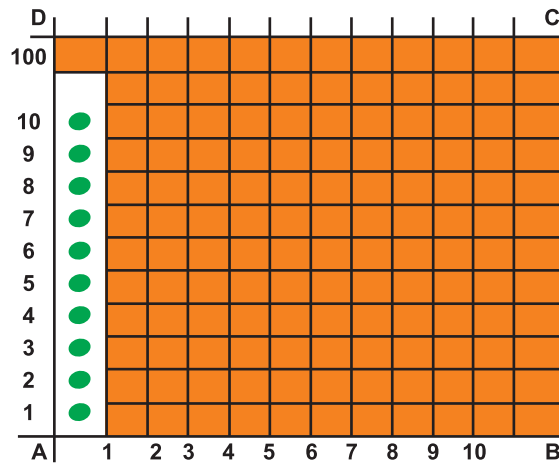


(i) What are the coordinates of red flag?

(ii) What are the coordinates of green flag?

(iii) What is the mirror image of green flag along x-axis and along y-axis.

(iv) Find the difference of ordinates and abscissa of red flag and green flag.

29. The diagram shows a model of pyramid placed on a cartesian plane in a mathematics lab in a school. Based on the diagram, answer the following questions.
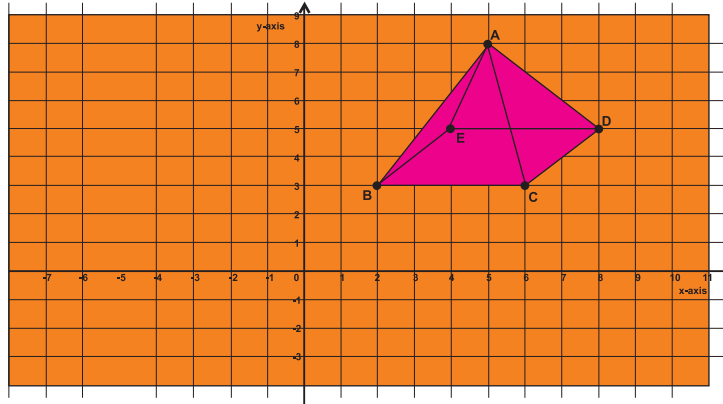
(i) What are the coordinates of the axis of the pyramid?

(ii) What is the perpendicular distance between the edges of B*C* and *ED*?

(iii) If the pyramid is moved 2 units to the right, what will be the coordinates of vertex *D*?

(iv) If the pyramid is moved 3 units below its actual position, what will be the coordinates of vertex B?

(v) If the vertex B would lie on the origin, what will be the coordinates of vertex *E*?

**30.** The municipal corporation decides to open a school in the town. The corporation chooses a plot *ABCD* in the town area to build the school. But this plot belongs to Amar singh, who gets agreed to exchange it with the triangular plot *PQR* outside the town border. The coordinates of both the plots *ABCD* & *PQR* are shown in the cartesian plane as below:
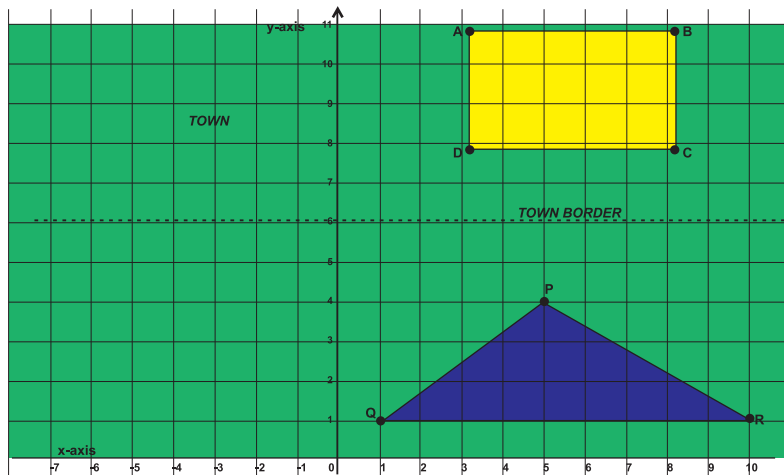


(i) What are the coordinates of vertex *C*?

(ii) What is the area of rectangular plot *ABCD*?

(iii) What is the area of triangular plot *PQR*?

(iv) Find the ratio of $Ar(ABCD)$ to $Ar(PQR)$.

**31.** A group of students decided to make project on statistics. They are collecting the heights ( in cm) of their 51 girls of Class IX-*A,B* and C of their school. After collecting the data, they arranged the data in the following frequency distribution table form:

| Height (in cm) | No. of girls |
|---|---|
| 135-140 | 4 |
| 140-145 | 7 |
| 145-150 | 18 |
| 150-155 | 11 |
| 155-160 | 6 |
| 160-165 | 5 |

Based the information, answer the following.

(i) Which is the class interval with highest frequency?

(ii) How many students of the height less than 155 cm?

(iii) How many students of the height 150 cm or above are there?

Or

How many students of the height more than 140 cm but less them 160 cm?

**32.** The following bar graph represent the heights (in cm) of 50 students of class IX of a particular school.
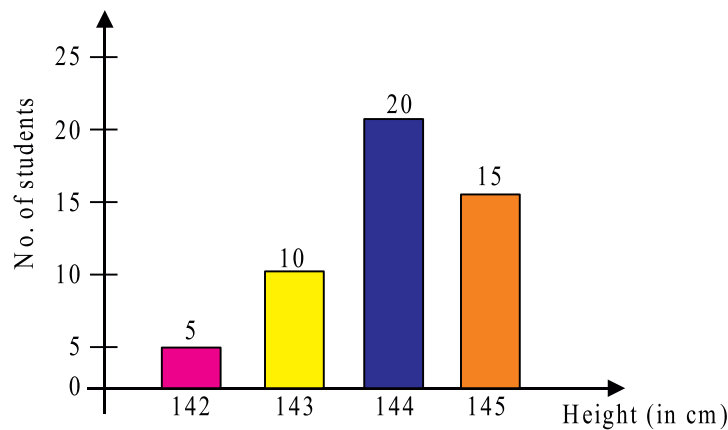


(i) What is the percentage of the total student whose height is more than 142 cm?

(ii) How many students in the class have maximum height?

(iii) How many students have their height between 142 cm and 145 cm.

Or

What is the range of the data?

# Answer

1.   (i)    $x + 2y = 100$

    (ii)   None

    (iii)  25

    (iv)  Less than a equal to 25

2.   (i)    ₹ 16

    (ii)   15 days

    (iii)  $3x - y = 5$

    (iv)  31

3.   (i)    36.5

    (ii)   98.6

    (iii)  IV

    (iv)  97.7 and 99.5

4.   (i)    96°

    (ii)   5 cm

    (iii)  24°, 28º

         Or

         96, 192

5.   (i)    70°

    (ii)   Interior angles

    (iii)  110°, 70°

         Or

         180°, 290º

6.   (i)    120°

    (ii)   250°

    (iii)  110°, None of these

         Or

         50°

7.   (i)   $\triangle ADC$

    (ii)   *SAS* congraency criteriab

    (iii)   *BC = CD*

8.   (i)   Scalene triangle

    (ii)   yes, triangles congrunent by *SSS* congnency criteria.

    (iii)   *BC = EF*

    (iv)   $\angle A = \angle D$

9.   (i)   Rhom bus

    (ii)   *AB = CD* & *KN = JO*

    (iii)   $\angle AFY = 70\text{-}56$

10.   (i)   CD=5.5 cm, BC=3 cm

    (ii)   60°

    (iii)   120°

    (iv)   3 cm

11.   (i)   $\sqrt{3}$

    (ii)   7 cm

    (iii)   8 cm

    (iv)   $4\sqrt{2}$ cm

12.   (i)   80°

    (ii)   24 m

    (iii)   50°

13.   (i)   20 m

    (ii)   30 m

    (iii)   $\angle BGC = 120°$ and $\angle ABQ = 30°$

    (iv)   $20\sqrt{3}$ m

14. (i) 2 : 1

    (ii) 4 m

    (iii) 1.4 m

    (iv) 9.6 m

15. (i) $a + 25°$

    (ii) 55°

    (iii) 280°

    (iv) 10 cm

    (v) 8 cm

16. (i) $16000\sqrt{2}$ cm²

    (ii) 19200 m²

    (iii) 19200 m², 1 : 1

    Or

    61000 sq.m, 6.1 Hectares

17. (i) 24 cm²

    (ii) $\sqrt{15}$ cm²

    (iii) $\sqrt{3}$ cm², $\sqrt{3}$ cm

    Or

    $(48 - \sqrt{15} - \sqrt{3})$ cm²

18. (i) 210 m

    (ii) 420 m

    (iii) ₹ 8300

    Or

    5600 m²

19. (i) 55.44 sq.cm

    (ii) 0.002772 sq.m

    (iii) ₹ 277.20

    (iv) 38.808 ml

20. (i) 20.109 cm

    (ii) 146.5 cm

    (iii) ₹ 2.11

    (iv) 92.4 cm³

21. (i) 4.2 cm

    (ii) 155.23cm²

    (iii) 997.92 cm²

    (iv) 620.92 cm²

22. (i) It is an irrational number

    (ii) Rational number

    (iii) P ≠ 2, 5 Rational

    Or

    4

23. (i) 4

    (ii) $\dfrac{-3}{4}$

    (iii) $\dfrac{-3}{4}$

    Or

    $\dfrac{3}{4}$, Integers

24. (i) $\sqrt{2}$ units

    (ii) $\sqrt{3}$ units

(iii) $\dfrac{\sqrt{2}}{2}$ , Irrational

Or

$\dfrac{\sqrt{6}}{3}$

25. (i) $(2x + 1)(x - 1)$

(ii) 10

(iii) $(x - 1)$

Or

$\dfrac{1}{2}$

26. (i) quadratic

(ii) $(x + 4)(3x + 2)$

(iii) $2(x - 1)$

Or

24

27. (i) y-axis

(ii) shop and school

(iii) shop (10, 4) Bank (4, 10)

(ordinate of shop) – (abscissa of bank) = 4 – 4 - 0

(iv) School and office school (–8, 4) office (–12, 8)

28. (i) (3, 25)

(ii) (7, 20)

(iii) along x-axis (7, –20) along y-axis (–7, 20)

(iv) ordinate difference = 25 – 20 = 5

abscissa difference = 3 – 7 = –4

29. (i) (5, 8)

(ii) 2 m

    (iii)    (10, 5)

    (iv)    (2, 0)

    (v)    (2, 2)

**30.**  (i)    (8,8)

    (ii)    15 sq.units

    (iii)    13.5 sq. units

    (iv)    10 : 9

**31.**  (i)    145 – 150

    (ii)    40

    (iii)    22

         Or

         42

**32.**  (i)    90 %

    (ii)    20

    (iii)    35

         Or

         3

# SAMPLE QUESTION PAPER-I
## MATHEMATICS (2022-23)
### Class-IX

**Time allowed : 3hrs**                                                                 **Max. Marks : 80**

**General Instructions:**

1. This question paper has 5 sections A, B, C, D and E.

2. Section A has 20 multiple choice questions (MCQs) carrying 1 mark each.

3. Section B has 5 short answer-I (SA-I) type questions carrying 2 marks each.

4. Section C has 6 short answer-II (SA-II) type questions carrying 3 marks each.

5. Section D has 4 long answer (LA) type questions carrying 5 marks each.

6. Section E has 3 case based integrated units of assessment (4 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.

7. All questions are compulsory. However, an internal choice in 2Qs of 2 marks, 2 Qs of 3 marks and 2 questions of 5 marks, 2 Qs of 3 marks and 2 Questions of 5 marks has been provided. An internal choice has been provided in the 2 marks questions of section E.

8. Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.

## Section-A

**Section A consists of 20 questions of 1 mark each.**

1. $\sqrt[4]{\sqrt[3]{3^2}}$ equals:

   (a) $3^{-1/6}$                                              (b) $3^{1/6}$

   (c) $3^{-6}$                                                (d) $3^6$

2. Sides of a triangle are in the ratio of 3 : 5 : 7 and its perimeter is 300 cm. Its area will be:

   (a) $1000\sqrt{3}$ sq. cm                                   (b) $1500\sqrt{3}$ sq. cm

   (c) $1700\sqrt{3}$ sq. cm                                   (d) $1900\sqrt{3}$ sq. cm

3. It is given that $\triangle ABC \cong \triangle FDE$ and $AB = 5$ cm, $\angle B = 40°$ and $\angle A = 80°$ then which one is true?

   (a) $DF = 5$ cm, $\angle F = 60°$                           (b) $DF = 5$ cm, $\angle E = 60°$

   (c) $DE = 5$ cm, $\angle E = 60°$                           (d) $DE = 5$ cm, $\angle D = 60°$

4. If $x^{1/3} + y^{1/3} + z^{1/3} = 0$ then which equation is correct

(a) $x^3 + y^3 + z^3 = 0$

(b) $x + y + z = 3x^{1/3} y^{1/3} z^{1/3}$

(c) $x + y + z = 3xyz$

(d) $x^3 + y^3 + z^3 = 3xyz$

5. When $P(x) = x^3 - 3x^2 + 5$ then what is the value of $P(-1)$

(a) 3

(b) $-1$

(c) 9

(d) 1

6. To rationalize the denominator of $\dfrac{1}{\sqrt{a}+b}$, we multiply this by

(a) $\dfrac{1}{\sqrt{a}+b}$

(b) $\dfrac{1}{\sqrt{a}-b}$

(c) $\dfrac{\sqrt{a}+b}{\sqrt{a}-b}$

(d) $\dfrac{\sqrt{a}-b}{\sqrt{a}-b}$

7. Find the value of $k$ for which $x = 1, y = 2$ is the solution of equation $2x + 3y = k$

(a) 5

(b) 6

(c) 7

(d) 8

8. If the point P lies in between M and N and C is mid point of MP, then:

(a) $MC + PN = MN$

(b) $MP + CP = MN$

(c) $MC + CN = MN$

(d) $CP + CN = MN$

9. In the given figure, ABCD is a parallelogram. Find the value of $x$
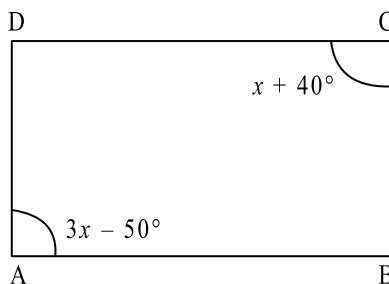


(a) $25°$

(b) $80°$

(c) $75°$

(d) $45°$

10. Distance of chord AB from the centre is 12 cm and length of the chord is 10 cm. Then the diameter of the circle is

(a) 26 cm

(b) 13 cm

(c) $\sqrt{244}$ cm

(d) 20 cm

**11.** What is the total surface area of a cone with radius is $r/2$ and slant height $2l$.

(a) $2\pi (l + r)$

(b) $\pi r \left( l + \dfrac{r}{4} \right)$

(c) $\pi r (l + r)$

(d) $2\pi r$

**12.** How many dimensions a point has?

(a) 1

(b) 0

(c) 3

(d) 2

**13.** The class mark of class 150–160 is

(a) 150

(b) 160

(c) 155

(d) 10

**14.** The class mark of a class is 10 and its class width is 6. The lower limit of the class is

(a) 5

(b) 7

(c) 8

(d) 8

**15.** Any point on the x-axis is of the form

(a) $(x, y)$

(b) $(0, y)$

(c) $(x, 0)$

(d) $(x, x)$

**16.** The centre of a circle lies in _____ of the circle.

(a) Exterior

(b) Interior

(c) Boundary

(d) None of these

**17.** Consecutive angles of a parallelogram are

(a) equal

(b) suphlementary

(c) complementary

(d) complete angle

**18.** The curved surface area of sphere is 616 cm². Its radius is

(a) 7 cm

(b) 5 cm

(c) 6 cm

(d) 8 cm

**Direction:** In the question number 19 and 20, a statement of assertion (A) is followed by a statement of Reason (R).

**Choose the correct option:**

**19.** Statement A (Assertion): $-7$ is a constant polynomial.

Statement R (Reason): Degree of a constant polynomial is zero.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)

(b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)

(c) Assertion (A) is true but reason (R) is false

(d) Assertion (A) is false but reason (R) is true

20. Statement A (Assertion) : Cuboid is a three dimenosional shape.

Statement B (Reason) : A solid has three dimensions

(a) Both assertion (A) and reason (R) are true and reason (R) is correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not correct explanation of assertion (A)

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true

## Section-B

**Section B consists of 5 questions of 2 marks each.**

21. Express $0.\overline{47}$ in the form of $\dfrac{p}{q}$

Or

Evaluate $27^{2/3} \times 27^{1/3} \times 27^{-4/3}$

22. Find the area of triangle two sides of which are 8 cm and 11 cm and the perimeter is 32 cm.

23. Find the points where the graph of equation $2x + 3y = 6$ cuts the $x$-axis and the $y$-axis.

24. Find the angle which is four times more than its complement.

Or

If the difference between two supplementary angles is 40° then find the smaller angle.

25. Write the equation of two lines passing through (3, 10).

## Section-C

**Section C consists of 6 questions of 3 marks each.**

26. Solve $\left[ 5\left( 8^{1/3} + 27^{1/3} \right)^3 \right]^{1/4}$

27. The sides of a triangular field are 40 cm, 9 cm and 41 cm. Find the number of flower beds that can be prepared in the field, if each flower bed, on an average needs 18 cm² space.

**28.** If $x^2 + y^2 = 49$ and $x - y = 3$ then find the value of $x^3 - y^3$.

**29.** Find the value of $a$ and $b$

$$\frac{\sqrt{2} + \sqrt{3}}{\sqrt{2} - \sqrt{3}} = a + b\sqrt{6}$$

**30.** Factorize $8x^3 + \sqrt{27}y^3$

Or

If $P(x) = x^2 - 3x + 2$ then find the value of $P(1) + P(-1) + P(0)$

**31.** In the given figure $l \parallel m$ and $n$ is the transversal find $x$.
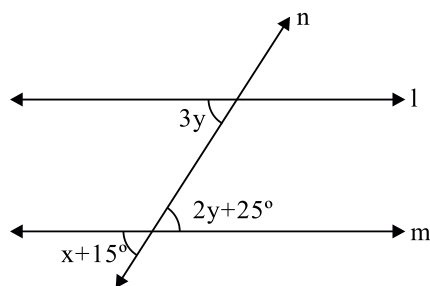


**32.** If $(x + 2)$ is a factor of polynomial $ax^3 + bx^2 + x - 6$ and get remainder of 4 in dividing polynomial by $(x - 2)$ then find values of $a$ and $b$.

**33.** Show that the quadrilateral formed by joining the mid-points of the sides of a square is also a square.

Or

In the given figure ABCD is a trapezium in which side AB is parallel to side DC and E is the mid-point of the side AD. If F is a point in the side BC such that line segement EF is parallel to DC then prove that $EF = \dfrac{1}{2}(AB + DC)$
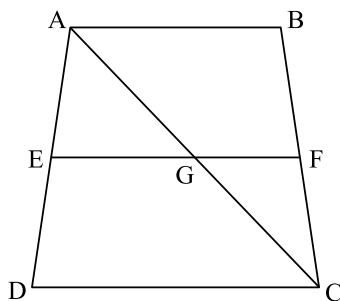


**34.** AC and BD are two chords of a circle that bisect each other.

Prove that:

(i)  AC and BC are diameter          (ii)    ABCD is a rectangle.

**35.** If the diameter of a sphere is reduced by 25% by how much percentage the surface area is reduced?

<div align="center">Or</div>

The inner and outer diameter of a hollow hemispherical container are 24 cm and 25 cm respectively. If the cost of painting 1 cm² of surface is ₹ 0.05, then what will be the cost of painting total surface of the container. (use $\pi = 22/7$)

## Case Study

**36.**
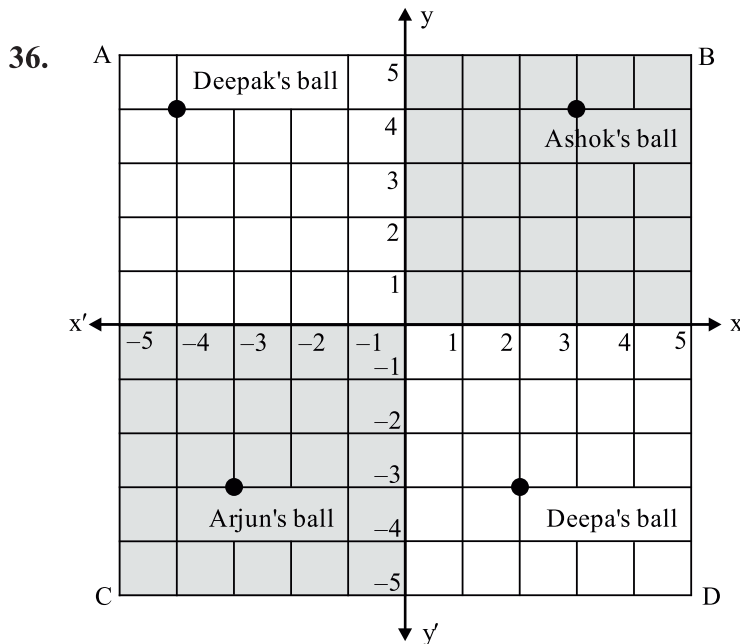


There is a square park ABCD in the middle a colony in Delhi. Four children Deepak, Ashok, Arjun and Deepa went to paly with their balls. The colour of the ball of Ashok, Deepak, Arjun and Deepa are red, blue, yellow and green respectively.

All four children roll their ball from centre point O in the direction of XOY, X'OY, X'OY, and XO'. Their balls stopped as shown in the above image.

Answer the following question: (*Attempt any one out of iii and iv*)

(i)   What the line XOX' is called?                                      (1 mark)

(ii)  What the centre point is called?                                   (1 mark)

(iii) What are the coordinates of the ball of Ashok and Deepa?          (2 marks)

(iv)  What is the distance of the Arjun's ball from X axis and Y axis?   (2 marks)

**37.** The COVID-19 pandemic, also known as the coronavirus pandemic, is an ongoing pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It was first identified in December 2019 in Wuhan, China.
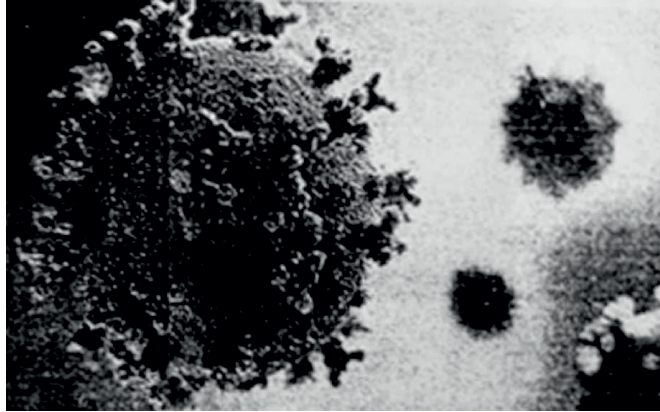


During survey, the ages of 80 patients infected by COVID and admitted in the one of the City hospital were recorded and the collected data is represented in the frequency distribution table.

| Age (in yrs) | No. of patients |
|:---:|:---:|
| 5–15 | 6 |
| 15–25 | 11 |
| 25–35 | 21 |
| 35–45 | 23 |
| 45–55 | 14 |
| 55–65 | 5 |

Based on the information answer the following questions: (*Attempt one out of iii and iv*)

(i)   Which class interval is of highest frequency.                              (1 mark)

(ii)  Which age group was affected the least?                                   (1 mark)

(iii) Draw histogram for the above data.                                        (2 marks)

(iv) Draw frequency polygon for the above data.                                 (2 marks)

38. Teena has a piture of triangles as given in the figure in which side AB is equal to side AD and ∠BAC is equal to ∠DAC.
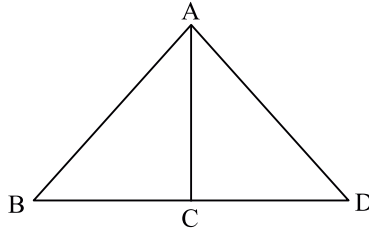


Based on the above information answer the following questions: (*Attempt one out of iii and iv*)

(i) Name the congruent triangles in the given figure. (1 mark)

(ii) By which property these triangles are tirangles? (1 mark)

(iii) Which angle of ΔADC is equal to ∠ABC of ΔABC and why? (2 marks)

(iv) Is CD = BC? if yes why? (2 marks)

## ANSWER

1. (b) $3^{1/6}$

2. (b) $1500\sqrt{3}$ sq. cm

3. (b) DF = 5 cm, ∠E = 60°

4. (c) $x + y + z = 3x^{1/3}y^{1/3}z^{1/3}$

5. (d) 1

6. (d) $\dfrac{\sqrt{a} - b}{\sqrt{a} - b}$

7. (d) 8

8. (c) MC + CN = MN

9. (d) 45°

10. (a) 26 cm

11. (b) $\pi r \left( l + \dfrac{r}{4} \right)$

12. (b) 0

13. (c) 155

**14.** (b) 7

**15.** (c) $(x, 0)$

**16.** (b) Interior

**17.** (b) Supplementary

**18.** (a) 7 cm

**19.** (a)

**20.** (a)

**21.** Let
$$x = 0.\overline{47} \qquad \qquad \qquad ...(1)$$
$$100x = 47.\overline{47} \qquad \qquad \qquad ...(2)$$

Eq. (2) - Eq. (1)
$$99x = 47$$
$$x = \frac{47}{99}$$

Or

$$27^{\frac{2}{3}+\frac{1}{3}-\frac{4}{3}} = 27^{\frac{3-4}{3}}$$
$$= 27^{\frac{-1}{3}}$$
$$= 3^{3 \times \frac{-1}{3}} = 3^{-1}$$
$$= \frac{1}{3}$$

**22.**
$$a = 8 \text{ cm}$$
$$b = 11 \text{ cm}$$
$$\text{Perimeter} = 32 \text{ cm}$$
$$8 + 11 + c = 32$$
$$c = 13$$
$$s = 16 \text{ cm}$$

$$\text{Area of } \Delta = \sqrt{16(16-8)(16-11)(16-13)}$$

$$= \sqrt{16 \times 8 \times 5 \times 3}$$

$$= \sqrt{2 \times 8 \times 8 \times 5 \times 3}$$

$$= 8\sqrt{30} \ \text{cm}^2$$

**23.** $x$-axis $(x, 0)$

$$2x + 3 \times 0 = 6$$

$$2x = 6$$

$$x = 3 \qquad\qquad\qquad (3, 0)$$

$y$-axis $(0, y)$

$$2 \times 0 + 3y = 6$$

$$3y = 6$$

$$y = 2 \qquad\qquad\qquad (0, 0)$$

**24.** Let angle $= x^\circ$

Complementary angle $= 90 - x^\circ$

$$x^\circ = 4(90 - x^\circ)$$

$$x = 72^\circ$$

Angles are $72^\circ, 18^\circ$.

<center>Or</center>

Let angle $= x^\circ$

Supplementary angle $= 180 - x^\circ$

$$x^\circ - (180 - x^\circ) = 40^\circ$$

$$x = 110^\circ$$

Supplementary angle $= 180^\circ - 110^\circ = 70^\circ$

**25.**
$$x + y - 13 = 0$$

$$y - x - 7 = 0$$

**26.**

$$\left[5\left(8^{\frac{1}{3}}+27^{\frac{1}{3}}\right)^3\right]^{\frac{1}{4}} = \left[5\left(2^{3\times\frac{1}{3}}+3^{3\times\frac{1}{3}}\right)^3\right]^{\frac{1}{4}}$$

$$= \left[5(2+3)^3\right]^{\frac{1}{4}} = (5\times5^3)^{\frac{1}{4}}$$

$$= 5^{4\times\frac{1}{4}} = 5^1 = 5$$

**27.**

$$a = 40 \text{ cm}$$

$$b = 9 \text{ cm}$$

$$c = 41 \text{ cm}$$

$$S = \frac{40+9+41}{2}$$

$$S = 45$$

$$\text{Area of } \Delta = \sqrt{45(45-40)(45-9)(45-41)}$$

$$= 180 \text{ cm}^2$$

$$\text{Number of beds} = \frac{180}{18} = 10$$

**28.**

$$x^2 + y^2 = 49$$

$$x - y = 3$$

$$(x - y)^2 = 32$$

$$x^2 + y^2 - 2xy = 9$$

$$49 - 2xy = 9$$

$$xy = 20$$

$$x^3 - y^3 = (x - y)(x^2 + y^2 + xy)$$

$$= 3(49 + 20)$$

$$= 207$$

**29.** $\dfrac{\sqrt{2}+\sqrt{3}}{\sqrt{2}-\sqrt{3}} \times \dfrac{\sqrt{2}+\sqrt{3}}{\sqrt{2}+\sqrt{3}} = \dfrac{\left(\sqrt{2}+\sqrt{3}\right)^2}{\left(\sqrt{2}\right)^2 + \left(\sqrt{3}\right)^2}$

$$= \dfrac{2+3+2\sqrt{6}}{2-3} = \dfrac{5+2\sqrt{6}}{-1}$$

$$= -5-2\sqrt{6} = a+b\sqrt{6}$$

$$a = -5,\ b = -2$$

**30.** $\qquad 8x^3 + \sqrt{27}y^3 = (2x)^3 + (\sqrt{3}y)^3$

$$a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$$

$$= (2x + \sqrt{3}y)((2x)^2 + (\sqrt{3}y)^2 - 2x \times \sqrt{3}y)$$

$$= (2x + \sqrt{3}y)(4x^2 + 3y^2 - 2\sqrt{3}xy)$$

Or

$$P(x) = x^2 - 3x + 2$$

$$P(1) = 1 - 3 + 2 = 3 - 3 = 0$$

$$P(-1) = (-1)^2 - 3(-1) + 2$$

$$= 1 + 3 + 2 = 6$$

$$P(0) = 0 - 3 \times 0 + 2 = 2$$

$$P(1) + P(-1) + P(0) = 6 + 2 = 8$$

**31.** $\qquad\qquad 3y = 2y + 25^\circ \qquad\qquad\qquad\qquad$ (AIA)

$$y = 25^\circ$$

$$x + 15^\circ = 2y + 25^\circ \qquad\qquad\qquad\qquad \text{(VOA)}$$

$$x + 15^\circ = 2 \times 25^\circ + 25^\circ$$

$$x + 15^\circ = 75$$

$$x = 75^\circ - 15^\circ$$

$$x = 60^\circ$$

**32.** $a = 0,\ b = 2$

**35.** 43.75% or ₹ 96.28

**36.** (i)  *x*-axis

    (ii)  Origin

    (iii) (3, 4) and (2 – 3)

    (iv) 3 units and 3 units

**37.** (i)  35–45 has highest frequency

    (ii) 55–65 has lowest frequency

       So least affected.

**38.** (i)  $\triangle ABC$ and $\triangle ADC$

    (ii)  SAS

    (iii) $\angle ADC$ By CPCT

    (iv) CD = BC by CPCT

**MATHEMATICS**

**Class-IX**

**Time allowed : 3hrs**                                               **Max. Marks : 80**

**General Instructions:**

1.   This question paper has 5 sections A, B, C, D and E.

2.   Section **A** has 20 MCQs carrying 1 mark each.

3.   Section **B** has 5 questions carrying 2 marks each.

4.   Section **C** has 6 questions carrying 3 marks each.

5.   Section **D** has 4 questions carrying 5 marks each.

6.   Section **E** has 3 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.

7.   All questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Qs of 2 marks has been provided. An internal choice has been provided in the 2 marks questions of section E.

8.   Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.

## Section-A

**Section A consists of 20 questions of 1 mark each.**

1.   Rational number $\dfrac{2}{25}$ is equal to

(a)   0.08                                           (b)  0.8

(c)   0.02                                           (d) 0.2

2.   The value of $125^{-1/3}$ is

(a)   $\dfrac{1}{125}$                                  (b) $\dfrac{1}{15}$

(c)   $\dfrac{1}{5}$                                     (d) $\dfrac{1}{25}$

3.   Zeros of the polynomial $P(x) = (x+1)(x+2)$ are:

(a)   −1, 2                                          (b) −1, −2

(c)   1, −2                                          (d) 1, 2

**4.** If $(x-1)$ is a factor of $x^2 + ax + 5$, then the value of $a$ is

    (a)   6                                     (b) 1

    (c)   −6                                  (d) 3

**5.** The linear equation $7x - 3y = 10$ has

    (a)   a unique solution                  (b) two solution

    (c)   No solution                       (d) Infinite many solutions

**6.** If $(1, 2)$ is a solution of the linear equation $4x + y = k$ then the value of $k$ is

    (a)   6                                    (b) −6

    (c)   5                                     (d) −5

**7.** If a point C lies between two points A and B such that AC = BC, then
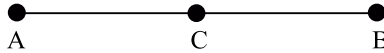


    (a)   AC = AB                       (b) $AC = \dfrac{1}{2} AB$

    (c)   $AB = \dfrac{1}{2} AC$              (d) $AC = \dfrac{1}{2} AB$

**8.** The angle which is four times its complement is

    (a)   45°                                  (b) 60°

    (c)   72°                                 (d) 18°

**9.** In figure, AB = AC and BE = CD. If $\triangle ACD \cong \triangle ABE$ then AD =
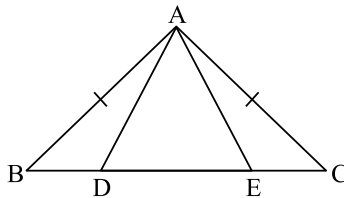


    (a)   AC                                  (b) AE

    (c)   AB                                  (d) None of these

**10.** The angles of a quadrilateral are in the ratio $1 : 2 : 2 : 4$ then respective angles of the quadrilateral are

    (a)   36°, 72°, 108°, 144°        (b) 120°, 100°, 80°, 60°

    (c)   60°, 80°, 100°, 120°        (d) 40°, 80°, 80°, 100°

11. The quadrilateral formed by joining the mid points of the sides of a quadrilateral PQRS, taken in order, is a rectangle, if

  (a) PQRS is rectangle
  (b) PQRS is a parallelogram
  (c) Diagonals of PQRS are perpendicular
  (d) Diagonals of PQRS are equal

12. A chord 6 cm long is drawn in a circle with a diameter equal to 10 cm, then its perpendicular distance from centre, is

  (a) 5 cm
  (b) 4 cm
  (c) 6 cm
  (d) 7 cm

13. In figure, $\angle ABC = 69°$, $\angle ACB = 31°$, then $\angle BDC$ is
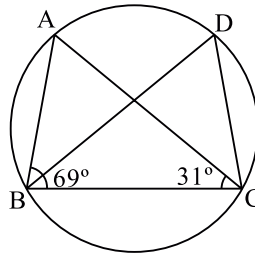


  (a) 60°
  (b) 80°
  (c) 90°
  (d) 100°

14. Area of an equilateral triangle of side $l$ units is

  (a) $\dfrac{\sqrt{3}}{4}l^2$
  (b) $\dfrac{\sqrt{3}}{2}l^2$
  (c) $\dfrac{\sqrt{3}}{2}l$
  (d) $\dfrac{\sqrt{3}}{4}l$

15. The volume of the sphere with diameter $3r$ units is

  (a) $\dfrac{4}{3}\pi r^3$
  (b) $\dfrac{9}{2}\pi r^3$
  (c) $36\pi r^3$
  (d) $\dfrac{27}{2}\pi r^3$

16. The volume of the right circular cone with radius 6 cm and height 3.5 cm is

  (a) 127 cm³
  (b) 132 cm³
  (c) 137 cm³
  (d) 147 cm³

**17.** The class mark and class size of a class interval are 12.5 and 5 respectively, then the class interval is

(a) 10–15

(b) 12–13

(c) 11–14

(d) 8–13

**18.** In the class intervals 15–25, 25–35, the number 25 is included in

(a) 15–25

(b) 25–35

(c) both the interval

(d) None of the intervals

**Direction:** In the question number 19 and 20, a statement of assertion (A) is followed by a statement of Reason (R).

Choose the correct option:

**19.** Statement A (Assertion): Degree of the polynomial $7y^5 - 2y^3 + 7y + 1$ is 5

Statement R (Reason): The highest power of the variable in a polynomial is called the degree of the polynomial

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct enplanation of assertion (A)

(b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)

(c) Assertion (A) is true but reason (R) is false

(d) Assertion (A) is false but reason (R) is true

**20.** Statement A (Assertion): In $\triangle ABC$, $\angle B = 70°$ and in $\triangle PQR$, $\angle P = 70°$ so $\angle B = \angle P$

Statement R (Reason): All right angles are equal

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct enplanation of assertion (A)

(b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)

(c) Assertion (A) is true but reason (R) is false

(d) Assertion (A) is false but reason (R) is true

## Section-B
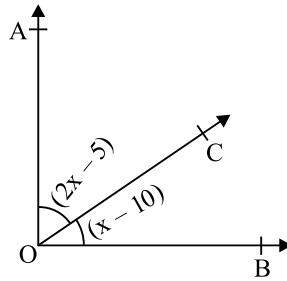
**Section B consists of 5 questions of 2 marks each.**

**21.** Simplify: $(16^{-1/5})^{5/2}$

Or

Simplify : $(\sqrt{5} - 2)(\sqrt{3} - \sqrt{5})$

22. If the point $(2k - 3, k + 2)$ lies on the graph of equation $2x + 3y + 15 = 0$, find the value of $k$.

23. Total number of legs in a herd of goats and hens is 40. Represent this situation in the form of a linear equation in true variables.

24. Find the area of an isosceles triangle each of whose equal sides is 13 cm and whjose base is 24 cm.

25. In figure AO $\perp$ OB, find $\angle$AOC and $\angle$BOC.



Or

In figure, if ACB is a straight line and $x : y = 2 : 1$. Find the value of $x$ and $y$.
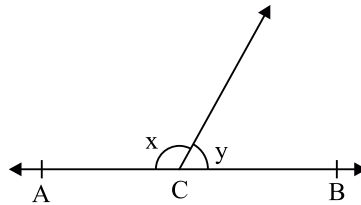


## Section-C

**Section C consists of 6 questions of 3 marks each.**
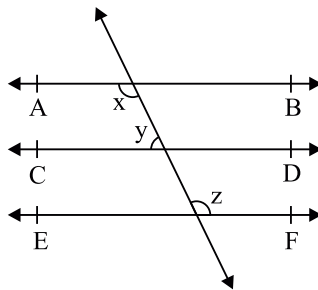
26. Evaluate: $\sqrt[4]{16} - 6\sqrt[3]{343} + 18\sqrt[5]{243} - \sqrt{196}$

27. Simplify: $\left(\sqrt{7} - \sqrt{2}\right)^2 - \left(\sqrt{7} + \sqrt{2}\right)^2$

28. If $a + b + c = 4$ and $a^2 + b^2 + c^2 = 14$ find $ab + bc + ca$

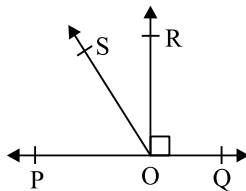**29.** Factorize : $(x - 7)^2 - 7(x^2 - y^2) + 12(x + y)^2$

Or

Simplify: $\dfrac{(a^2 - b^2)^3 + (b^2 - c^2)^3 + (c^2 - a^2)^3}{(a - b)^3 + (b - c)^3 + (c - a)^3}$

**30.** In figure, if AB ‖ CD, CD ‖ EF and $y : z = 3 : 7$ find $x, y$ and $z$



Or

In figure, POQ is a line. Ray OR is perpendicular to line PQ . OS is another ray lying between rays OP and OR.



Prove that $\angle ROS = \dfrac{1}{2}(\angle QOS - \angle POS)$

**31.** A triangular park in a city has dimensions 30 m, 26 m and 28 m. A gardener has to plant grass inside it at ₹ 1.50 per m². Find the amount to be paid to the gardener.

## Section-D

**Section D consists of 4 questions of 5 marks each.**

**32.** The polynomials $ax^3 - 3x^2 + 4$ and $2x^3 - 5x + a$, when divided by $(x - 2)$, leave the remainders $p$ and $q$ respectively. If $p - 2q = 4$, find the value of $a$.

**33.** Show that the bisectors of angles of a parallelogram form a rectangle.

Or

ABCD is a rhombus and P, Q, R and S are the mid-points of the sides AB, BC, CD and DA respectively. Show that the quadrilateral PQRS is a rectangle.

**34.** 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. Using the above theorem, find the values of $x$ in the given figure.
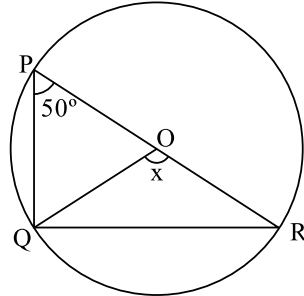


Or

Prove that the quadrilateral formed by the internal angle bisectors of any quadrilateral is cyclic.

**35.** A bus stop is barricaded from the remaining part of the road by using 50 hallow cones made of recycled and board. Each one has a base diameter of 40 cm and height 1 m. If the outer side of each of the cones is to be painted and the cost of painting is ₹ 12 per m², what will be the cost of painint all these cones?
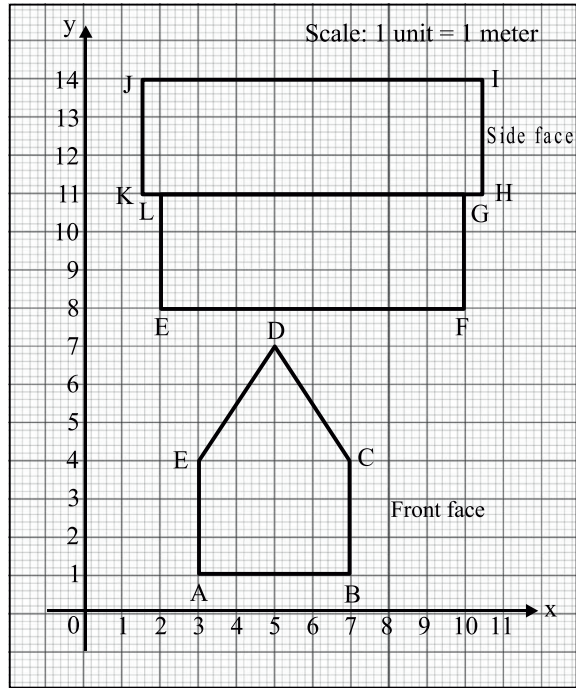
[use $\pi = 3.14$ and take $\sqrt{1.04} = 1.02$ ]

## Section-E

**Case study based questions are compulsory.**

**36.** Side and Front face of the house are plotted on the graph sheet.

Scale: 1 unit = 1 meter

(i) Find the coordinates of the points A and B.

(b) Mention the points whose coordinates are (5, 7) and (2, 11).

(c) Find the area of the pentagon ABCDE.

**37.** During a rangoli competition Ananya made a geometrical rangoli as shown below:
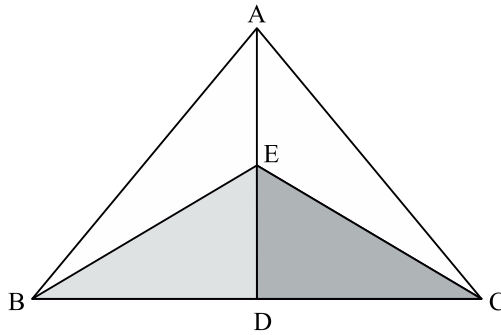


On measuring the dimensions it was found that AB and AC are equal and BE and CE are also equal.

(a) Which side is common in triangles AEB and AEC?

(b) Are triangles BED and AEC congruent?

(c) Show that $\angle BED = \angle CED$

**38.** The award list of a mid term examination of Mathematics of class IX A is shown below:

| Roll No. | Marks (out of 80) | Roll No. | Marks (out of 80) |
|---|---|---|---|
| 1 | 32 | 16 | 44 |
| 2 | 35 | 17 | 65 |
| 3 | 61 | 18 | 72 |
| 4 | 68 | 19 | 78 |
| 5 | 72 | 20 | 15 |
| 6 | 73 | 21 | 30 |
| 7 | 54 | 22 | 32 |
| 8 | 17 | 23 | 35 |
| 9 | 28 | 24 | 54 |
| 10 | 16 | 25 | 62 |
| 11 | 32 | 26 | 66 |
| 12 | 35 | 27 | 5 |
| 13 | 32 | 28 | 19 |
| 14 | 38 | 29 | 76 |
| 15 | 34 | 30 | 9 |

(a) What are the minimum and the maximum marks obtained?

(b) Find the range of data.

(c) Taking class interval 0-10, 10-20 and so on, construct a frequency distribution table.

## ANSWERS

### Section-A

**1.** (a) 0.08

**2.** (c) $\dfrac{1}{5}$

**3.** (b) –1, –2

**4.** (c) –6

**5.** (d) Infinite many solution

**6.** (a) 6

**7.** (b) $AC = \dfrac{1}{2} AB$

**8.** (c) 72º

**9.** (b) AE

**10.** (d) 40º, 80º, 80º, 160º

**11.** (c) Diagonals of PQRS are perpendicular

**12.** (b) 4 cm

**13.** (b) 80º

**14.** (a) $\dfrac{\sqrt{3}}{4} l^2$

**15.** (b) $\dfrac{9}{2} \pi r^3$

**16.** (b) 132 cm³

**17.** (a) 10–15

**18.** (b) 25–35

**19.** (a)

**20.** (b)

## Section-B

**21.** $\dfrac{1}{4}$    Or    $\sqrt{15} - 5 - 2\sqrt{3} - 2\sqrt{5}$

**22.** $k = \dfrac{-15}{7}$

**23.** $2x + y = 20$

**24.** 60 cm²

**25.** $\angle AOC = 65º$; $\angle BOC = 25º$

Or

$x = 120º$; $y = 60º$

## Section-C

**26.** 0

**27.** $-4\sqrt{14}$

**28.** 1

**29.** $2(x + 2y)(3x + 5y)$

Or

$(a + b)(b + c)(c + a)$

**30.** $x = 126º$   $y = 54º$   $z = 126º$

**31.** ₹ 504

## Section-D

**32.** 4

**34.** $x = 100º$

**35.** ₹ 384.34 (approx)

## Section-E

**36.** (i)   A(3, 1) B(7, 1)

(ii)  D, L

(iii) 18 sq. units

**37.** (i)   AE

(ii)  No

**38.** (i)   5, 78

(ii)  73

(iii)

| C.I | 0–10 | 10–20 | 20–30 | 30–40 | 40–50 | 50–60 | 60–70 | 70–80 |
|-----|------|-------|-------|-------|-------|-------|-------|-------|
| f   | 2    | 4     | 2     | 9     | 1     | 2     | 5     | 5     |

## PRACTICE QUESTION PAPER-III
## MATHEMATICS
### Class-IX

**Time allowed : 3hrs**                             **Max. Marks : 80**

**General Instructions:**

1. This question paper has 5 sections A, B, C, D and E.

2. Section **A** has 20 multiple choice questions (MCQs) carrying 1 mark each.

3. Section **B** has 5 short answer-I (SA-I) type questions carrying 2 marks each.

4. Section **C** has 6 short answer-II (SA-II) type questions carrying 3 marks each.

5. Section **D** has 4 long answer (LA) type questions carrying 5 marks each.

6. Section **E** has 3 case based integrated units of assessment (4 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.

7. All questions are compulsory. However, an internal choice in 2Qs of 2 marks, 2 Qs of 3 marks and 2 questions of 5 marks, 2 Qs of 3 marks and 2 Questions of 5 marks has been provided. An internal choice has been provided in the 2 marks questions of section E.

8. Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.

### Section-A

**Section A consists of 20 questions of 1 mark each.**

1. A national number $\dfrac{5}{7}$ is equivalent to

   (a) $\dfrac{15}{17}$                                   (b) $\dfrac{25}{27}$

   (c) $\dfrac{10}{14}$                                   (d) $\dfrac{10}{27}$

2. The zero of the polynomial $p(x) = 2x + 5$ is

   (a) 2                                          (b) $\dfrac{2}{5}$

   (c) 5                                          (d) $\dfrac{-5}{2}$

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 less than its supplement?
   (a) 148°
   (b) 60°
   (c) 74°
   (d) 55°

7. In the given figure AD is the median then $\angle$BAD is
   (a) 70º
   (b) 55º
   (c) 110º
   (d) 35º
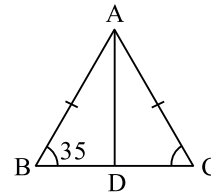
8. The radius of hemisphere is "$r$" what is its total surface area.
   (a) $\dfrac{2}{3}\pi r^3$
   (b) $3\pi r^2$
   (c) $2\pi r^2$
   (d) $\dfrac{4}{3}\pi r^2$

9. The sides of a triangle are in the ration 3 : 4 : 5. If its perimeter is 36 cm. Then what is its area?
   (a) 72 cm²
   (b) 67 cm²
   (c) 32 cm²
   (d) 54 cm²

10. 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
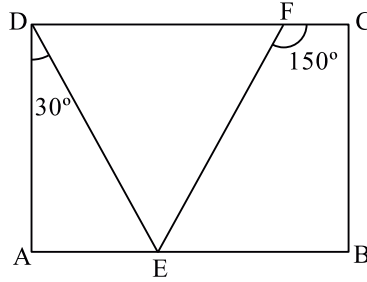
**11.** In the given figure if O is the centre of a circle, then measure of ∠ACB is
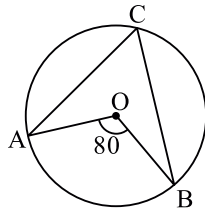


(a)  80°                                 (b) 40°

(c)  160°                                (d) 35°

**12.** $\sqrt[4]{\sqrt[3]{2^2}}$

(a)  $2^{-1/6}$                          (b) $2^{-6}$

(c)  $2^{1/6}$                           (d) $2^6$

**13.** The angle of the semicircle is

(a)  120°                                (b) 60°

(c)  180°                                (d) 90°

**14.** The class mark of the class 90–120 is

(a)  90                                  (b) 105

(c)  115                                 (d) 120

**15.** Which of the following is the formula for the volume of the sphere?

(a)  $\dfrac{1}{3}\pi r^3$               (b) $\dfrac{2}{3}\pi r^3$

(c)  $\pi r^3$                           (d) $\dfrac{4}{3}\pi r^3$

**16.** The number of line segments determined by three collinear points is.........

(a)  Only one                            (b) two

(c)  three                               (d) none of the these

**17.** 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

**18.** In the given figure ABCD is a rectangle m$\angle$ADE = 30º and m$\angle$CFE = 150º. What is m$\angle$DEF



(a) 90º                                   (b) 75º

(c) 110º                                 (d) 85º

**19.** Direction : In the question no. 19 and 20 a statement of assertion (A) is followed by a statement of reason (A) choose the correct option.

Statement A (Assertion): There can be infinite number of lines that can be drawn through a single point.

Statement R (Reason): From this point we can draw only two lines.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)

(b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)

(c) Assertion (A) is true but reason (R) is false

(d) Assertion (A) is false but reason (R) is true

**20.** Statement A (Assertion): Degree of a non-zero constant polynomial is zero.

Statement R (Reason): Polynomials having two terms are called binomials.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)

(b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)

(c) Assertion (A) is true but reason (R) is false

(d) Assertion (A) is false but reason (R) is true

## Section-B

**Section B consists of 5 questions of 2 marks each.**

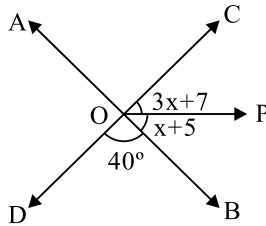**21.** Find the value of $x$ if $(\sqrt{3})^x = 3^7$

Or

Add : $\sqrt{125} : 2\sqrt{27}$ and $-5\sqrt{5} - \sqrt{3}$

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

**23.** Write the coordinates of the point where the graph of the equation $5x + 2y = 10$ intersects both the axes.

**24.** In the given figure AB and CD are two straight lines intersecting at O and OP is a ray. What is the measure of $\angle AOD$? Also find the value of $x$.



OR

Find the angle which is four times more than its complement.

**25.** Find the area of an equilateral triangle whose sides are 4 cm each.

## Section-C

**Section C consists of 6 questions of 3 marks each.**

**26.** Evaluate: $\dfrac{2^{38} + 2^{37} + 2^{36}}{2^{39} + 2^{38} + 2^{37}}$

**27.** Find the value of $a$ if $\dfrac{6}{3\sqrt{2} - 2\sqrt{3}} - 3\sqrt{2} - a\sqrt{3}.$
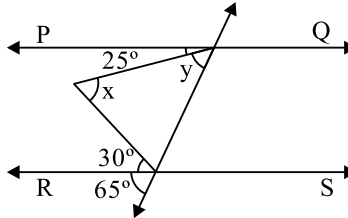
**28.** Factories : $64a^2 + 96ab + 36b^2$

Or

If $x^2 + y^2 = 49$ and $x - y = 3$, then find the value of $x^3 - y^3$.

**29.** Find the product $\left( p - \dfrac{1}{p} \right)\left( p + \dfrac{1}{p} \right)\left( p^2 + \dfrac{1}{p^2} \right)\left( p^4 + \dfrac{1}{p^4} \right)$
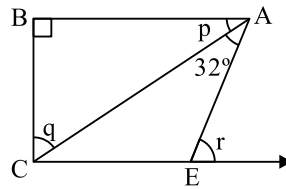
**30.** In the adjoining figure PQ $\parallel$ RS find $x$ and $y$.



Or

In the figure.

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



**31.** The perimeter of a triangle is 50 cm. One side of a triangle is 4 cm longer than the smaller side and the third side is 6 cm less than twice the smller side. Find the area of the triangle.

## Section-D

**Section D consists of 4 questions of 5 marks each.**

**32.** If $(x + 4)$ is a factor of the polynomial $x^3 - x^2 - 14x + 24$, find the other factors.

**33.** ABCD is a parallelogram. Side AB is produced on both sides to E and F as in figure such that BE = BC and AF = AD. Show that EC and FD when produced meets at right angle.
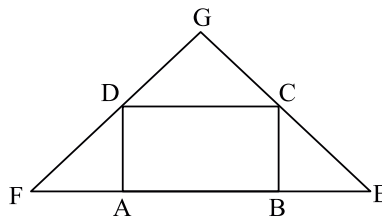
Or
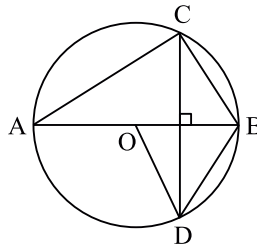
P is mid point of side CD of a parallelogram ABCD. A line through C parallel to PA intersects AB at Q and DA produced at R. Prove that DA = AR and CQ = QR.
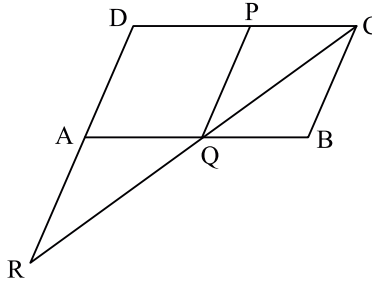


34. Prove that the angle subtended by an arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

Or

In figure, O is the centre of the circle, BD = OD and CD⊥AB. Find ∠CAB.



35. A hemispherical bowl is to be painted from inside at the rate of ₹ 20 per 100 m². The total cost of painting is ₹ 30.80. Find

(i) Inner surface area of the bowl.

(ii) Volume of air inside the bowl.

**CASE STUDY BASED QUESTIONS:**

36. During a Van Mahotsava week, 50 trees each were planted by 25 schools. After one month, it was found that following number of trees were survived in the schools.



| 30 | 27 | 26 | 32 | 40 |
|----|----|----|----|----|
| 32 | 26 | 25 | 30 | 20 |
| 38 | 30 | 29 | 15 | 21 |
| 25 | 27 | 21 | 20 | 29 |
| 42 | 40 | 37 | 16 | 22 |

(i) Find the mean of the data.

Or

Find the median of the data.

(ii) Find the mode of the data.

(iii) What are the number of schools where the number of surviving plants is more than the mean?

**37.** Ritesh opened the door at an angle of 43° to enter the class. In the recess, he came out of the class by opening the door at an angle of 72°. After the recess, he again opened the door at 43° and entered the class. The door length is 80 cm.



Fig. 1    Fig. 2    Fig. 3
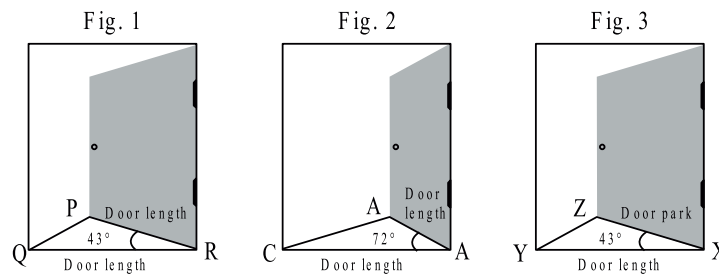
(i) The types of the triangle formed by opening the door is ........................ .

(ii) Which of the triangles are congruent?

Or

If figure 2, which is the largest side?

(iii) What is the measure of ∠P?

**38.** MNQ school provide tree education to underpreviliged children. Municipal corporation of a city wants to open an ABC school in the town on a rectangular plot ABCD as shown in figure. But this plot belongs to Amar Singh who has agreed to exchange it with a triangular plot PQR out of the town as shown in figure. Based on the above information, answer the following questions:
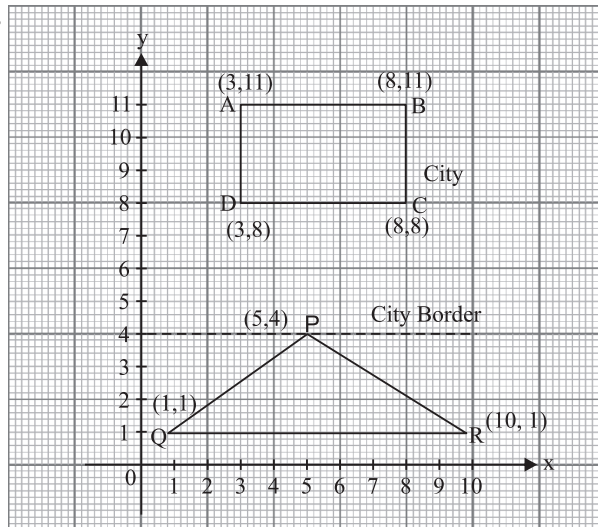
(i) What are the coordinates of vertex C of rectangular plot

(ii) What is the perpendicular distance of point C form x-axis

Or

What is length of BC. What will be the coordinates of foot of perpendicular drawn from D, on y-axis.

(iii) Find the ratio of Ar(ABCD) to Ar(PQR)

## ANSWERS

### Section-A

1.  (c) 10/14

2.  (d) $-5/2$

3.  (a) Linear

4.  (c) $(-1, 1)$

5.  (b) $y = 2$

6.  (c) $74°$

7.  (b) $55°$

8.  (b) $3\pi r^2$

9.  (d) $54 \text{ cm}^2$

10. (a) $38°$

11. (b) $40°$

12. (c) $2^{1/6}$

13. (c) $180°$

14. (b) $105°$

15. (d) $\dfrac{4}{3}\pi r^3$

16. (a) Only one

17. (d) 96

18. (a) $90°$

**19.** (b)

**20.** (c)

**21.** $x = 14$ or $5\sqrt{2}$

**22.** $P = \dfrac{40 - 10}{9}$

**23.** $(0,5)$ & $(2,0)$

**24.** $x = 32, 140°$ or $72°$

**25.** $4\sqrt{3}$ cm$^2$

**26.** $\dfrac{1}{2}$

**27.** $a = -2$

**28.** $(8a + 6b)^2$ or $207$

**29.** $P^8 - \dfrac{1}{q^8}$

**30.** $x = 55°$, y$=40°$ or $33°$, $57°$, $65°$

**31.** 13, 17, 20, 109.6 cm$^2$

**32.** $(x - 3)(x - 2)$

**34.** $30°$

**35.** 154 m$^2$, 251.5 m$^3$

**36.** (1) 28 or 27

(2) 30

(3) 12

**37.** (i) Isosceles

(ii) $\Delta PQR$ & $\Delta XYZ$ or $BC$

(iii) $68\dfrac{1}{2}°$

**38.** (i) $(8, 8)$

(ii) 8 units or 3 units

(iii) $(0, 8)$

# NOTES