**Class-ix**

**SA 1 Short Notes:**

**Chapter:1/Topics/Number system**

**Natural number**: It is a counting number which is starting from 1 and there is no ending. It is represented as ‘N’

 E.g. 1,2,3,4, ………………………………….

**Whole Number**: It is also a counting number which is starting from 0 and there is no ending. It is denoted as ‘W’

 E.g. 0,1,2,3, …………………………………

**Integers**: It is collection of negative of natural numbers and whole number. It is denoted as ‘I’.

 E.g. ……-3, -2, -1, 0, 1,2,3,……………

**Rational Number**: It is in the form of p/q , where q0, p and q are co-prime(common factor of p and q is 1) integers terminating decimal, repeating and non-terminating decimal numbers are called rational number.

 E.g. 0,1,-1, 2.356, 6.3456, 2.333333……., etc.

**Irrational Number**: It is not in the form of p/q, where q0, p and q are co-prime (common factor of p and q is 1) Integers and non-repeating and non terminating decimals are called irrational number.

 E.g. 1.0010010001…..

**Real Number**: It is the collection of all numbers. It is represented as R

Real Number

Rational Number

Irrational Number

Integers

(….-3, -2,-1,0,1,2,3………)

Non-Integers

(…..-1/2, 1/3, 1/4, ….)

Negative integers

(…-3.-2.-1.0………)

Non-Negative integers (Whole Number)

(0, 1, 2, 3, 4,…………..)

90

Zero

Natural number

(1,2,3,4, …………)

Terminating and non-terminating repeating decimals

Non-Terminating and

Non-Repeating decimals

**Questions Based on above Topics:**

* Is every natural number is whole number?
* Is every integers rational number?
* Is every rational number real number?
* Is every irrational number real numbers?
* Is every integers whole number?
* Is every whole number natural number?

**Insert Rational numbers between any two natural or rational numbers**

* We can insert infinite(uncountable) rational numbers between any two rational numbers.
* We have different methods to insert rational numbers.

2

3

**First Method**:- Insert 3 rational numbers between 2 and 3.

Step 1: First rational number between 2 and 3==

Step 2: Second rational number will be between 2 and = =

Step 3: Third rational number will be between and 3=

**Second Method**: Insert 3 rational numbers between 2 and 3.

* First of all we write 2 and 3 in the form of p/q. and
* We see the denominator of rational number are same or not, make the same by taking L.C.M. if it is not, if it is, then we multiply denominator as well as numerator by just one more than inserting number[question is asking insert 3, so we multiply(3+1=4)]
* , = ,
* We write three rational number between , = , ,

**Extra Questions**: Insert 7 rational number between and (Hint: take the L.C.M. of 3 and 4 do the second method)

Insert irrational numbers between two rational numbers:

We will understand by examples: Insert 3 irrational numbers between and

Sol: There are infinite irrational numbers between any two rational numbers. First of all convert decimals from rational number =0.666666…….. and 0.77777……………….

We write three irrational numbers between these two rational numbers

 0.6706700670000…. , 0.707007000………. and 0.757557555……

**Properties of irrational number**:

1. Sum of a rational number and an irrational number is irrational number.

E.g. 5+ is irrational number

1. Difference of a rational number and an irrational number is an irrational number.

E.g 2- 3- etc.

1. Product of a rational and an irrational number is an irrational number. E.g. 6 , 7 etc.
2. Quotient of a rational number and an irrational number is an irrational number.

e.g. , , etc.

 Repeating decimals or recurring: In number after decimal figures are repeating again and again is called is repeating or recurring. E.g. 3.333333………, 2.73232323232……

**Pure recurring**: Just after decimal a figure is repeating again and again is called pure recurring

 E.g. 4.65656565……

**Mixed recurring**: To leave one or more figures after decimal figure is repeating again and again.

 E.g. 2.32222222…. , 0.47525252525……………

**How to represent irrational numbers on the number line:** We show the representation of irrational numbers on the number line by help of a example

Example: Locate on the number line.

Solution: Draw a number line. Take O as origin on it represents O. Let OA= 1 unit (inch or cm) and draw AB perpendicular to OA such that AB=1 unit. Join OB. By Pythagoras theorem, OB= = =

With O as centre and OB as radius, draw an arc which cuts the number line at P. Then OP=OB= units. Thus, P represents on the number line.

**Extra Questions:**  on the number line.(Hint: similar to above example)

**Rationalization of irrational number:**- The process of multiplying a given irrational number by its rationalizing factor to get a rational number as product is called rationalization of the given irrational number.

“The product of two irrationals is a rational number, each is called the rationalizing factors of the other”

The following examples are given below of rationalizing factor.

1. Rationalising factor of is []
2. Rationalising factor of is
3. Rationalising factor of is

**Extra questions**: If both a and b are rational numbers and = , find the values of a and b.

(Hint: rationalize and compare rational and irrational both sides we get the values of a and b)

Laws of exponents for real numbers:-

Let a and b any two rational numbers and let m and n be integers , then we have,

1. amxan=am+n ii) , a
2. iv)
3. , b v)

**Rational numbers as exponent**: If a any positive real number and m be an integer while n be a natural number, then ,

Where is called the Radicand. is called radical and n is called the index of radical(It is always positive integer), the sign is called the radical sign.

E.g. we can express the following radicals in exponential form, which is given below

i) = ii) =

**Positive rational number as exponent:**

**Negative rational number as exponent:**

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**Positive rational number as exponent:**

**Negative rational number as exponent:**

**Surd:** A number which is remain in radical sign , e.g. , etc

**Chapter-2/ Topics/ Polynomials**

**Polynomial:-** A polynomial is an algebraic expression in which the variables involved have only non-negative integral(whole number) powers.

Standard form of Polynomial: P(x)=anxn+an-1xn-1+an-2xn-2+…………………….a2x2+a1x+a0

Where a0, a1……………………………an-2,an-1, an are called real numbers (real numbers are polynomial) and n is whole number.

**E.g.** 1=1x0, 2x2, 4y5+9y2, 6x+2x3 etc . are polynomials but x-1, = x1/2,, x+y+z are not polynomials.

**Term:** Each individual part of an expression or sum which stands alone or is converted to other parts of an expression by a plus(+) or minus sign(-). In expression 3x2+4x+9, there are three terms 3x2, 4x and 9.

**Coefficient of polynomial:** Refers to multiplying factor

**Example:** coefficients of x in 5x and 7xy; 5 and 7y.

**Degree of polynomial:** The highest power of the variable in polynomial is called degree.

 **E.**g. x3+x2+x5+5 , here power of maximum variable is 5 , so degree is 5

**Types of polynomial(According to degree)**

**Zero polynomial :** it is not defined e.g. 0

**Constant polynomial :** Degree of polynomial is zero.

**E.**g. 1=1x0 here power of variable is 0 so degree is 0 basis of this definition we can say all real numbers are zero polynomial except zero.

**Linear polynomial :** Degree of polynomial is one

 **E.**g. x, x+2, y+3, etc…………

**Quadratic polynomial :** Degree of polynomial is 2

 **E.**g. 4x2+5x+6, x2+1, etc……………

**Cubic polynomial :** Degree of polynomial is 3

 **E.**g. x2+9x3+5, y3, z3+z2, etc………..

 **Biquadratic polynomial :** Degree of polynomial is 4

 **E.**g. x4+x3+x+2, z4, etc……

**Remarks:** we can define polynomial with help of degree.

**Types of polynomial( According to Terms)**

**Monomial :** A polynomial having one term is called a monomial. E.g. 2x, 5y , 10 etc.

**Binomial :** A polynomial having two terms is called a binomial .

 **E.**g. 2x+3, 5y+200 etc.

**Trinomial** : A polynomial having three terms is called trinomial.

 E.g. 7z+2z2+3 , x100+x50+1 etc.

**Zero of polynomial** : A real number ‘a’ is a zero of a polynomial P(x), if P(a) =0

 E.g. Find the zero of the polynomial P(x)=2x+3

 2x+3=0, x=-3/2

**Remainder theorem** : Let P(x) be any polynomial of degree greater than or equal to 1 and let ‘a’ be any real number. If the polynomial P(x) is divided by linear polynomial (x-a), then the remainder is P(a).

**Factor theorem** : If P(x) is a polynomial of degree greater than or equal to 1 and a is any real number, then (i) (x-a) is a factor of P(x), if P(a)=0 (ii) P(a)=0, if (x-a) is factor of P(x)

**Extra questions** : 1. When ax3+9x2-4x-8 is divided by x-3, then remainder is -20, find the value of a

 (Hint: Use remainder theorem)

 2. If the polynomials az3+4z2+3z-4 and z3-4z+a. Leave the same remainder when divided by z-3. Find the value of z. (Hint: Use remainder theorem in both polynomial)

**Factorization of quadratic polynomials**:

We have the following procedure for factorizing the quadratic polynomial ax2+bx+c, where a, b, c0

1. Rewrite the quadratic polynomial in standard form (ax2+bx+c), if not already in the form.
2. Find the product of constant term and coefficient of x2, i.e. axc=ac
3. (a) observe that, if ac is positive(+ve), then the factors p and q of ac such that p+q=b

(b) If ac is negative(–Ve) . Then find two factors p and q of ac such that p-q=b

1. Split the middle term into two terms with coefficients p and q.
2. Factorize the four terms by grouping.

**Factorization of cubic polynomials**:

**Algebraic identities:**

1. (x+a) (x+b) = x2+(a+b)x+ab
2. (a-b) (a+b) = a2-b2
3. (a+b)2 =a2+2ab+b2
4. (a-b)2 =a2-2ab+b2
5. (a3+b3) = (a+b) (a2-ab+b2)
6. (a3-b3) = (a-b) (a2+ab+b2)
7. (a+b)3 = a3+b3+3a2b+3b2a = a3+b3+3ab(a+b)
8. (a-b)3 = a3-b3-3a2b+3ab2 = a3-b3-3ab(a-b)
9. (a+b+c)2 = a2+b2+c2+2ab+2bc+2ca
10. (a+b)2 – (a-b)2 =4ab
11. a3+b3+c3-3abc=(a+b+c)(a2+b2+c2-ab-bc-ca) = ½(a+b+c)[(a-b)2 + (b-c)2 + (c-a)2]
12. If a+b+c=0, then a3+b3+c3 = 3abc
13. (a-)2 +2= = (a+)2 -2
14. =()3 -3
15. =()3 +3
16. a2+b2=(a+b)2 -2ab =(a-b)2 +2ab

**Extra question**: Simplify (Hint: use identity 6)

**Chapter -3/ Topics/Coordinate Geometry**

**Coordinate:** A set of numbers which locate a point, In general, two numbers are needed to locate a point in a plane and written as (x, y).

**Origin**: The intersecting point of Horizontal line and vertical line is called origin.The points of origin are (0, 0)

**Quadrant**: (1/4)th part of a plane divided by coordinate axes is known as a quadrant. The names are as follows first quadrant(x-coordinate and y-coordinate are in positive), second quadrant(x-coordinate is negative and y-coordinate is positive), third quadrant(x and y-coordinates are negative) and fourth quadrant(x-coordinate is positive and y-coordinate is negative)

**Abscissa**: X-coordinate (the first point of coordinate) .It is perpendicular distance from y-axis

**Ordinate**: Y-coordinate (the second point of coordinate). It is perpendicular distance from x-axis.

**Cartesian system**: the system consisting of the x-axis (Horizontal line) , y-axis(Vertical line) and the origin.

Equation of x-axis is Y=0 and Equation of parallel to x-axis is Y=K

 Equation of y-axis is X=0 and Equation of parallel to y-axis is X=K (Where K is arbitrary constant)

Fourth quadrant: (+, -)

X-coordinate is Positive and y-coordinate is Negative

Second quadrant: (-, +)

X-coordinate is negative and y-coordinate is positive

Third quadrant: (-, -)

Both coordinate is negative

O (0, 0)

First quadrant: Both coordinates are positive

(+, +)

x-axis or Horizontal line

X1

Y1

Y-axis or vertical line

**Chapter-5/Topics/Euclid’s Geometry**

**Axioms**: The basic facts which are taken for granted, without proof are called axioms. Following axioms are given below:

1. Thing which are equal to the same thing are equal to one another. That is if A=B and C=B then A=C
2. If equals are added and subtracted to equals the wholes are equal. If A=B, the A+C=B+C, A-C=B-C
3. Things which coincide (to occupy the same space) with one another are equal to one another.
4. The whole is greater than the part.
5. Things which are double of the same things are equal to one another. That is , if A=B, Then 2A=2B
6. Things which are halves of the same things are equal to one another. That is , if A=B, then A/2=B/2

**Postulates**: A statement whose validity is accepted without proof is called postulate.

1. A straight line may be drawn from any one point to any other point.
2. A terminated line can be produced indefinitely.
3. A circle can be drawn with any centre and any radius.
4. All right angles are equal to one another.
5. If straight line falling on two straight lines makes the interior angle 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 angles is less than two right angles.

**Statement:** A sentence which can be judged either true or false is called statement.

 E.g. The sum of angles to a quadrilateral is 3600, is true statement.

**Theorem**: A theorem is a statement that has been proven on the basis of previously statement.

**Corollary**: A proposition, whose truth can be easily be deducted from a preceding theorem is called its corollary.

**Point**: A point is a mark of position which has no length , no-breadth and no thickness.

**Plane**: A plane is a surface such that every point of the line – joining any tow points on it, lies on it.
**Line:** A line has no end points

**Ray**: A ray has one end point.

**Line segment**: A line has definite length.

**Collinear points**: Three or more than three points are said to be collinear, if they lie on the same line.

 A,B, and C are collinear but P, Q and R are not collinear.

**Parallel lines**: the straight lines which lie on the same plane and never intersect to each other.

AB and PQ are parallel lines



**Intersecting lines**: Two lines having a common point are known as intersecting line

**Concurrent lines**: Three or more lines passing through the same point is called concurrent lines.

**Perpendicular lines**: If two lines AB and CD intersect at right angle, then they are known as perpendicular lines.

A

B

C

D

**Circle**: It is a simple closed figure consisting of all points at a given distance from a fixed point is known as circle.

**Angle**: An is formed two line segments two rays have a common end point.angle

**Chapter-6/Topics/Lines and angles**

**Basic Terms and definition**:

**Angle**: An is formed two line segments two rays have a common end point.angle

**Interior of an angle**: The region lies interior of an angle

**Exterior of an angle**: Outer region of an angle.

Congruent: If the measures of the angles are same then they said to be congruent or equal angles.

Types of angles:

1. **Right angle**: The angle which measures equal to 900 is called a right angle.
2. **Acute angle**: The angle which measures less than 900 and greater than 00 (00<angle<900)
3. **Obtuse angle**: The angle which measures less than 1800 and greater than 900 (900<angle<1800)
4. **Straight angle**: The angle which measures equal to two right angle ( 2x900=1800)
5. **Reflex angle:** The angle which measures less than 3600and greater than 1800 (1800<angle<3600).
6. **Complete angle:** The angle which measure 3600.
7. **Complementary angle**: Sum of two angles is 900. They are called complementary angles.
8. **Supplementary angles**: If the sum of two angles is 1800. They are called supplementary angles.
9. **Bisector of an angle**: A ray is called the bisector of an angle if it divides the angle into two equal parts.
10. **Pair of angles**: (i) Adjacent angle (ii) Linear pair
11. Adjacent angle: Two angles are adjacent, if they have the same vertex, they have a common arm and other arms of these angles are an opposite sides of the common arm.

C

**B**

O

A

 And are adjacent angles

1. **Linear pair angles**: Two adjacent angles are said to be form a linear pair of angles, if their non-common arms are two rays

**B**

C

O

A

 And are linear pairs.

 + =1800( by linear pair)

**Axiom 6.1**: If ray stands on a line, then the sum of two adjacent angles so formed is 1800.

**Axiom 6.2**: If the sum of two adjacent angles is 1800, then the non-common arms of the angles form a line.

Parallel lines and a transversal line:-

A line which intersects two or more given lines at distinct points called transversal lines. l is parallel to m, and n is transversal line.

l

n

m

**Axiom 6.3**: If a transversal line intersects two parallel lines, then each pair of corresponding angles are equal.

**Axiom 6.4:** If transversal line intersects two lines such that pair of corresponding angles is equal, then two lines are parallel to each other. It is called converse of corresponding angles.

1. Corresponding angles i) ii) iii) iv)

**Theorem 6.1**: If a transversal line intersects two parallel lines, then each pair of alternate interior or exterior angles is equal.

**Theorem 6.2**: If a transversal intersects two lines such that a pair of alternate interior or exterior angles is equal , then the two lines are parallel.

1. Alternate interior angles i) ii)
2. Alternate exterior angles i) ii)

**Theorem 6.3**: If a transversal intersects two parallel lines, then each pair of interior angles on the same side of the transversal is supplementary

**Theorem 6.4**: If a transversal intersects two lines such that a point of interior angles on the same side of transversal line is supplementary, then the two lines are parallel.

1. + = 1800, + =1800 [interior angles on the same side of transversal line is supplementary.

**Vertically opposite angles**: Two angles are called a pair of vertically opposite angles , if their arms form two pair of opposite rays e.g. , , and from above figure.

**Theorem 6.5:** Sum of all interior angles in triangle is 1800.

**Theorem 6.6**: If a side of a triangle is produced, then the exterior angle so formed is equal to the sum of the two interior opposite angles.

**Extra questions**: 1. If a transversal line intersects two lines such that the bisectors of a pair of corresponding angles are equal then prove that two lines are parallel.

2. Prove that if two parallel lines are intersected by a transversal then bisectors of any two corresponding angles are parallel. (Hint: Use corresponding angles).

**Chapter-6/Topics/Triangles**

**Triangle**: It is simple closed figure made up of three line segments is called triangle.

**Kinds of triangles (according to their sides)**

1. Equilateral **triangle**: All sides and angles are equal.
2. **Isosceles triangle**: Two sides and its opposite angles are equal.
3. **Scalene triangle**: All sides and angles are unequal.

**Kinds of triangles (according to their angles)**

1. **Acute angle triangle**: Each angle of triangle is acute.
2. **Obtuse angle triangle**: At most one angle of triangle is obtuse.
3. **Right angle triangle**: At most one angle of triangle is right angle.

Some important terms related to the triangle:

 **Medians:** A median of a triangle is the line segment that joins a vertex to the mid-point of the opposite side.

**Centroid of the triangle:** All the medians of triangle intersect at point is called centroid of the triangle.

 **Altlitudes:** An altitude of a triangle is the line segment from a vertex of the triangle, perpendicular to the opposite side.

 **Orthocentr**e: The point of occurrence of the altitudes of a triangle is called the orthocenter of the triangle.

 **Circumcentre:** The point of concurrence of the perpendicular bisectors of the sides of a triangle is called the circumcentre of the triangle.

 **Incentre**: The angle bisectors of a triangle will all lie in the interior of the triangle, the incentre of a triangle always lies in its interior.

**Congruence**: If two geometrical figures coincide exactly, by placing one over the other, the figures are said to be congruent to each other. It is denoted as .

1. Two figures are congruent, if they have exactly the same shape and size.
2. Two line segments are congruent, if they have the same length.
3. Two angles are congruent, if they have same measures.
4. Two squares are congruent, if they have the same side length.
5. Two rectangles are congruent, if they have the same length and breadths.
6. Two circles are congruent, if they have the same radii.
7. Two equilateral triangles are congruent, if they have same measurements of side.
8. Two triangles are congruent, if three sides and three angles of one triangle are respectively equal to the corresponding three sides and three angles of the other.
9. **SSS (side-side-side) congruence condition**: Two triangles are congruent if three sides of one triangle are respectively equal to the three sides of the other.
10. **SAS (side-angle-side) congruence condition:** Two triangles are congruent if two sides and the included angle of one triangle are respectively equal to the two sides and included angle of the other.
11. **ASA (angle-side-angle) congruence condition**: Two triangles are congruent if two angles and the included side of one triangle are respectively equal the two angles and the included side of the other.
12. **RHS (right-hypotenuse-side) congruence condition**: Two right triangles are congruent if the hypotenuse and one side of one triangle are respectively equal to the hypotenuse and corresponding side of the other.
13. **CPCT** is short form of corresponding parts of congruence triangle. This CPCT is follow when two triangles are congruent to each other.

**Theorem 7.1**: Angles opposite to equal sides of an isosceles triangle are equal.

**Theorem 7.2**: The sides opposite to equal angles of a triangle are equal.

**Theorem 7.3**: If two sides of a triangle are unequal, the angle opposite to the longer side is larger.

**Theorem 7.4**: In triangle, the side opposite to the larger angle is longer.

**Theorem 7.5**: The sum of any two sides of a triangle is greater than the third side.

**Question**: Show that hypotenuse is longest side (use theorem 7.4)

**Chapter-12/Topics/ Heron’s formula**

**Introduction:** In this chapter we calculate area of triangle by using Heron’s formula

**Area of triangle**= ½ base x height

**Area of equilateral triangle**= (side)2

**Heron’s Formula**

**Area of triangle**=

Where s= semi perimeter of triangle, and a, b, &c are sides of triangle.

S==semi-perimeter of triangle.

**Class-IX**

**Subject: Mathematics**

**Chapter:4/Topics/Linear Equations in Two Variables**

**Linear equation in two variables**: An equation of the form ax+by+c=0, where a, b, c are real numbers, is called a linear equation in x and y(power of x and y is 1).

Example: 2x+36y=10, x-9y=0 etc.

**Solution of linear equation**: A linear equation in two variables has infinitely many solutions

We say that x=m and y=n is a solution of ax+by+c=0 if am+bn+c=c.

**Remarks**: we can write infinitely many linear equations in two variables with single solution. The graph of the equation is always straight.

**Graph of ax+by+c=0:**

**Equation of parallel to x-axis: Y=k, where k is any arbitrary constant**

**Equation of x-axis: y=0**

**Equation of parallel to y-axis: X=k. where k is any arbitrary constant**

**Equation of y-axis: X=0**

**Chapter:8/Topic/Quadrilaterals.**

**Quadrilaterals:** It is simple closed figure which is made up of four line segments. It has four angles, four vertices and two diagonals.

**Angle sum property**: Sum of all interior angles in quadrilateral is 3600

There are six types of quadrilateral:

1. **Parallelogram**  :
2. Opposite sides are equal and parallel
3. Opposites angles are equal
4. Diagonals are divided into two congruent triangles
5. Diagonals are bisect to each other
6. Sum of adjacent angles is 1800
7. **Rectangle**
8. All the properties of parallelogram hold in it.
9. Diagonals are equal
10. Each angle of rectangle is 900
11. **Rhombus**
12. All the properties of parallelogram hold in it.
13. Diagonals are bisecting at right angle.
14. All sides are equal.
15. **Square**
16. All the properties of rhombus hold in it.
17. All the properties of rectangle hold in it.
18. All the properties of parallelogram hold in it.
19. All angles, sides, diagonals are equal.
20. Diagonal are bisect at right angle.
21. **Kite**:
22. One pair of adjacent sides are equal.
23. One diagonal of kite bisect at right angle.
24. **Trapezium**
25. One pair of opposite sides are parallel

**Intercept theorem:** If there are three parallel lines and the intercepts made by them on one transversal are equal then the intercepts on any other transversal are also equal.

**Midpoint theorem**: The line segment joining the midpoints of any two sides of a triangle is parallel to the third side and equal to half of it.

**Converse of midpoint theorem**: The line drawn through the midpoint of one side of a triangle, parallel to another side, intersects the third side at its midpoint.

**Chapter: 9/Topic/ Area of parallelogram**

**Interior of triangle**: The part of the plane enclosed by a triangle is called the interior of the triangle.

**Triangular region**: The union of a triangle and its interior is called a triangular region.

**Polygonal Region**: The union of a polygon and its interior is called a polygon and its interior is called a polygonal region.

**Base and altitude of a parallelogram**:

**Base:** Any side of a parallelogram can be called its base.

**Altitude**: The length of the line segment which is perpendicular to the base from the opposite vertex is called the altitude or height of the parallelogram corresponding to the given base.

**Theorem1**: Parallelograms on the same base and between the same parallels are equal in area.

**Theorem 2:** Congruent polygon they must have equal in area. Converse need not be true.

**Theorem 3:** Triangles on the same base and between the same parallels are equal in area.

**Theorem 4**: If a triangle and a parallelogram are on the same base, and between the same parallels, then the area of the triangle is equal to half the area of the parallelogram.

**Theorem5**: The line segment joining the midpoints of a pair of opposite sides of parallelograms divides it into two equal parallelograms.

**Theorem6:** A median of a triangle divides it into two triangles of equal areas.

**Chapter: 10/Topics/Circles**

**Circle**: A circle is the locus of a point which moves in a plane in such a way that its distance from a given fixed point is always constant.

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**Terms related to circle:** AB and CD are diameters and OA, OB, OC and OD are radius.

**Radius**: A line segment joining the centre and a point on the circle is called its radius.

**Circumference**: The perimeter of a circle is called its circumference, it is denoted as C=2

 **Chord**: A chord of a circle is a line segment joining any two points on the circle.(Diameter=2x radius, is the longest chord of the circle).

**Secant**: A line which intersects a circle in two distinct points is called a secant of the circle.

**Tangent**: A line that intersects the circle in exactly one point is called a tangent to the circle.

**Point of contact**: The point at which the tangent meets the circle is called its point of contact.

**Interior of a circle**: The region consisting of all points lying on the circumference of a circle and inside it is called the interior of the circle.

**Exterior of a circle**: The region consisting of all points lying outside a circle is called the exterior of the circle.

**Circular region**: The region consisting of all points which are either on the circle or lie inside the circle is called the circular region or circular disc.

**Concentric circles**: Circle which have the same centre and different radii are called concentric circles.

**Arc of circle**: A continuous piece of a circle is called an of the circle.

**Semicircle**: A diameter of a circle divides it into two equal arcs. Each of these two arcs is called a semicircle.

**Minor and Major arcs of a Circle**: If the length of an arc is less than the length of the arc of the semicircle then it is called a minor arc, Otherwise it is a major arc . 

**Segment of circle**: The part of the circular region bounded by an arc and a chord, including the arc and, including the arc and the chord is called a segment of the circle.

**Alternate segment of a circle**: The minor and major segments of a circle are called the alternate segments of the circle.

**Sector of a Circle:** The region between two radii of circle and piece of circle (or arc).

**Quadrant of circle**: One fourth of circle is called quadrant of circle.

**Congruent circles**: Two circles are congruent if they have equal radius.

**Chord properties of circles:**

**Theorem1:** Equal chords of a circle subtend equal angles at the centre.

**Theorem2:** If the angles subtended by two chords at the centre of a circle are equal then the chord are equal.

**Theorem 3**: The line drawn through the centre of a circle to bisect a chord is perpendicular to the chord.

**Theorem 4:** The perpendicular from the centre of a circle to a chord bisects the chord.

**Theorem 5**: Equal chords of a circle are equidistant from the centre.

**Theorem 6**: There is one and only one circle passing through given non-collinear points.

**Theorem 7**: Equal chords of congruent circles are equidistant from the corresponding centres.

**Theorem 8**: The angle subtended by an arc of a circle at the centre is double the angle subtended by it by any point on the remaining part of the circle.

**Theorem 9:** The angle in a semicircle is a right angle.

**Theorem 10**: Angles in the same segment of a circle are equal.

**Theorem 11**: If a line segment joining two points subtends equal angles at two other points lying on the same side of the line segment then the four points are concyclic. i.e. lie on the same circle.

**Chapter: 11/Topics/Construction**

**To draw the bisector of a line segment:**

1. Draw a line segment AB=x unit
2. With A as centre and a radius equal to more than half of AB , draw two arcs, one above AB and the other below AB
3. With B as centre and the same radius, cutting the previously drawn arcs at points C and D respectively.
4. Join CD, interesting AB at a point P, then, CD bisects AB at the point.

**To draw the bisector of a given angle.**

1. Draw a line segment AB.
2. With A as centre and a small radius, draw an arc, cutting AB at P
3. With P as centre and the same radius as above, draw an arc, cutting the previous arc at Q.
4. Join AQ and produce it to any point C. Then, Angle=x0, where x is any given angle.
5. With P as centre and a convenient radius, draw and arc.
6. With Q as centre and with the same radius, draw another arc, cutting the previous arc at D
7. Join AD. Then AD is the required bisector of angle x.

**Chapter: 13/Topics/Volume and Surface area**

Formula of 2-dimensional shapes (which have two dimensions)

|  |  |
| --- | --- |
| Area of triangle= ½ base x height | Perimeter of triangle= sum of all sides |
| Area of equilateral triangle= x (side)2 | Perimeter of equilateral triangle=3 x sides |
| Area of rectangle= Length x Breadth | Perimeter of rectangle=2(length +Breadth) |
| Area of square= Side x Side | Perimeter of square= 4 x Side |
| Area of Parallelogram = Base x Height | Perimeter= 2 x Sum of adjacent sides |
| Area of rhombus= Base X height =1/2 x Length of first diagonal x Second diagonal  |  Perimeter=2 x Sum of adjacent sides |
| Area of trapezium= x sum of parallel sides x Height | Perimeter = sum of all sides |
| Area of simple quadrilateral= x (h1+h2) x length of diagonal , where h1 and h2 are altitudes from vertex to diagonal | Perimeter = sum of all sides |
| Area of circle= , where r is the radius of circle | Circumference of circle=2 r |

Formula of 3-Dimensional shape (which have three dimensions)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S.N. | Name of 3-d shapes | Volume  | Lateral surface/curved surface area of | Total surface or surface area |
| 1 | Cuboid | Length (l)x Breadth(b) x Height(h) | 2(l+b)h | 2(lb+bh+hl) |
| 2 | Cube | Edge(l) x Edge(l) x Edge(l) | 4l2 | 6l2 |
| 3 | Right circular cylinder | h, where h is height of Cylinder | 2 r h | 2 r h +2  |
| 4 | Right circular cone | h, where r is the radius of circular base , h is the height and l is the slant height |  r l |  r l +  |
| 5 | Sphere |  x  | 4 | 4 |
| 6 | Hemi- sphere |  x  |  | 3 |

 Area of the wall=2(l+b)h

 Area of the open box=2(l+b)h +lb

 Diagonal of cuboid=

**Chapter: 14/Topics/Statistics**

**Data**: The word data means information or set of given facts in numerical figures.

**Statistics**: It is the science which deals with the collection, presentation, analysis and interpretation of numerical data.

**Types of Data**:

**Primary Data**: The data collected by the investigator he or she with a definite plan in mind is known as primary data.

**Secondary Data**: The data collected by someone, other than the investigator are known as secondary data.

**Class interval**: Each group into which the raw data is condensed, is called a class interval.

**Class size**: The difference between the true upper limit and the true lower limit of class is called it class size.

**Class marks**: Average between lower limit and upper limit of class interval (Class mark=

**Range**: The difference between the maximum value and the minimum value of observation is called range.

**Frequency**: Observation is coming again and again.

**Cumulative frequency**: The cumulative frequency corresponding to a class is the sum of all frequencies up to and including that class.

**Arithmetic mean**: The average of a given set of numbers is called the arithmetic mean.()

Measures of central tendency

**Mean**: let n observations consist of values x1, x2, …….xn of a variable xi, occurring with frequencies f1, f2, ……fn, respectively. Then, the mean, , of these observation is given by

 ==

**Median**: First arrange the data in either ascending order or descending order.

 Let the total frequency be n.

1. If n is odd, then

Median=th term

1. If n is even , then

Median=

**Mode**: For an individual data, mode is the value of the variable which occurs most frequency.

**Relation of mode, mean and median**:

**Mode= 3(median)- 2(mean**)

**Chapter: 15 /Topics/Probability**

**Probability**: The words ‘most probably’, ‘chances’, doubt, etc. , show uncertainty or probability of occurrence of an event.

**Experiment**: An operation which can produce some well-defined outcomes, is called and experiment.

**Random experiment**: An experiment in which all possible outcomes are known and the exact outcome cannot be predicted in advance is called a random experiment.

**Trial**: By a trial, we mean performing a random experiment.

**Empirical probability**: Suppose we perform an experiment and let n be the total number of trials. The empirical probability of happening of an event E is defined as

 P (E) =

The probability of an even is always greater than or equal to zero and less than or equal to one.

Probability of happening + probability of not happening=1

**Extra questions**: Probability of Rohit pass in examination is 23%.What is the probability of Rohit fail in examination?

(**Hint**: Use Probability of pass + probability of fail=1)