**SA II**

**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$\ne 0$, b$\ne 0$, 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$πr$

 **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=$\frac{\sqrt{3}}{4}$ 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=$\frac{1}{2}$ x sum of parallel sides x Height | Perimeter = sum of all sides |
| Area of simple quadrilateral=$\frac{1}{2}$ 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= $π r^{2}$, where r is the radius of circle | Circumference of circle=2 $π$ 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 | $ Area of base ×height=π r^{2}$h, where h is height of Cylinder | 2 $π$ r h | 2 $π$ r h +2$ π r^{2}$  |
| 4 | Right circular cone | $\frac{1}{3}π r^{2}$h, where r is the radius of circular base , h is the height and l is the slant height | $π$ r l | $π$ r l + $π r^{2}$ |
| 5 | Sphere | $\frac{4}{3}$ x $π r^{3}$ | 4$ π r^{2}$ | 4$ π r^{2}$ |
| 6 | Hemi- sphere | $\frac{2}{3}$ x $π r^{3}$ | $$2 π r^{2}$$ | 3$ π r^{2}$ |

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

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

 Diagonal of cuboid=$\sqrt{l^{2}+b^{2}+h^{2}}$

**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=$\frac{lower limit+upper limit}{2})$

**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.($\frac{Sum of all obervations }{Total number of observations}$)

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, $\overbar{x}$, of these observation is given by

 $\overbar{x}$=$\frac{(f\_{1}x\_{1}+f\_{2}x\_{2}+f\_{3}x\_{3}+……….f\_{n}x\_{n}).}{f\_{1}+f\_{2}+………..f\_{n}}$=$\frac{\sum\_{i=1}^{n}f\_{i}x\_{i}}{\sum\_{}^{}f\_{i}}$

**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=$\frac{n+1}{2}$th term

1. If n is even , then

Median=$\frac{1}{2}\left[\left(\frac{n}{2}\right)th+\left(\frac{n+1}{2}\right)th\right]$

**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) =$\frac{Number of trials in which the event happened }{Total number of trials}$

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)