Class 9th (C.B.S.E.)

Mathematics Formulas (Cont.)

Chapter 8: Quadrilateral

A quadrilateral is a four-sided plane figure with four corners or vertices. Common types of quadrilaterals include rectangles, squares, trapezoids, and kites, as well as irregular or unclassified figures with four sides.

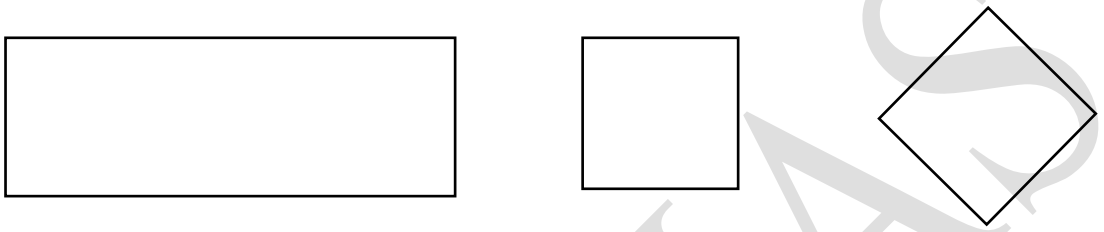


Fig.- Some Examples of Quadrilaterals

Here are some important points about quadrilaterals:

Sure! Here's the revised list without the dots at the beginning:

General Properties of Quadrilaterals:

- A quadrilateral is a four-sided polygon with four vertices and four edges.
- The sum of all angles in a quadrilateral is 360°.
- The area of a quadrilateral can often be calculated by dividing it into triangles or using specific formulas depending on the type of quadrilateral.
- The properties of a cyclic quadrilateral (one that can be inscribed in a circle) include the sum of opposite angles being 180°.

Properties of Parallelograms: In a parallelogram:

- The diagonals bisect each other.
- Opposite angles are equal.
- Opposite sides are equal.
- A diagonal of a parallelogram divides it into two congruent triangles.
- In a parallelogram, the angle bisectors of any two consecutive angles intersect at a right angle.

- If a diagonal of a parallelogram bisects one angle, it also bisects the opposite angle.

  The angle bisectors of a parallelogram form a rectangle.

Properties of Squares:

- A square is a type of parallelogram where all sides are equal and all angles are 90°.
- In a square, the diagonals bisect each other at right angles, are equal, and vice versa.

Properties of Rectangles:

- A rectangle is a parallelogram with all angles equal to 90°.
- Each of the four angles of a rectangle is a right angle.

Properties of Rhombuses:

- A rhombus is a parallelogram with all sides equal, but angles are not necessarily 90°.
- The diagonals of a rhombus are perpendicular to each other.

Properties of Trapezoids:

- A trapezoid has one pair of parallel sides.

Properties of Kites:

- A kite has two pairs of adjacent sides that are equal.
- The diagonals of a kite are perpendicular and one of them bisects the other.

Other Important Theorems:

- A line passing through the midpoint of one side of a triangle and parallel to another side bisects the third side. (Midpoint theorem)
- The line segment connecting the midpoints of two sides of a triangle is parallel to the third side and is half its length.

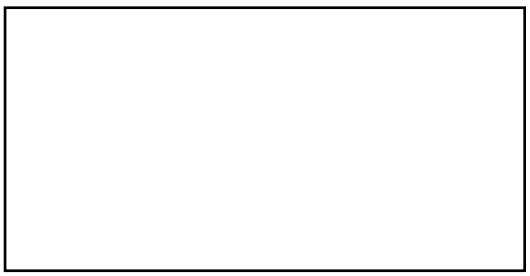


Fig.-Rectangle

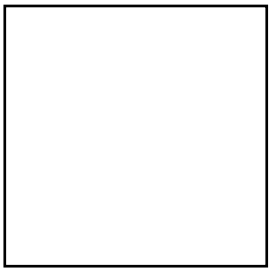


Fig.-Square

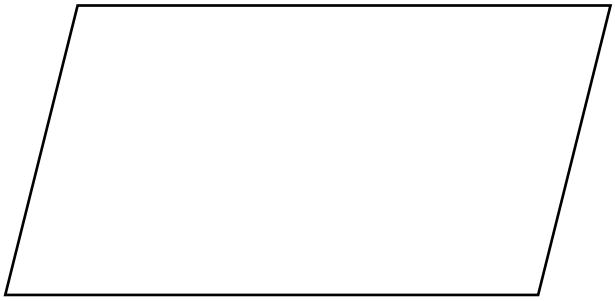


Fig.-Parallelogram

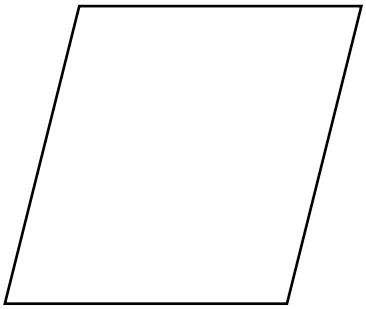


Fig.-Rhombus

Fig.-Trapezoid

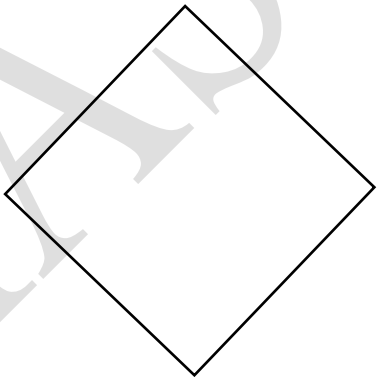


Fig.-Kite

Chapter 9: Areas of Parallelograms and Triangles

The area of a plane figure refers to the amount of surface covered by a closed geometric shape, such as a rectangle, square, etc. A parallelogram is a type of quadrilateral with opposite sides that are parallel. Below is a list of formulas used to calculate the areas of parallelograms and triangles:

1. *Area of Parallelogram = Base × Height*
2. *Area of Triangle = 1/2 × Base × Height or 1/2 × Area of Parallelogram*
3. *Area of Trapezium = 1/2 × (Sum of its parallel sides) × Distance between the two parallel side*
4. *Area of Rhombus = 1/2 × Product of its two diagonals*

Table for area and perimeter:

Geometric Figures	Area	Perimeter
Rectangle	**$A = l \times b$** **Here, l= length and b= breadth**	**$P = 2 \times (l+b)$**
Triangle	**$A = (1/2) \times b \times h$** **Here, b= base and h= height**	**$A = (1/2) \times b \times h$** **Here, b= base and h= height**
Trapezoid	**$A = (1/2) \times h \times (b_1 + b_2)$** **Here, b_1, b_2 are length of parallel sides of trapezoid.**	**$P = a + b + c + d$** **a,b,c,d are the sides of the trapezoid**
Parallelogram	**$A = b \times h$** **Here, b= base and h= height**	**$P = 2 (a+b)$** **a and b are the sides of the parallelogram**

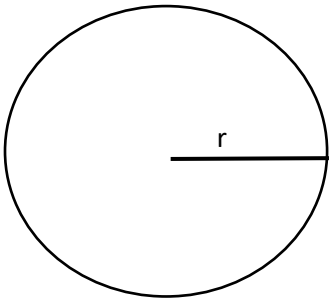
Chapter 10: Circles

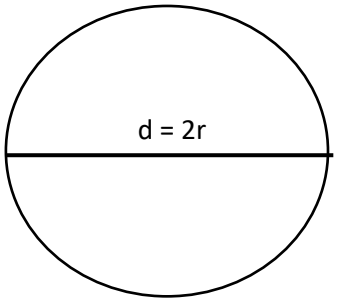
A circle is the locus of points that are equidistant from a fixed centre. The radius of a circle is the distance from the centre to any point on the circumference. The diameter is a line that passes through the centre and divides the circle into two equal halves; it is twice the length of the radius. The following important properties and formulas related to circles are covered in the Class 9 syllabus:

- ***Concentric circles*** *are circles with the same centre but different radii.*
- ***Arc:*** *An arc of the circle is a continuous portion of a circle.*
- ***Chord:*** *The chord of the circle is a line segment that connects any two locations on a circle. Some important properties of Chords of a circle are:*

- *The diameter of a circle is defined as a chord that passes across its centre.*
- *A circle's diameter divides it into two equal sections, which are called arcs. A semi-circle is made up of these two arcs.*
- *If two arcs of a circle have the same degree of measure, they are said to be congruent.*
- *When two arcs have the same length, their associated chords are likewise the same length.*
- *The chord is bisected by a perpendicular drawn from the centre to the chord of the circle, and vice versa.*
- *Three non-collinear points are intersected by one and only one circle.*
- *Equal circle chords are equidistant from the centre.*
- *The line across the centres of two circles intersecting in two points is perpendicular to the common chord.*
- *An arc's angle at the centre of the circle is double the angle it has throughout the rest of the circumference.*
- *Any two angles in the same circle segment are equal.*
- *A circle's equal chords form an equal angle at the centre.*
- *The greater chord of a circle is closer to the centre than the smaller chord.*
- *The semicircle has a right angle. At the circle's centre, equal chords subtend an equal angle.*

- ***Cyclic Quadrilateral:*** *A quadrilateral is said to be cyclic if all of its vertices are on the perimeter of a circle.*
  - *The sum of opposing angles in a cyclic quadrilateral is 180°, and vice versa.*
  - *A cyclic quadrilateral's exterior angle is equal to its inner opposite angle.*
- *The tangent and radius of the circle intersect perpendicular to each other.*
- *Area of Circle* $= pi \times r^2$
- *Perimeter of Circle* $= 2 \times pi \times r$





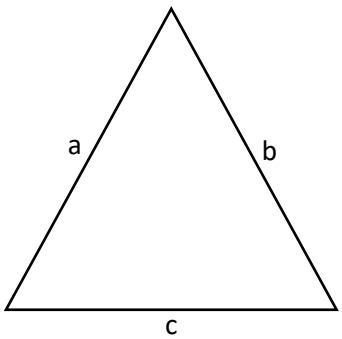
Chapter 11: Constructions

This chapter illustrates how to design various shapes using a compass and ruler. It details the process of constructing the bisector of a given angle and the perpendicular bisector of a line segment, presenting each step with clarity and visual aids. The following are the guidelines for constructing essential geometric figures:

- Constructing the bisector of a line segment.
- Constructing the bisector of a given angle.
- Constructing an equilateral triangle.
- Constructing a triangle when the base, the sum of the other two sides, and one base angle are given.
- Constructing a triangle when the base, the difference of the other two sides, and one base angle are given.
- Constructing a triangle with a given perimeter and two base angles.

Chapter 12: Heron's Formula

A triangle is a closed two-dimensional figure in geometry. Heron's formula is a method used to calculate the area of a triangle. Here is a list of Heron's formula and some of its significant Applications:



- *The semi-perimeter of a Triangle, $s = (a+b+c)/2$*
- *Area of the triangle* / Heron's Formula = $\sqrt{\{s \times (s-a) \times (s-b) \times (s-c)\}}$ *sq. unit.*
- *For an Equilateral Triangle with side a:*
    - *Its Perimeter = $3 \times a$ units*
    - *Its Altitude = $\sqrt{3}/2 \times a$ units*
    - *Its Area = $\sqrt{3}/4 \times a^2$ units*

Chapter 13: Surface Areas and Volumes

Surface Area is a key concept in the study of Surface Areas and Volumes. When calculating the space covered by a two-dimensional shape, it is referred to as the area and is measured in square units. However, when determining the space occupied by a three-dimensional object, it is called the surface area, which is also measured in square units. There are two types of surface areas:

1. ***Total Surface Area:*** *The Total Surface Area refers to the entire area covered by the surface of an object. Below is a list of the total surface areas for some key geometric figures:*
    I. *Total Surface Area of a Cuboid = $2(l \times b) + 2(b \times h) + 2(h \times l)$*
    II. *Total Surface Area of a Cube = $6 \times s^2$*
    III. *Total Surface Area of a Right circular Cylinder = $2 \times \pi \times r \times (h+r)$*
    IV. *Total Surface Area of a Right circular Cone = $\pi \times r \times (l+r)$*
    V. *Total Surface Area of a Sphere = $4 \times \pi \times r^2$*
    VI. *Total Surface Area of a hemisphere = $3 \times \pi \times r^2$*
2. ***Lateral/Curved Surface Area:*** *The curved surface area refers to the area of just the curved part of an object, or in the case of cuboids or cubes, it represents the area of the four sides, excluding the top and bottom. For shapes like cylinders and cones, this is known as the lateral surface area.*

I. *Curved Surface Area of a Cuboid = $2 \times h \times (l+b)$*

II. *Curved Surface Area of a Cube = $4 \times s^2$*

III. *Curved Surface Area of a Right circular Cylinder = $2 \times \pi \times r \times h$*

IV. *Curved Surface Area of a Right circular Cone = $\pi \times r \times l$*

3. ***Volume:*** *The volume of an object or material refers to the amount of space it occupies, measured in cubic units, compared to the area of a figure that is measured in square units. Two dimensional objects do not have volume, only area. For example, a square is a 2D figure which has it's own area but no volume, a cube is a 3D figure with it's volume.*

    1. *Volume of a Cuboid = $l \times b \times h$*
    2. *Volume of a Cube = s^3*
    3. *Volume of a Right circular Cylinder = $\pi \times r \times {}^2h$*
    4. *Volume of a Right circular Cone = $1/3 \times \pi \times r \times {}^2h$*
    5. *Volume of a Sphere = $4/3 \times \pi \times r^3$*
    6. *Volume of a hemisphere = $2/3 \times \pi \times r^3$*

Fig.- Cuboid

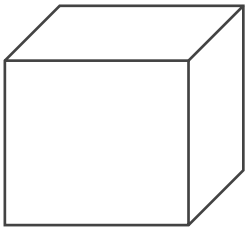


Fig.- Cube

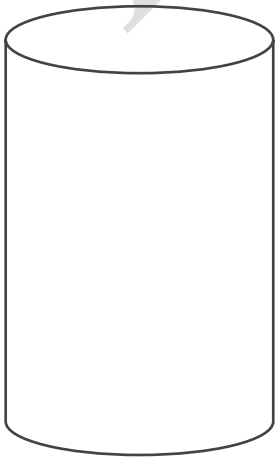


Fig.- Cylinder

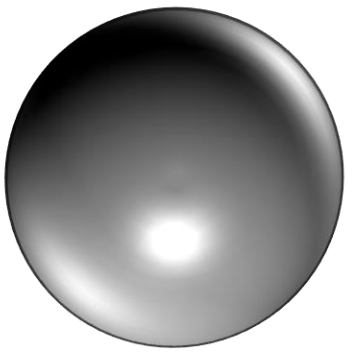


Fig.- Sphere

Chapter 14: Statistics

Statistics is the field that focuses on the systematic collection, organization, analysis, interpretation, and presentation of data. Simply put, it offers a mathematical framework for gathering and summarizing information. Data refers to facts, figures, or observations that can be collected and utilized for a specific purpose. These data can be organized and displayed in various ways, such as frequency distributions, to help identify patterns or trends. Graphical representations, like charts or graphs, are commonly used to make data more understandable and accessible. Below is a concise overview of the main concepts covered in this chapter:

- ***Class mark:*** *Class mark, in statistics, is the average of the upper limit and the lower limit of a class in a frequency distribution. In other words, the class mark is the mid-value of the given class interval.*
    - *Class mark= (Lower Limit + Upper Limit)/2*
- *The three central tendencies are measured as:*
    - ***Mean*** $(\bar{x})$ **=** *Sum of all observations* $(\sum x_n)$ */ Total Number of observation (N)*
    - ***Median*** **=** *The median for even number of observation is equal to the* $[\{(n/2)^{th} + ((n+1)/2)^{th})\}/2]$ *observation for the odd number of observation it is equal to value of* $((n+1)/2)^{th}$ *observation*
    - ***Mode*** **=** *It is equal to observation which occurs the most or have the maximum frequency in the given data.*

Chapter 15: Probability

This section on Probability covers the basic concepts of probability theory, which are also used in probability distributions to understand the likelihood of different outcomes in a random experiment. It aims to calculate the probability of a specific event happening, given the total number of possible outcomes. Probability is essentially the chance that an event will occur. The value of probability lies between 0 and 1, with 0 representing an event that cannot happen and 1 representing an event that is guaranteed to occur.

- ***Probability P (E) =*** *Number of favorable outcomes / Total Number of outcomes*
- *The probability of any event only lies between 1 and 0.*

- ***Trial:*** *It is defined as the set of observations of event in which one or more outcomes are observed.*
- ***Event:*** *It is defined as the collection of observation performed to observe an experiment.*