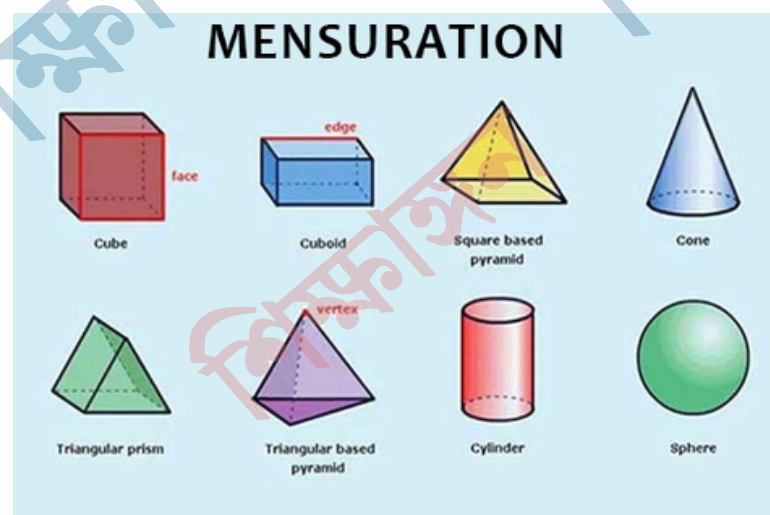


Mensuration

- Mensuration is the branch of mathematics that studies the measurement of the 2D and 3D figures on parameters like length, volume, shape, surface area, etc. In other words, it is the process of measurement based on algebraic equations and mathematical formulas.
- Mensuration can be explained as an act of measurement. We live in a three-dimensional world. The concept of measurement plays an important role in primary as well as secondary school mathematics. Moreover, measurement has a direct connection to our everyday lives. When learning to measure objects we learn to do so for both 3D shapes and 2D shapes. Objects or quantities can be measured using both standard and nonstandard units of measurement. For example, a non-standard unit of measuring length would be handspans. You can even do an activity on it by asking children to measure the length of objects using handspans. Let children notice that while measuring objects using non-standard units there will always be a scope of a discrepancy. Hence the need for standard units of measurement. To measure parameters like length, weight, and capacity we now have units like kilometer, meter, kilogram, gram, liter, milliliter, etc.
- **3D Shapes Definition**
- A shape or a solid that has three dimensions is called a 3D shape that has faces, edges, and vertices. They have a surface area that includes the area of all their faces. The space occupied by these shapes gives their volume. Some examples of 3D shapes are cube, cuboid, cone, cylinder and some real-world examples are a book, a birthday hat, and, a coke tin.
- **2D Shapes Definition**
- In geometry, 2D shapes can be defined as plane figures that are completely flat and have only two dimensions – length and width. They do not have any thickness and can be measured only by the two dimensions.
- **Uses of Mensuration**
- Mensuration is an important topic with high applicability in real-life scenarios. Given below are some of the scenarios.
- Measurement of agricultural fields, floor areas required for purchase/selling transactions.
- Measurement of volumes required for packaging milk, liquids, solid edible food items.
- Measurements of surface areas required for estimation of painting houses, buildings, etc.
- Volumes and heights are useful in knowing water levels and amounts in rivers or lakes.
- Optimum cost packaging sachets for milk etc. like tetra packing.





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- **Important Mensuration Terms**

- Mensuration deals with the measurement of plane shapes and solid shapes.

- **Area**

- Area is the amount of space occupied by a two-dimensional figure. It is expressed in square units.

- **Perimeter**

- Perimeter is the total distance around the shape or the length of the boundary of any closed shape. It is expressed in square units.

- **Volume**

- Volume is the amount of space occupied by a 3D shape. It is expressed in cubic meter.

- **Surface Area**

- Surface Area is the total area occupied by the surfaces of a 3D object. They are classified into two - Curved or Lateral Surface Area and Total Surface Area.

- **Mensuration Formulas**

- Mensuration formulas involve both 3D and 2D shapes. The most commonly used formula is the surface area and volume of these shapes.

- **3D Shape Formulas**

- The following table shows different 3D shapes and their formulas.

- Diameter = $2 \times r$; (where 'r' is the radius)

- Surface Area = $4\pi r^2$

- Volume = $(4/3)\pi r^3$

- **Cylinder**

- Total Surface Area = $2\pi r(h+r)$; (where 'r' is the radius and 'h' is the height of the cylinder)

- Volume = $\pi r^2 h$

- **Cone**

- Curved Surface Area = $\pi r l$; (where 'l' is the slant height and $l = \sqrt{h^2 + r^2}$)

- Total Surface Area = $\pi r(l + r)$

- Volume = $(1/3)\pi r^2 h$

- **Cube**

- Lateral Surface Area = $4a^2$; (where 'a' is the side length of the cube)

- Total Surface Area = $6a^2$

- Volume = a^3

- **Cuboid**

- Lateral Surface Area = $2h(l + w)$; (where 'h' is the height, 'l' is the length and 'w' is the width)

- Total Surface Area = $2(lw + wh + lh)$

- Volume = $(l \times w \times h)$

- **Prism**

- Surface Area = $[(2 \times \text{Base Area}) + (\text{Perimeter} \times \text{Height})]$

- Volume = $(\text{Base Area} \times \text{Height})$

- **Pyramid**

- Surface Area = $\text{Base Area} + (1/2 \times \text{Perimeter} \times \text{Slant Height})$

- Volume = $[(1/3) \times \text{Base Area} \times \text{Altitude}]$



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- **2D Shape Formulas**

- The following table shows the formulas that are used to calculate the area and perimeter of a few common 2D shapes:

- **Circle**

- $A = \pi \times r^2$, where 'r' is the radius of the circle and ' π ' is a constant whose value is taken as $\frac{22}{7}$ or 3.14

- Circumference (Perimeter) = $2\pi r$

- **Triangle**

- Area = $\frac{1}{2}$ (Base \times height)
- Perimeter = Sum of the three sides

- **Square**

- Area = Side²
- Perimeter = 4 \times side

- **Rectangle**

- Area = Length \times Width
- Perimeter = 2 (Length + Width)

