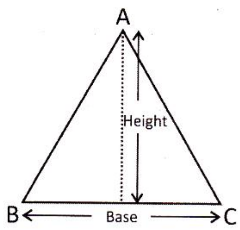
# Surface Area and Volume

In this chapter, we will learn about some important formulas related to $2-D$ and $3-D$ geometrical shapes.

**Area of a Triangle**

- Area of a triangle $= \frac{1}{2} \times$ (Perpendicular) $\times$ Base
- Area of a triangle having lengths of the sides a, b and c is
  $= \sqrt{s(s-a)(s-b)(s-c)}$ sq. units,

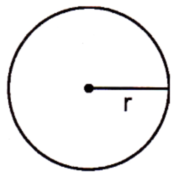
  Where $s = \frac{1}{2}$ (a + b + c)




- Area of an equilateral triangle $= \frac{\sqrt{3}}{4}a^2$, where a is the side of the equilateral triangle.

**Circle**

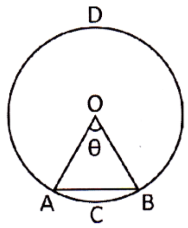
- Circumference of the circle = $2\pi r$
- Area of the circle = $\pi r^2$
- Area of the semicircle = $\frac{1}{2}\pi r^2$
- Perimeter of the semicircle $= \pi r + 2r$




**Length of Arc and Area of a Sector**

Let an arc AB makes an angle $\theta < 180°$ at the center (O) of a circle of radius r, then we have:

- Length of the arc AB = $\frac{2\pi r\theta}{360°}$
- Area of the sector OACB = $\frac{\pi r^2\theta}{360°}$

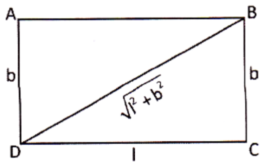



- Area of the minor segments ACBA = area of sector OACB − area of the corresponding triangle AOB
- Area of the major segment ADBA = area of the circle − area of the minor segment

**Perimeter and Area of a Rectangle**

Let ABCD be a rectangle in which length AB = l units, breadth BC = b units then we have:

- Area = $(l \times b)$ square units
- Length (l) $= \dfrac{area\ (A)}{breadth\ (B)}$ units




- breadth (b) $= \dfrac{area\ (A)}{length\ (l)}$ units
- Diagonal (d) = $\sqrt{l^2 + b^2}$ units
- Perimeter (p) = 2(l + b) units

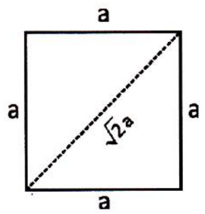
**Area of Four Walls of a Room**

Let l, b and h are respectively the length, breadth and height of a room, then area of four walls of the room $= \{2\ (l\ +\ b)\ x\ h\}$ sq units.

**Perimeter and Area of Square**

Let ABCD be a square with each side equal to 'a' units, then

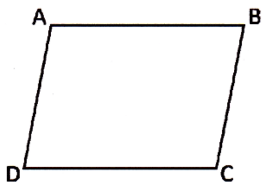
- Area = $a^2$ sq. units
- Area = $\left(\frac{1}{2} \times (Diagonal)^2\right)$ sq. units



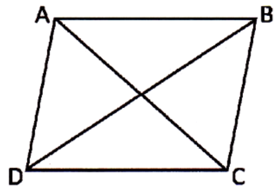

- Diagonal = $a\sqrt{2}$ units
- Perimeter =4a units

**Area of Some Special Types of Quadrilateral**

- Area of a parallelogram = (base × height)

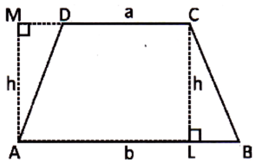



- Area of a rhombus = $\frac{1}{2} \times$ (product of diagonals)




- Area of a Trapezium = $\frac{1}{2}$ (Sum of lengths of parallel sides) $\times$ (distance between them)

  = $\frac{1}{2}$ (a + b) $\times$ h




**Solids**

The objects having definite shape and size are called solids. A solid occupies a definite space.

**Cuboid**

For a cuboid of length = l, breadth = b and height = h, we have:

- Volume = (l $\times$ b $\times$ h) cubic units
- Total surface area = 2 $(lb+bh+lh)$ sq. units
- Lateral surface area = $[2(l+b)\times h]$ sq. units
- Diagonal of a cuboid = $\sqrt{l^2+b^2+h^2}$

**Cube**

For a cube having each edge = a units, we have:

- Volume = $a^3$ cubic units
- Total surface area = $6a^2$ sq. units
- Lateral surface area = $4a^2$ sq. units
- Diagonal of a cube = a $\sqrt{3}$

**Cylinder**

Solids like jar, circular pencils, circular pipes, road rollers, gas cylinders are of cylindrical shape. For a cylinder of base radius = r units and height = h units, we have:

- Volume = $\pi r^2 h$ cubic units
- Curved surface area = $2\pi rh$ square units
- Total surface area =
  $(2\pi rh+2\pi r^2)=2\pi\,\mathrm{r(h+r)}$ sq. units

**Cone**

Consider a cone in which base radius = r, height = h and slant height (l) = $\sqrt{h^2+r^2}$ , then we have:

- Volume of the cone = $\frac{1}{3}\pi r^{2h}$
- Curved surface area of the cone = $\pi rl$
- Total surface area of the cone = (curved surface area) + (area of the base) = $\pi rl + \pi rl^2 = \pi rl$
  (l + r)

**Sphere**

Objects like a football, a cricket ball, etc. are of spherical shapes. For a sphere of radius r, we have:

- Volume of the sphere $= \frac{4}{3}\pi r^3$
- Surface area of the sphere $= 4\pi r^2$

**Hemisphere**

A plane through the centre of a sphere cuts it into two equal parts, each part is called a hemisphere. For a hemisphere of radius r, we have:

- Volume of the hemisphere $= \frac{2}{3}\pi r^3$
- Curved surface area of the hemisphere $= 2\pi r^2$
- Total surface area of the hemisphere $= 3\pi r^2$