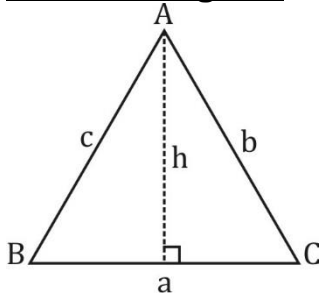


Mensuration - Formulas of Different 3D & 2D Figures

Formulae of Areas of Different Triangles

➤ **Scalene triangle:** →



$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

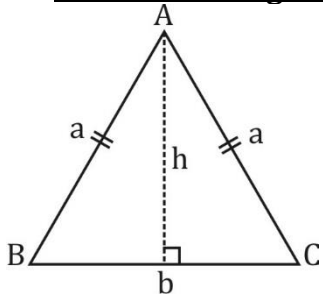
$$\text{Where } S = \frac{a+b+c}{2}$$

$$\text{Area} = \frac{1}{2} \times a \times c \sin B$$

$$= \frac{1}{2} \times a \times b \times \sin C$$

$$= \frac{1}{2} \times b \times c \times \sin A$$

➤ **Isosceles triangle:** →

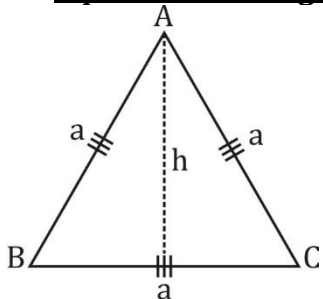


$$\text{Height (h)} = \frac{1}{2} \sqrt{4a^2 - b^2}$$

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$\text{Area} = \frac{1}{2} b \sqrt{4a^2 - b^2}$$

➤ **Equilateral triangle:** →



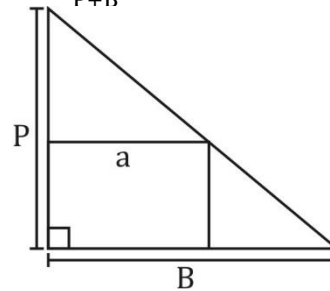
$$\text{Area} = \frac{\sqrt{3}}{4} a^2$$

$$h = \frac{\sqrt{3}}{2} a$$

➤ **Right angled triangle:** →

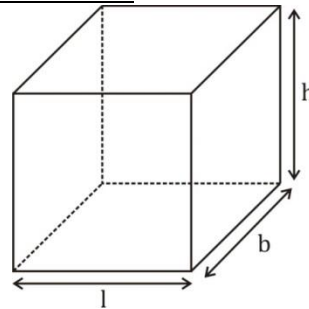
Side of the maximum size square inscribed in a right angle Δ =

$$a = \frac{P \times b}{P + B}$$



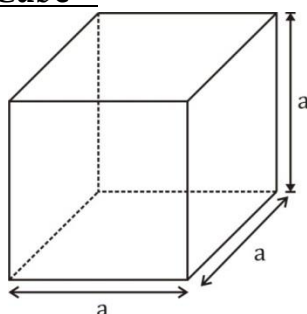
Formulae of Surface Area & Volume of Different 3D Figures

1. Cuboid →



- Volume of cuboid = $l \times b \times h$
- Lateral surface Area = Perimeter of Base $\times$ Height
Base = $2(l + b) \times h$
- Total surface area = Lateral surface Area + 2 $\times$ Area of base = $2(lh + bh + lb)$
- Diagonal = $\sqrt{l^2 + b^2 + h^2}$
- $V = \sqrt{A_1 \times A_2 \times A_3}$
 $A_1 \Rightarrow$ Area of base or top = lb
 $A_2 \Rightarrow$ Area of one side face = bh
 $A_3 \Rightarrow$ Area of another side face = hl
- To find the total surface area of a cuboid if the sum of all three sides and diagonals are given.
 Total surface area = (sum of all three side)² - (Diagonal)²
- For painting the surface area of a box or to know how much tin sheet is required, we will use, Total surface area.
- To find the length of the longest pole to be placed in a room, we will calculate diagonal i.e. $\sqrt{l^2 + b^2 + h^2}$

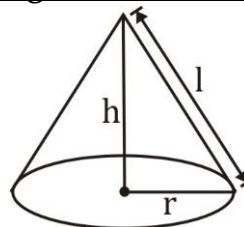
2. Cube →



- Volume = (side)³ = a^3
- Lateral surface area = $4a^2$

- Total surface area = $6a^2$
- Diagonal of the cube = $\sqrt{3}a$
- Face diagonal of the cube = $\sqrt{2}a$
- Volume of cube = $\left(\sqrt{\frac{\text{total surface area}}{6}}\right)^3$
- In Radius of cube = $\frac{a}{2}$
- Circumradius of cube = $\frac{\sqrt{3}}{2}a$

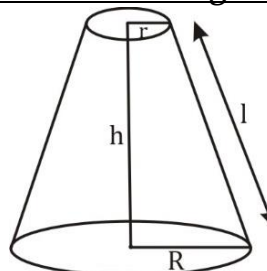
3. Right circular cone →



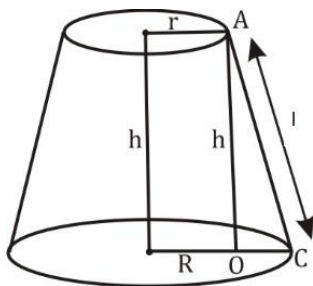
- Slant height, $l = \sqrt{r^2 + h^2}$
- Volume = $\frac{1}{3} \times$ area of base $\times$ height = $\frac{1}{3} \pi r^2 h$
- Curved surface area = $\frac{1}{2}$ (Perimeter of base) $\times$ slant height
 $= \frac{1}{2} \times 2\pi r \times l = \pi r l = \pi r \sqrt{r^2 + h^2}$
- Total surface area = C.S.A + Area of base
 $= \pi r l + \pi r^2 = \pi r(l + r)$
- If cone is formed by sector of a circle, then.
 - Slant height = radius of circle
 - circumference of base of cone = length of arc of sector
- Radius of maximum size sphere in a cone
 $= \frac{h \times r}{l + r}$

$\left[\begin{array}{l} r \rightarrow \text{radius of cone} \\ l \rightarrow \text{slant height of cone} \\ h \rightarrow \text{height of cone} \end{array} \right]$
- If cone is cut parallel to its base and ratio of heights, radius or slant height of both parts is given as $\rightarrow x : y$.
 Then Ratio of their volume = $x^3 : y^3$

4. Frustum of a right Circular cone →



- Slant height

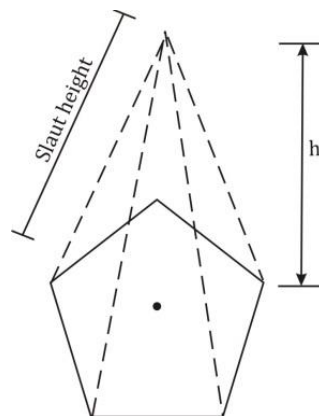


$$AC = l, AB = h, BC = R - r$$

Applying Pythagorean theorem in ΔABC

$$L = \sqrt{h^2 + (R - r)^2}$$

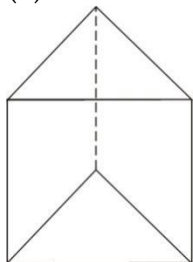
- volume of frustum = $\frac{1}{3}\pi(R^2 + r^2 + Rr)h$
- Curved surface area = $\pi(R + r)l$
- Total surface area, T.S.A = $\pi(R + r)l + \pi(R^2 + r^2)$



- Volume = $\frac{1}{3}(\text{area of base}) \times \text{height}$
- Curved surface area = $\frac{1}{2} \times (\text{perimeter of base}) \times \text{slant height}$
- Total surface area = curved surface area + area of the base
- Whenever in a question, If we want to find Slant height or height, then we will use inradius of the base not the Radius or side of the base.

5. Prism →

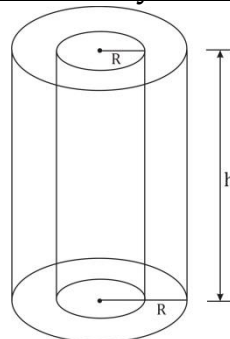
- A prism is a solid object with:
 - (a) Identical Ends
 - (b) Flat faces



- Volume of Prism = Area of base $\times$ height
- Lateral surface area of prism = perimeter of base $\times$ height
- Total surface area of = Perimeter of base $\times$ height + 2 $\times$ area of base

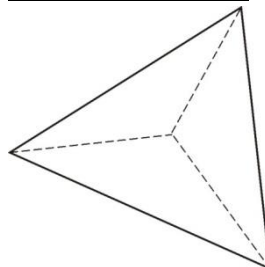
6. Pyramids →

7. Hollow Cylinder →



- Volume = $\pi(R^2 - r^2)h$
- Curved Surface Area = $2\pi(R+r)h$
- Total surface area = $2\pi(R+r)h + 2\pi(R^2 - r^2)$

8. Tetrahedron →



- Height = $\sqrt{\frac{2}{3}}a$
- Volume = $\frac{\sqrt{2}}{12}a^3$

- Lateral surface area = $\frac{3\sqrt{3}}{4}a^2$
- Total surface area = $\sqrt{3}a^2$
- Slant height = $\frac{\sqrt{3}}{2}a$
- Slant Edge = a

9. Swimming Pool:

- Volume of swimming Pool = $\frac{1}{2}$ [Sum of depth of both sides] × length × Breadth