

1. Perimeter and Area of Compound Shapes

Compound shapes are made by combining two or more simple shapes (like rectangles, triangles, circles, etc.).

Key Steps:

- Break the shape into known simpler shapes.
- Calculate each part separately.
- Add or subtract areas accordingly.
- For perimeter: Only add **outer edges** (do **not** count internal lines).

Example 1: Area of a Compound Shape

A shape is made of a rectangle (10 cm × 4 cm) and a semicircle of radius 2 cm on one end.

Area = Area of rectangle + Area of semicircle

$$= 10 \times 4 + \frac{1}{2}\pi \times 2^2$$

$$= 40 + 2\pi \text{ cm}^2$$

Example 2: Perimeter of the Same Shape

Perimeter = Straight sides + arc of semicircle

$$= 10 + 4 + 10 + \pi \times 2$$

$$= 24 + 2\pi \text{ cm}$$

2. Surface Area and Volume of Compound Solids

These are 3D shapes made from combinations like cylinders, cones, cuboids, spheres, etc.

Key Formulas:

- Cylinder Surface Area = $2\pi r^2 + 2\pi rh$
- Cylinder Volume = $\pi r^2 h$
- Cone Surface Area = $\pi r^2 + \pi rl$
- Cone Volume = $\frac{1}{3}\pi r^2 h$
- Sphere Surface Area = $4\pi r^2$
- Sphere Volume = $\frac{4}{3}\pi r^3$

Frustum (e.g., cut cone)

A frustum is formed when a cone or pyramid is cut parallel to its base.

Surface Area of a Frustum (Cone)

$$A = \pi(r_1 + r_2)l + \pi r_1^2 + \pi r_2^2$$

Where:

- r_1 = radius of larger base
- r_2 = radius of smaller base
- l = slant height of frustum

Volume of a Frustum

$$V = \frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$$

Where:

- h = vertical height of frustum

Example: Volume of a Frustum

A cone is cut to form a frustum with radii 5 cm and 3 cm, and height 6 cm.

$$\begin{aligned} V &= \frac{1}{3}\pi \times 6 \times (5^2 + 3^2 + 5 \times 3) \\ &= \frac{1}{3}\pi \times 6 \times (25 + 9 + 15) \\ &= \frac{1}{3}\pi \times 6 \times 49 = 98\pi \text{ cm}^3 \end{aligned}$$