Mensuration

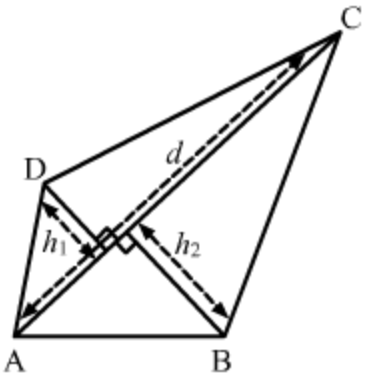
- Area and perimeter of various shapes:

Shape	Area	Perimeter
Rectangle with adjacent sides a and b	$a \times b$	$2(a + b)$
Square with side a	a^2	$4a$
Circle with radius r	πr^2	$2\pi r$
Triangle with base b and its corresponding height h	$\frac{1}{2} \times b \times h$	Sum of the three sides
Parallelogram with base b and its corresponding height h	$b \times h$	Sum of the four sides

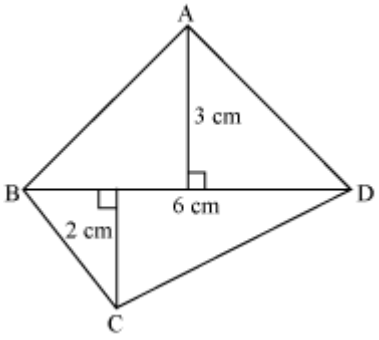
Area of trapezium = $\frac{1}{2}$ (Sum of the lengths of the parallel sides) × (Perpendicular distance between them)

- Area of quadrilateral ABCD = Area of ΔABC + Area of ΔACD

  = 12×d×h1 + 12×d×h2= 12×d×h1+h2



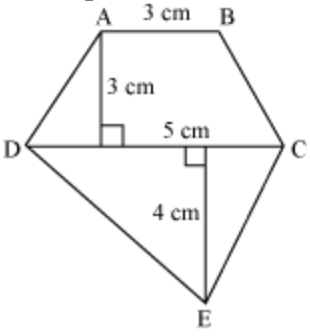
Example: Find the area of the quadrilateral ABCD.



Solution: Area of the quadrilateral ABCD = Area of ΔABD + Area of ΔBCD
Area of triangle =12 × base × corresponding height
Area of ΔABD $= \frac{1}{2} \times 6\text{cm} \times 3\text{cm} = 9\text{cm}^2$
Area of ΔBCD $= \frac{1}{2} \times 6\text{cm} \times 2\text{cm} = 6\text{cm}^2$
∴ Area of quadrilateral ABCD = 9 cm^2 + 6 cm^2 = 15 cm^2

- Area of rhombus $= \frac{1}{2}$ (Product of its diagonals)
- Area of a polygon can be calculated by breaking the polygon into triangles or any types of a quadrilateral.

Example: Find the area of the given polygon, where ABCD is a trapezium.



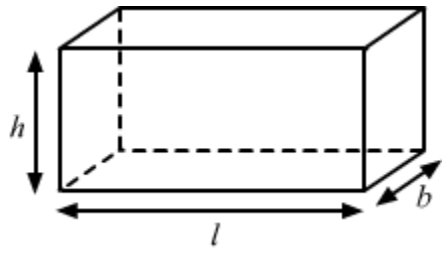
Solution: Area of ABCED = Area of trapezium ABCD + Area of ΔCDE

=12×3+5×3 + 12×5×4

= 12 + 10

= 22 cm^2

- **Surface areas of cuboid:**



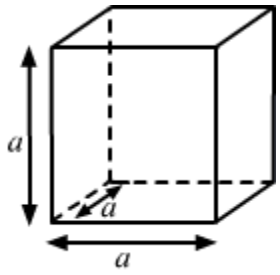
Lateral surface area of the cuboid = $2h\ (l + b)$
Total surface area of the cuboid = $2\ (lb + bh + hl)$

Note: Length of the diagonal of a cuboid = $\sqrt{l^2 + b^2 + h^2}$

Example: **Find the edge of a cube whose surface area is 294 m^2.**

Solution: Let the edge of the given cube be a.
∴ Surface area of the cube = $6a^2$
Given, $6a^2 = 294$
$\Rightarrow a^2 = 49\ m^2$
$\therefore a = \sqrt{49}\ m = 7\ m$

- **Surface areas of cube:**



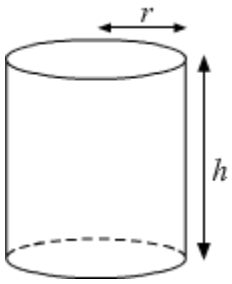
Lateral surface area of the cube = $4a^2$
Total surface area of the cube = $6a^2$

Note: Length of the diagonal of a cube = $\sqrt{a^2 + a^2 + a^2} = \sqrt{3a^2} = \sqrt{3}a$

- **Surface areas of solid cylinder**

- Curved surface area = $2\pi rh$, where r and h are the radius and height

- Total surface area = $2\pi r\,(r + h)$, where r and h are the radius and height



Example : What is the curved surface area of a cylinder of radius 2 cm and height 14 cm?

Solution: Curved surface area of cylinder = $2\pi rh$

$= 2 \times \frac{22}{7} \times 2 \times 14\,\text{cm}^2$

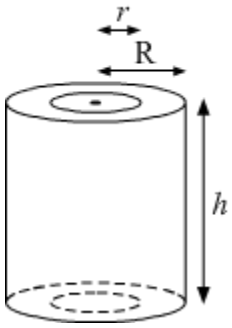
$= 176\,\text{cm}^2$

- **Surface areas of hollow cylinder**

- Curved surface area = $2\pi h\,(r + R)$, where r, R and h are the inner radius, outer radius and height

- Total surface area = CSA of outer cylinder + CSA of inner cylinder + 2 × Area of base

  = $2\pi\,(r + R)$ (h + R – r), where r, R and h are the inner radius, outer radius and height



- **Volume of cube and cuboid**

- Volume of cube = a^3, where a is the side of the cube
- Volume of cuboid = $l \times b \times h$, where l, b and h are respectively the length, breadth and height of the cuboid.

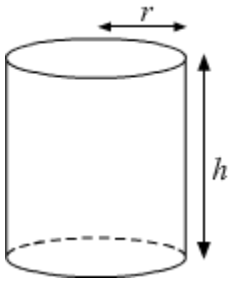
Example: What is the side of a cube of volume 512 cm^3?

Solution: Volume of cube = 512 cm^3

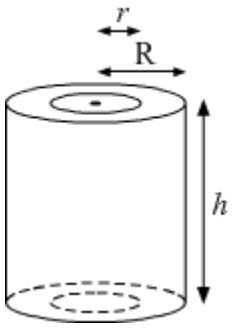
$$\Rightarrow a^3 = 512\,\text{cm}^3$$
$$\Rightarrow a = \sqrt[3]{512}\,\text{cm}^3$$
$$\Rightarrow a = 8\,\text{cm}$$

- **Volume of the solid cylinder and hollow cylinder**

- Volume of solid cylinder = $\pi r^2 h$, where r and h are the radius and height of the solid cylinder



- Volume of the hollow cylinder = $\pi\,(R^2 - r^2)\,h$, where r, R and h are the inner radius, outer radius and height of hollow cylinder



Example: Find the volume of the pillar of radius 70 cm and height 10 m.

Solution: Radius of the pillar (r) = 70 cm = $\frac{70\text{ m}}{100}$ = 0.7 m

Height of the pillar (h) = 10 m

$$\text{Volume of the pillar} = \pi r^2 h$$
$$= \frac{22}{7} \times (0.7)^2 \times 10\,\text{m}^3$$
$$= 15.4\,\text{m}^3$$