

LESSON 7

Mensuration Formula – 2D and 3D shapes

Definition:

Mensuration is the part of mathematics that deals with the length, area, and volume of different geometrical figures.

7.1. Type of shapes and differences:

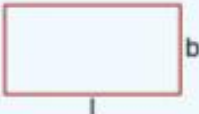
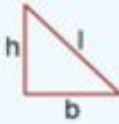
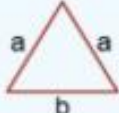
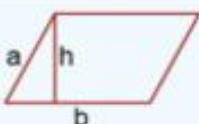
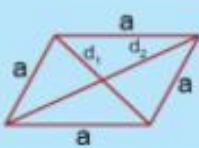
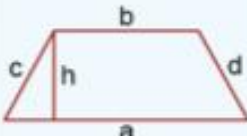
The two things that are broadly dealt with in Mensuration are two-dimensional figures and three-dimensional solids. The detailed description, along with their differences, is attached below:

2-D Figures	3-D Solids
1) A 2-D shape is surrounded by three or more lines in the plane.	1) Several surfaces surround a 3-D solid in the plane.
2) They don't have height in shape.	2) They have height in the respective figures.
3) As the name suggests, it has only two dimensions, length and breadth.	3) Length, breadth and height are the three dimensions.
4) Perimeter and area are the measure quantities in 2-D figures	4) Lateral Surface Area, Total Surface area, and volume are the measurable quantities in 3-D Solids.

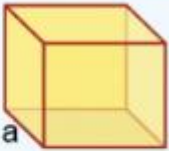
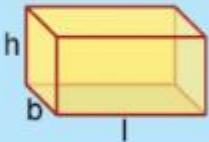
7.1.1. Important terms

Terms	Denotation	Unit	Description
Area	A	Squared units (m^2 or cm^2)	It is the amount of space enclosed by all the sides of the shape.
Perimeter	P	units (m or cm)	Sum of all sides
Volume	V	Cubic units (m^3 or cm^3)	It is the amount of space occupied by a solid in a 3-D plane.
Lateral Surface Area	LSA	Squared units (m^2 or cm^2)	Total area of all surfaces excluding the bases.
Total Surface Area	TSA	Squared units (m^2 or cm^2)	Total area of all surfaces.
Square Unit		Squared units (m^2 or cm^2)	It is the amount of area occupied by a square of one unit.
Cube unit		Cubic units (m^3 or cm^3)	It is the amount of volume occupied by a cube of one unit.

7.1.2. 2D mensuration formula:

Shape	Area (in square units)	Perimeter (in units)	Figure
Rectangle l = length b = breadth	$l \times b$	$2(l + b)$	
Square a = side	a^2	$4a$	
Right Angled Triangle b = base h = height l = hypotenuse	$\frac{1}{2} \times b \times h$	$b + h + l$	
Equilateral Triangle a = side	$(\sqrt{3}/4) \times a^2$	$3a$	
Isosceles Triangle a = length of one of the two equal sides b = length of the unequal side	$\frac{1}{2}[\sqrt{(a^2 - b^2/4)} \times b]$	$2a + b$	
Scalene Triangle a, b and c = sides of the triangle $s = (a + b + c)/2$	$\sqrt{s(s-a)(s-b)(s-c)}$, where, $s = (a + b + c)/2$	$a + b + c$	
Parallelogram b = base h = height	$b \times h$	$2(a + b)$	
Rhombus a = side d_1 , d_2 = diagonals	$\frac{1}{2} \times d_1 \times d_2$	$4a$	
Trapezium a, b = parallel sides c, d = non parallel sides h = height	$\frac{1}{2} \times (a + b) \times h$	$a + b + c + d$	
Circle r = radius	πr^2	$2\pi r$	

7.1.3 Mensuration formula 3D:

Solid	Volume	CSA	TSA	Figure
Cube a=side	a^3	$4 a^2$	$6 a^2$	
Cuboid l = length b = breadth h = height	$l \times b \times h$	$2h(l + b)$	$2 (lb +bh +hl)$	
Sphere r = radius	$(4/3) \pi r^3$	$4 \pi r^2$	$4 \pi r^2$	
Hemisphere r = radius	$(\frac{2}{3}) \pi r^3$	$2 \pi r^2$	$3 \pi r^2$	
Cylinder r = radius h = height	$\pi r^2 h$	$2\pi r h$	$2\pi rh + 2\pi r^2$	
Cone r = radius l = slant height h = height	$(\frac{1}{3}) \pi r^2 h$	$\pi r l$	$\pi r (r + l)$	

7.2. Solved Examples:

1. Calculate the area of a square with side 5 cm.

The area of a square of side 5cm is $A=L^2=5^2=25 \text{ cm}^2$

2. Calculate the perimeter of a rectangle having a length of 10 cm and breadth of 5 cm.

The perimeter of a rectangle with length 10 cm and breadth 5 cm is:

$$2(L + b) = 2(10 + 5) = 30 \text{ cm.}$$

3. What is the area of a right-angled triangle with two of its perpendicular sides as 3 and 4 cm?

The area of a right angled triangle with two of its perpendicular sides as 3 cm and 4 cm is:

$$A = \frac{1}{2} \times b \times h = 0.5 \times 3 \times 4 = 6 \text{ cm}^2.$$

4. Calculate the volume of a cone having a radius of 7 cm and height of 5 cm?

The volume of a cone with a radius of 7 cm and height of 5 cm is:

$$(1/3)\pi r^2 h = 256.67 \text{ cm}^3$$

5. What is the total surface area and curved surface area of a cylinder with a radius of 14 cm and height of 10 cm?

The total surface area of a cylinder with radius 14 cm and height 10 cm is:

$$2\pi rh + 2\pi r^2 = 2112 \text{ cm}^2$$

The curved surface area of a cylinder with radius 14cm and height 10cm is:

$$2\pi rh = 880 \text{ cm}^2$$