

9. MENSURATION

Introduction:

- Mensuration is a branch of Mathematics, which deals Lengths, Areas and Volumes of geometrical figures
- In this chapter we measure, length, perimeters and areas of two dimensional figures and surface areas, volumes of three dimensional figures.
- 2 - D figures

Figures having two measurements like length and breadth and without any thickness

Ex : Triangle, Square, Rectangle

- 3- D figures

Figures with three measurements like length, breadth and height (or) thickness

Ex : Cuboid, cube, sphere

1.Perimeters and Area of 2-D figures

I. Perimeter of a closed figure : -

Def : Sum of lengths of all the boundaries of a closed figures is called its perimeter

Ex : The three sides of a triangle are its boundaries

∴ Perimeter of triangle is equal to sum of its three sides.

1. Triangle :

Perimeter (P) = sum of lengths of three sides

2. Rectangle : Perimeter $p = 2(l + b)$ → $l = \text{length}$

→ $b = \text{breadth}$

3. Square : Perimeter (P) = $s + s + s + s$
= $4s$ → $s = \text{side}$

4. Quadrilateral :-

Perimeter (P) = Sum of lengths of 4 sides

5. Pentagon :

Perimeter (P) = Sum of lengths of 5 sides

6. Polygon with 'n' sides :

Perimeter (P) = sum of lengths of n sides

7. Regular polygon :-

Perimeter (P) = No. of sides x length of side

8. Circle :-

Perimeter (P) = $2\pi r$

→ r = Radius

(or) P = πd

→ $\pi = 22/7$ or 3.14



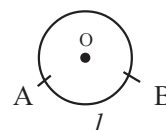
9. Semi circle :

Perimeter P = $\pi r + 2r = \frac{36}{7}r$



10. Arc :-

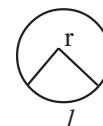
Length of Arc AB, $l = \frac{x^\circ}{360^\circ} \times 2\pi r$



→ x° is the angle subtended by the arc at centre of the circle

11. Sector

Perimeter of Sector, $P = l + 2r$



II. Area of 2-D figures -

Def : Space occupied by a closed figures is its area

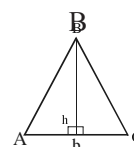
Ex : Area of a triangle is space occupied by that triangle in the page

1. Triangle:

Area $A = \frac{1}{2} b \times h$

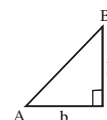
→ b = base

→ h = corresponding height



2. Right angled triangle :

Area (A) = $\frac{1}{2} a \times b$ a, b are legs of the Triangle.

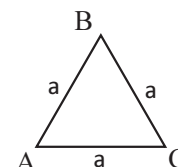


3. Equilateral triangle :-

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

(or) $A = \frac{h^2}{\sqrt{3}}$

h = height



→ a = length of side

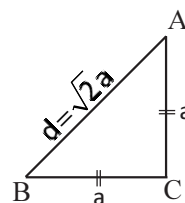
4. Right angled isosceles triangle :-

$$\text{Area } A = \frac{1}{2} \times a \times a = \frac{a^2}{2}$$

a = length of equal sides

$$(\text{or}) A = \frac{d^2}{4}$$

d = length of diagonal

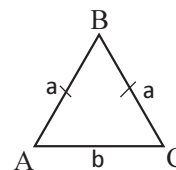


5. Isosceles triangle :-

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

→ a = length of equal sides

→ b = length of non equal side



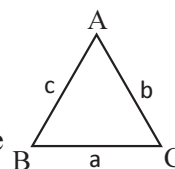
6. Scalene triangle :

(Heron's formula)

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

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

= Half the perimeter of triangle



Note: 1. Each median divides the triangle into two equal areas.

2. Areas of 6 triangles formed by three medians of triangle are equal.

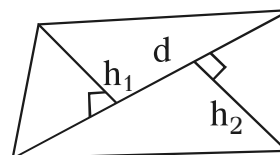
AREAS OF QUADRILATERAL

7. Quadrilateral :-

$$\text{Area } (A) = \frac{1}{2} d (h_1 + h_2)$$

→ d = length of diagonal

→ h_1, h_2 are perpendiculars drawn from remaining vertices to the diagonal

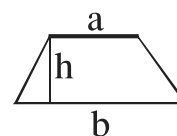


8. Trapezium :-

$$\text{Area } (A) = \frac{1}{2} h (a+b)$$

→ a, b are lengths of parallel sides

→ h is perpendicular distance between the parallel sides

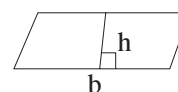


9. Parallelogram:-

$$\text{Area } (A) = bh$$

b = base

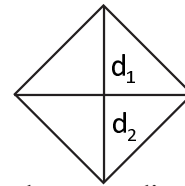
h = height



10. Rhombus

$$\text{Area (A)} = \frac{1}{2} \times d_1 \times d_2$$

d_1, d_2 are lengths of two diagonals



Note: This formula holds for any quadrilateral whose diagonals are perpendicular to each other.

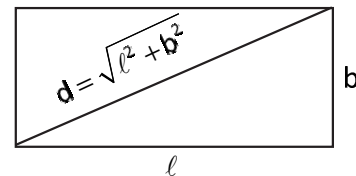
Ex :- Kite, Square etc.,

11. Rectangle :-

$$\text{Area (A)} = l \times b$$

→ l = length

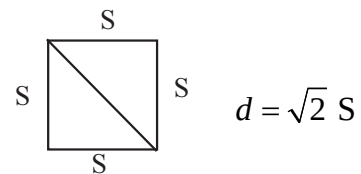
→ b = breadth



12. Square:-

$$\text{Area (A)} = s \times s = s^2 \quad s = \text{length of the side}$$

$$(\text{or}) A = \frac{d^2}{2} \quad d = \text{length of diagonal}$$



13. Regular Polygon :

$$\text{Area (A)} = 6 \times \frac{\sqrt{3}}{4} a^2$$

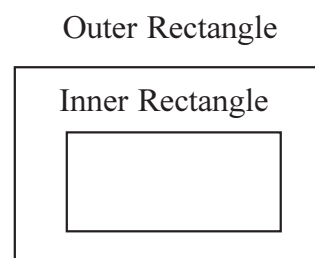
→ a = length of side

→ 6 = number of sides

14. Rectangular path

$$\text{Area (A)} = \text{Area of outer}$$

$$\text{Rectangle} - \text{Area of inner Rectangle}$$



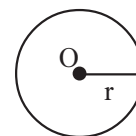
15. Circle

$$\text{Area (A)} = \pi r^2$$

$$(\text{or}) A = \frac{\pi d^2}{4}$$

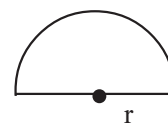
→ r = radius

d = diameter



16. Semi circle:-

$$\text{Area (A)} = \frac{1}{2} \times \pi r^2 \quad (\text{or}) A = \frac{\pi d^2}{8}$$



17. Annulus (Circular path) :-

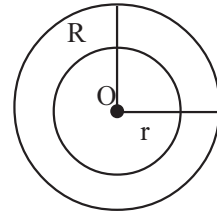
Area (A) = Area of outer circle - Area of inner circle

$$= \pi (R^2 - r^2)$$

→ R = outer radius

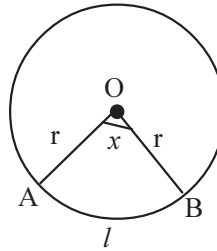
$$= \pi (R + r) (R - r)$$

→ r = inner radius



17. Sector :-

$$\text{Area, } A = \frac{x^0}{360^0} \times \pi r^2$$



$$(\text{or}) A = \frac{lr}{2}$$

→ x^0 = Angle subtended by the arc at centre

→ r = radius

→ l = length of the arc

Note : - 1. Lengths and Perimeters always measure in units (mm ; cm ; m ; km,)

2. Areas always measure in square units (mm^2 , cm^2 , m^2 , km^2 ,)

SOLVED PROBLEMS

1. A rectangle lawn is 130 m x 120 m. It has two roads each 2m. Wide running in the middle of it. One

Parallel to the breadth and the other to the length. Find the total cost of planting grass on both the roads

at the rate of Rs.150 per square meter.

- a) Rs. 74,000 b) Rs. 74,400
c) Rs. 76,400 d) Rs. 67,400

Sol : Length , $l = 130$ m ; breadth $b = 120$ m

length of 1st road = 130 m

breadth = 2m

$$\begin{aligned}\therefore \text{Area} &= l \times b \\ &= 130 \times 2 = 260 \text{ m}^2\end{aligned}$$

Length of 2nd road = 120 m

breadth = 2 m

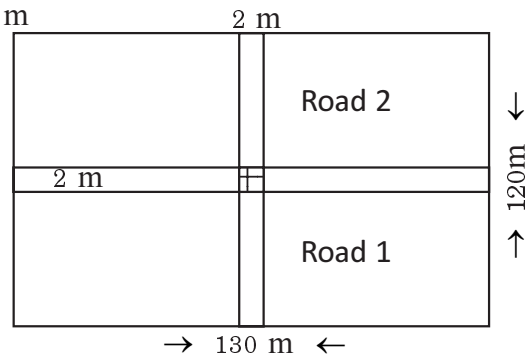
$$\therefore \text{Area} = 120 \times 2 = 240 \text{ m}^2$$

Common area of two roads = $2 \times 2 = 4 \text{ m}^2$

$$\begin{aligned}\text{Total Area of two roads} &= 260 \text{ m}^2 + 240 \text{ m}^2 - 4 \text{ m}^2 \\ &= 496 \text{ m}^2\end{aligned}$$

Cost per square meter of grass = Rs. 150

$$\begin{aligned}\therefore \text{Total cost} &= 496 \times 150 \\ &= \text{Rs. } 74,400\end{aligned}$$



2. The diagram shows a rectangle ABCD. Where $AB : AD = 1 : 2$. Point E is on AC such taht DE is perpendicular to AC. What is the ratio of the areas of the triangle DCE to the rectangle ABCD ?

- a) $1 : 4\sqrt{2}$ b) $1 : 6$ c) $1 : 8$ d) $1 : 10$

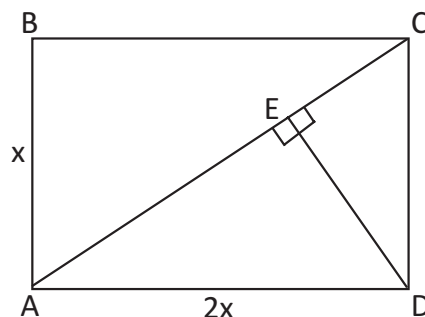
Sol : $AB : AD = 1 : 2$

Let $AB = x$ and $AD = 2x$

$$\begin{aligned}\text{in } \Delta ACD, AC^2 &= AD^2 + CD^2 \\ &= (2x)^2 + x^2 \\ &= 5x^2\end{aligned}$$

$$\therefore AC = \sqrt{5} x$$

Let $AE = K$ then $CE = \sqrt{5} x - k$



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In ΔADE , ΔCDE

$$DE^2 = x^2 - k^2 \text{ and } DE^2 = (2x)^2 - (\sqrt{5}x - k)^2$$

$$\Rightarrow DE = \sqrt{x^2 - k^2}$$

$$\therefore x^2 - k^2 = (2x)^2 - (\sqrt{5}x - k)^2$$

$$\Rightarrow x^2 - k^2 = 4x^2 - 5x^2 - k^2 + 2\sqrt{5}kx$$

$$\Rightarrow 2\sqrt{5}kx = x^2 - k^2 - 4x^2 + 5x^2 + k^2$$

$$\Rightarrow \Rightarrow K = \frac{2x^2}{2\sqrt{5}x} = \frac{x}{\sqrt{5}}$$

$$\therefore \frac{Ar(\Delta DCE)}{Ar(\square ABCD)} = \frac{\frac{1}{2} \times k \times \sqrt{x^2 - k^2}}{2x \times x}$$

$$= \frac{\frac{1}{2} \times \frac{x}{\sqrt{5}} \times \sqrt{x^2 - \frac{x^2}{5}}}{2x^2}$$

$$= \frac{\frac{1}{2} \times \frac{x}{\sqrt{5}} \times \frac{2x}{\sqrt{5}}}{2x^2}$$

$$= \frac{1}{2x^2} \times \frac{x^2}{5}$$

$$= \frac{1}{10}$$

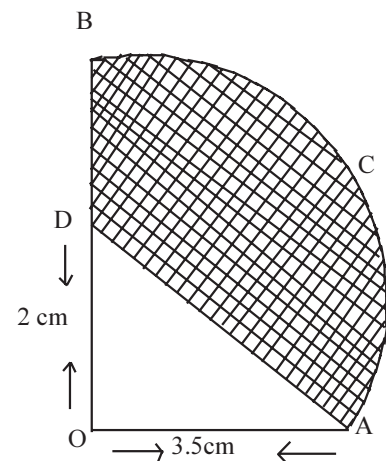
$$\therefore \text{Ratio} = 1:10$$

- 3 . If the given figure AOBKA represents a quadrant of a circle of radius 3.5 cm with centre O. Calculate the area of the shaded portion.

- a) 6.125 cm² b) 6.215 cm²
c) 7.125 cm² d) 7.215 cm²

sol;- Area of the shaded portion = Area of quadrant- Area of ΔOAD

$$= \frac{1}{4}\pi r^2 - \frac{1}{2}bh$$



$$\begin{aligned}
&= \frac{1}{4} \times \frac{22}{7} \times 3.5 \times 3.5 - \frac{1}{2} \times 3.5 \times 2 \\
&= 9.625 - 3.5 \\
&= 6.125 \text{ cm}^2
\end{aligned}$$

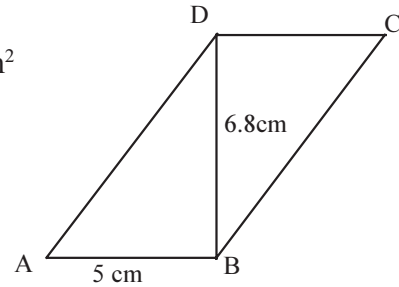
- 4 . In the given figure, ABCD is a parallelogram in which $\overline{AB} = \overline{CD}$ and $\overline{BD} \perp \overline{CD}$ such that BD=6.8cm.then the area of parallelogram is.....

- a) 17 cm² b) 25 cm² c) 34 cm² d) 68 cm²

sol;- Since BD is diagonal ,
area of parallelogram

ABCD= 2x AREA OF $\triangle BCD$

$$= 2 \times \frac{1}{2}bh = 5 \times 6.8 = 34 \text{ cm}^2$$



- 5 . ABCD is a trapezium in which $\overline{AB} \parallel \overline{CD}$ and $AB=2CD$.

Its diagonals intersect each other at O. Then the ratio of the areas of triangles AOB and COD is.....

- a) 1:2 b) 2:1 c) 4:1 d) 1:4

sol:- Let $CD=x$ then $AB=2x$

$$\frac{Ar.(\triangle AOB)}{Ar.(\triangle COD)} = \frac{\frac{1}{2} \times AB \times OP}{\frac{1}{2} \times CD \times OQ}$$

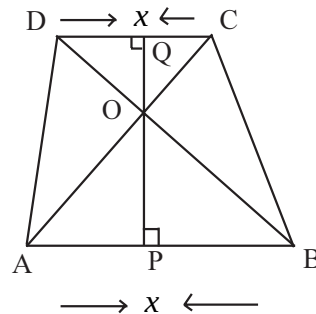
$$= \frac{2x \times OP}{x \times OQ}$$

$$= \frac{2OP}{OQ}$$

$$= \frac{2 \times 2OQ}{OQ}$$

$$= \frac{4}{1}$$

$\therefore$ Ratio = 4:1



6 . $\triangle ABC$ and $\triangle BDE$ are two equilateral triangles such that D is the midpoint of $\overline{BC}$. Then $Ar(\triangle BDE) : Ar(\triangle ABC) = ?$

- a) 1:2 b) 1:4 c) $\sqrt{3}:2$ d) 3:4

sol:- $\triangle ABC, \triangle BDE$ are equilateral triangles

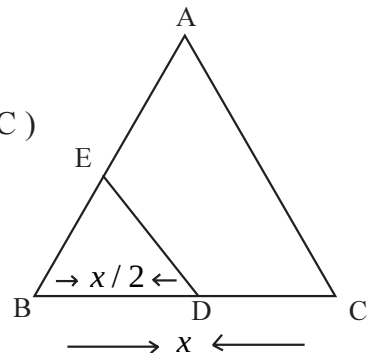
Let $BC=x$ then $BD=\frac{x}{2}$ ($\therefore$ D is the midpoint of BC)

$$Ar(\triangle BDE) : Ar(\triangle ABC) = \frac{\sqrt{3}}{4} \times \left(\frac{x}{2}\right)^2 : \frac{\sqrt{3}}{4} \times x^2$$

$$= \frac{x^2}{4} : x^2$$

$$= \frac{1}{4} : 1$$

$$= 1:4$$



7 . The vertex A of $\triangle ABC$ is joined to a point D on BC. If E is the midpoint of $\overline{AD}$, then $Ar(\triangle BEC) = \dots\dots\dots$

- a) $\frac{1}{2} Ar(\triangle ABC)$ b) $\frac{1}{3} Ar(\triangle ABC)$ c) $\frac{1}{4} Ar(\triangle ABC)$
d) $\frac{1}{6} Ar(\triangle ABC)$

sol:- In $\triangle ABD$, BE is the median

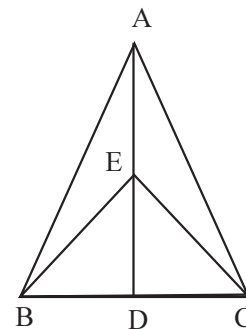
$$\therefore Ar(\triangle BDE) = \frac{1}{2} \times Ar(\triangle ABD)$$

In $\triangle ACD$, CE is the median

$$\therefore Ar(\triangle CED) = \frac{1}{2} \times Ar(\triangle ACD)$$

$$\therefore Ar(\triangle BDE) + Ar(\triangle CED) = \frac{1}{2} \times Ar(\triangle ABD) + \frac{1}{2} \times Ar(\triangle ACD)$$

$$\Rightarrow Ar(\triangle BEC) = \frac{1}{2} \times Ar(\triangle ABC)$$



8 . $\triangle ABC$ is such that $AB=3$ cm, $BC=2$ cm and $AC=2.5$ cm. $\triangle DEF$ is similar to $\triangle ABC$. If $EF=4$ cm then the perimeter of $\triangle DEF$ is

- a) 5 cm b) 7.5 cm c) 15 cm d) 18 cm

sol:- $\Delta ABC \sim \Delta DEF$

$$\Rightarrow \frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$$

$$\Rightarrow \frac{3}{DE} = \frac{2}{4} = \frac{2.5}{DF}$$

$$\Rightarrow \frac{3}{DE} = \frac{1}{2} \Rightarrow DE = 6 \text{ cm and}$$

$$\Rightarrow \frac{1}{2} = \frac{2.5}{DF} \Rightarrow DF = 5 \text{ cm,}$$

$$\therefore \text{Perimeter of } \Delta DEF = 6\text{cm} + 4\text{cm} + 5\text{cm} \\ = 15 \text{ cm.}$$

9 . In two triangles , the ratio of the areas is 4:3 and ratio of their heights is 3:4 . Find the ratio of their bases

a) 16:9

b) 9:16

c) 9:12

d) 16:12

sol:- Ratio of areas = $\frac{1}{2}b_1h_1 : \frac{1}{2}b_2h_2 = 4:3$

$$\Rightarrow 3x \times b_1 : 4x \times b_2 = 4:3$$

$$\Rightarrow \frac{3x \times b_1}{4x \times b_2} = \frac{4}{3}$$

$$\Rightarrow \frac{b_1}{b_2} = \frac{16}{9}$$

$\therefore$ Ratio of bases = 16:9

10 . In ΔABC , it is given that D is the midpoint of BC; E is the midpoint of BD and O is the midpoint of AE. Then

$Ar(\Delta BOE) = \dots\dots\dots$

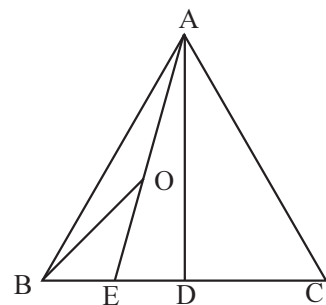
a) $\frac{1}{3}Ar(\Delta ABC)$ b) $\frac{1}{4}Ar(\Delta ABC)$ c) $\frac{1}{6}Ar(\Delta ABC)$ d) $\frac{1}{8}Ar(\Delta ABC)$

sol:- $Ar(\Delta ABD) = \frac{1}{2} \times Ar(\Delta ABC)$

$$Ar(\Delta BAE) = \frac{1}{2} \times Ar(\Delta ABD)$$

$$= \frac{1}{2} \times \frac{1}{2} \times Ar(\Delta ABC)$$

$$= \frac{1}{4} \times Ar(\Delta ABC)$$



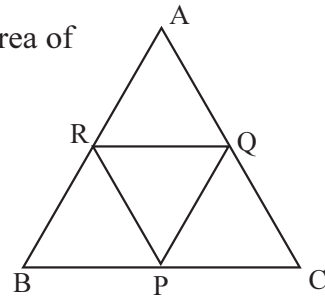
$$Ar(\triangle BOE) = \frac{1}{2} \times Ar(\triangle BAE) = \frac{1}{2} \left[\frac{1}{4} \times Ar(\triangle ABC) \right]$$

$$= \frac{1}{8} \times Ar(\triangle ABC)$$

11. The triangle is formed by joining the mid points of the sides $\overline{AB}$, $\overline{BC}$ and $\overline{CA}$ of $\triangle ABC$ and the area of $\triangle PQR$ is 6 cm^2 then the area of $\triangle ABC$ is

- a) 36 cm^2 b) 12 cm^2
c) 18 cm^2 d) 24 cm^2

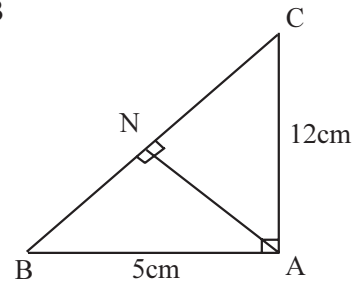
sol : $Ar(\triangle ABC) = 4 \times Ar(\triangle PQR)$
 $= 4 \times 6 \text{ cm}^2$
 $= 24 \text{ cm}^2$



12. ABC is a triangle in which $\angle A = 90^\circ$, $AN \perp BC$, $AC = 12 \text{ cm}$ and $AB = 5 \text{ cm}$. Find the ratio of the areas of $\triangle ANC$ and $\triangle ANB$

- a) $125 : 44$ b) $25 : 144$
c) $144 : 25$ d) $12 : 5$

Sol : $\triangle NBA \sim \triangle ABC$ and
 $\triangle NAC \sim \triangle ABC$ (A.A.similarity)
 $\therefore \triangle NBA \sim \triangle NAC$



Since the Ratio of Areas of similar triangle is equal to ratio of squares of the corresponding sides

$$Ar(\triangle ANC) : Ar(\triangle ANB) = AC^2 : AB^2 = (12\text{cm})^2 : (5\text{cm})^2$$

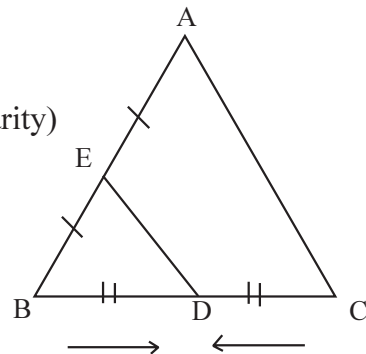
$$= 144 : 25$$

13. Area of $\triangle ABC = 30 \text{ cm}^2$. D and E are the mid points of $\overline{BC}$ and $\overline{AB}$ respectively. Find $Ar(\triangle BDE)$

- a) 10 cm^2 b) 7.5 cm^2
c) 15 cm^2 d) None of these

Sol : $\triangle BED \sim \triangle BAC$ ($\therefore S \parallel A \parallel S$ similarity)

$$\therefore \frac{Ar(\triangle BDE)}{Ar(\triangle ABC)} = \frac{1^2}{2^2} = \frac{1}{4}$$



$$\Rightarrow \frac{Ar(\triangle BDE)}{30\text{cm}^2} = \frac{1}{4}$$

$$\Rightarrow Ar(\triangle BDE) = \frac{1}{4} \times 30\text{cm}^2$$

$$= 7.5\text{ cm}^2$$

14. What is the maximum area of triangle that can be enclosed in a triangle of perimeter 24 cm

a) 32 cm^2 b) $16\sqrt{3}\text{ cm}^2$ c) $16\sqrt{2}\text{ cm}^2$ d) 27 cm^2

it is a an equilateral triangle

perimeter , $3a = 24\text{ cm}$

$$\Rightarrow a = 8\text{ cm}$$

$$\therefore \text{Area} = \frac{\sqrt{3}}{4} \times 8 \times 8$$

$$= 16\sqrt{3}\text{ cm}^2$$

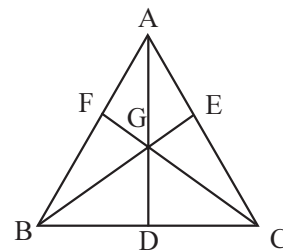
15. If G be centroid of $\triangle ABC$ and the area of $\triangle GBD$ is 6 cm^2 . Where D is the mid point of side BC. then the area of $\triangle ABC$ is

a) 18 cm^2 b) 12 cm^2
c) 24 cm^2 d) 36 cm^2

Sol : $Ar(\triangle ABC) = 6 \times Ar(\triangle GDB)$

$$= 6 \times 6\text{ cm}^2$$

$$= 36\text{ cm}^2$$



16. If G is the centroid and $\overline{AD}$, $\overline{BE}$ and $\overline{CF}$ are three medians of $\triangle ABC$ with area 72 cm^2 , then the area of

$\triangle BDG$ is

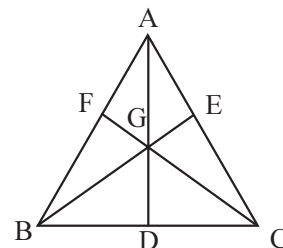
a) 12 cm^2 b) 16 cm^2 c) 24 cm^2 d) 8 cm^2

Sol : $Ar(\triangle ABC) = 6 \times Ar(\triangle BDG)$

$$\therefore Ar(\triangle BDG) = \frac{1}{6} \times Ar(\triangle ABC)$$

$$= \frac{1}{6} \times 72\text{ cm}^2$$

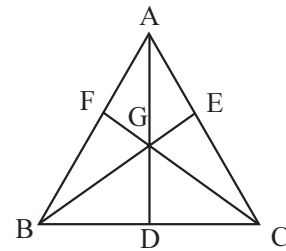
$$= 12\text{ cm}^2$$



17. The three medians $\overline{AD}$, $\overline{BE}$ and $\overline{CF}$ of $\triangle ABC$ intersect at point G. If the area of $\triangle ABC$ is 60 cm^2 then the area of the quadrilateral BDGF is

a) 10 cm^2 b) 15 cm^2 c) 20 cm^2 d) 30 cm^2

$$\begin{aligned}
 \text{Sol : } \text{Ar}(\square BDGF) &= \text{Ar}(\triangle BDG) + \text{Ar}(\triangle BGF) \\
 &= \frac{1}{6} \times (\text{Ar}\triangle ADB) + \frac{1}{6} \times (\text{Ar}\triangle ABC) \\
 &= 2 \times \frac{1}{6} \times \text{Ar}(\triangle ABC) \\
 &= \frac{1}{3} \times 60 \text{ cm}^2 \\
 &= 20 \text{ cm}^2
 \end{aligned}$$

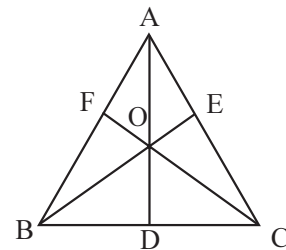


18. In $\triangle ABC$, O is the centroid and AD, BE, CF are three medians and the area of $\triangle AOE = 15 \text{ cm}^2$ then

area of quadrilateral BDOF is

a) 20 cm^2 b) 30 cm^2 c) 40 cm^2 d) 25 cm^2

$$\begin{aligned}
 \text{Sol : } \text{Ar}(\triangle AOE) &= 15 \text{ cm}^2 \\
 \text{Ar}(\square BDOF) &= \text{Ar}(\triangle OBD) + \text{Ar}(\triangle OBF) \\
 &= 15 \text{ cm}^2 + 15 \text{ cm}^2 \\
 &= 30 \text{ cm}^2
 \end{aligned}$$



19. A straight line parallel to the base BC of the triangle ABC intersects $\overline{AB}$ and $\overline{AC}$ at the points D and E

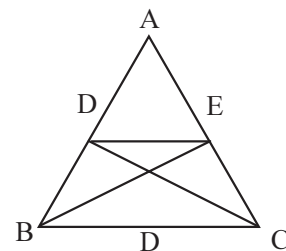
respectively. If the area of the $\triangle ABC$ is 36 cm^2 then the area of $\triangle ADE$

a) 18 cm^2 b) 36 cm^2 c) 18 cm d) 36 cm

Sol : $DE \parallel BC$

$\triangle ADE$ and $\triangle DEC$ are the triangle with same base and between same parallel line

$$\begin{aligned}
 \therefore \text{Ar}(\triangle ADE) &= \text{Ar}(\triangle DEC) \quad (1) \\
 \text{Given, } \text{Ar}(\triangle ABE) &= 36 \text{ cm}^2 \\
 \Rightarrow \text{Ar}(\triangle ADE) + \text{Ar}(\triangle DEB) &= 36 \text{ cm}^2 \\
 \Rightarrow \text{Ar}(\triangle ADE) + \text{Ar}(\triangle DEC) &= 36 \text{ cm}^2 \quad (\therefore \text{from (1)}) \\
 \Rightarrow \text{Ar}(\triangle ADC) &= 36 \text{ cm}^2
 \end{aligned}$$



20. ABC is an equilateral triangle P and Q are points of $\overline{AB}$ and $\overline{AC}$ respectively such that $PQ \parallel \overline{BC}$

If $PQ = 5\text{ cm}$, then the area of ΔAPQ is

- a) $\frac{25}{4}\text{ cm}^2$ b) $\frac{25}{\sqrt{3}}\text{ cm}^2$ c) $\frac{25\sqrt{3}}{4}\text{ cm}^2$ d) $25\sqrt{3}\text{ cm}^2$

Sol : In Equilateral ΔABC

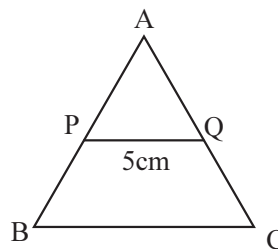
$$\angle A = \angle B = \angle C = 60^\circ$$

$PQ \parallel BC$ and AB, AC are transversal

$$\therefore \angle P = \angle B = 60^\circ, \angle Q = \angle C = 60^\circ \quad (\because \text{Corresponding angles})$$

$\therefore \Delta APQ$ is equilateral triangle

$$\begin{aligned} \therefore \text{Ar}(\Delta APQ) &= \frac{\sqrt{3}}{4} a^2 \\ &= \frac{\sqrt{3}}{4} \times 5^2 \\ &= \frac{25\sqrt{3}}{4} \text{ cm}^2 \end{aligned}$$



21. The Area of an equilateral triangle is $4\sqrt{3}\text{ cm}^2$. Its perimeter is .

- a) 12 cm b) 6 cm c) 8 cm
d) $3\sqrt{3}\text{ cm}$

Sol : Area of Equilateral triangle = $4\sqrt{3}\text{ cm}^2$

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

$$\Rightarrow a^2 = 4\sqrt{3} \times \frac{4}{\sqrt{3}}$$

$$\therefore a = 4\text{ cm}$$

$$\therefore \text{Perimeter} = 3 \times 4 = 12\text{ cm}$$

22. The ratio of length of each equal side and the non equal side of an isosceles triangle is 3 : 4. If the area of the

triangle is $18\sqrt{5}\text{ sq. units}$, the non equal side is

- a) 16 units b) $5\sqrt{10}$ units c) $8\sqrt{2}$ units d) 12 units

Sol : Let the sides of triangle be $3x, 3x, 4x$

$$\begin{aligned}
 \text{Area of } \Delta &= \sqrt{s(s-a)(s-b)(s-c)} \\
 s &= \frac{3x+3x+4x}{2} = \frac{10x}{2} = 5x \\
 \Delta &= \sqrt{5x(5x-3x)(5x-3x)(5x-4x)} = 18\sqrt{5} \\
 &\Rightarrow \sqrt{5x \times 2x \times 2x \times x} = 18\sqrt{5} \\
 &\Rightarrow \sqrt{20x^4} = 18\sqrt{5} \\
 &\Rightarrow 2\sqrt{5}x^2 = 18\sqrt{5} \\
 &\Rightarrow x^2 = \frac{18\sqrt{5}}{2\sqrt{5}} = 9 \\
 \therefore x &= 3
 \end{aligned}$$

length of 3rd side = $4 \times 3 = 12$ m

23. The ratio of sides of a triangle is $3 : 4 : 5$. If area of the triangle is 72 sq.units, then the length of the smallest side is .

a) $4\sqrt{3}$ units b) $5\sqrt{3}$ units c) $6\sqrt{3}$ units d) $3\sqrt{3}$ units

Sol : Let the sides = $3x, 4x, 5x$

$$\begin{aligned}
 \Delta &= \frac{3x+4x+5x}{2} = \frac{12x}{2} = 6x \\
 \Delta &= \sqrt{s(s-a)(s-b)(s-c)} = 72\text{cm}^2 \\
 &\Rightarrow \sqrt{6x(6x-3x)(6x-4x)(6x-5x)} = 72 \\
 &\Rightarrow \sqrt{6x \times 3x \times 2x \times x} = 72 \\
 &\Rightarrow 6x^2 = 72 \\
 &\Rightarrow x^2 = 12 \\
 \therefore x &= \sqrt{12} = 2\sqrt{3} \text{ units} \\
 \therefore \text{length of smallest side} &= 3x = 3 \times 2\sqrt{3} = 6\sqrt{3} \text{ units}
 \end{aligned}$$

24. The Area of an isoscles triangle is 4 sq.units . If the length of non equal side is 2 untis. the length of each

equal side is

a) 4 units b) $2\sqrt{3}$ units c) $\sqrt{17}$ units d) $3\sqrt{2}$ units

Sol : Let the equal sides = x

$$\text{Area of isoscles } \Delta = \frac{b}{4} \sqrt{4a^2 - b^2}$$

$$\Rightarrow \frac{2}{4} \sqrt{4x^2 - 2^2} = 4$$

$$\Rightarrow \frac{1}{2} \times \sqrt{4x^2 - 4} = 4$$

$$\Rightarrow \sqrt{4x^2 - 4} = 8$$

$$\Rightarrow 2\sqrt{x^2 - 1} = 8$$

$$\Rightarrow \sqrt{x^2 - 1} = 4$$

$$\therefore x^2 - 1 = 16$$

$$\Rightarrow x^2 = 17$$

$$\Rightarrow x = \sqrt{17}$$

$\therefore$ Lengths of Equal sides = $\sqrt{17}$ units

25. Two triangles ABC and DEF are similar to each other in which AB=10Cm, DE=8Cm then the ratio of the areas of triangles ABC and DEF is

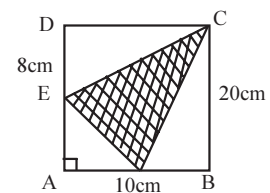
a) 4 : 5 b) 25 : 16 c) 64 ; 125 d) 4 : 7

Solve : Ratio of Areas of similar traingles to equal to ratio of squares of its corresponding sides

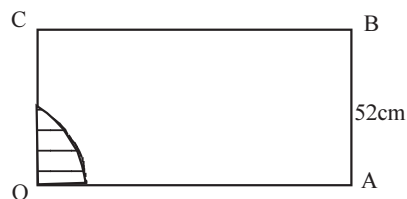
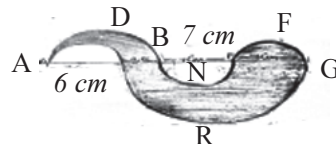
$$\begin{aligned} \therefore Ar(\Delta ABC) : Ar(\Delta DEF) &= AB^2 : DE^2 \\ &= 10^2 : 8^2 \\ &= 100 : 64 \\ &= 25 : 16 \end{aligned}$$

LEVEL -1 PROBLEMS

- How many different rectangles can you make with a 24cm long string with integral sides? []
a) 5 b) 6 c) 7 d) 10
- How many tiles with dimensions 12cm and 5cm will be needed to fit a region whose length and breadth are 144cm and 100 cm respectively []
a) 240 b) 250 c) 270 d) 300
- In the figure ABCD, Find the area of the shaded region
a) 125 cm² b) 150 cm²
c) 160 cm² d) 175 cm²



4. The ratio of the diameters of two circles is 3 : 4. Find the ratio of their circumferences []
 a) 3 : 4 b) $\sqrt{3}:2$ c) 9 : 16 d) 3 : 2
5. How many times will a wheel of radius 35cm be rotate to travel 660 cm?
 a) 3 b) 5 c) 2 d) 1
6. The minute hand of a circular clock is 15cm. How far distance does tip of the minute hand move in 1 hour? []
 a) 92.40 cm b) 94.20 cm c) 95cm d) 95.20 cm
7. The length of a rectangular park is 700m and its breadth is 300m. The cross roads, each of width 10m, cut the centre of a rectangular park and are parallel to its sides. Find the area of the park excluding the area of the cross roads
 a) 200100 m² b) 2010 m² c) 30001 m² d) 20001 m²
8. The ratio of length of parallel sides of a trapezium is 4 : 1 . The distance between them is 10cm. If the area of the trapezium is 500 cm². Find the lengths of the parallel sides []
 a) 50 cm b) 80 cm c) 70 cm d) 100 cm
9. The adjacent figures consists of four small semi-circles of equal radii and two big semi-circles of equal radii (each 42cm). Find the area of the shaded region
 a) 5544 cm² b) 4455 cm² c) 4444 cm² d) 5555 cm²
10. Find the area of shaded region of the figure given below
 a) 144.75 cm² b) 144.50 cm²
 c) 144.375 cm² d) 145.375 cm²
11. A horse is placed for grazing inside a rectangular field 70m by 52m, and its tethered to one corner by a rope 21m long. How much area can it graze?
 a) 345.5 m² b) 344.5 m² []
 c) 346. 5cm² d) 346.5m²
12. The given figure is made up of a 1cm squares. Find the perimeter of the figure []
 a) 10 cm b) 12 cm
 c) 14 cm d) 16 cm
13. Perimeter of a square is 36 cm. then its area is []
 a) 36 cm² b) 49 cm² c) 64 cm² d) 81 cm²

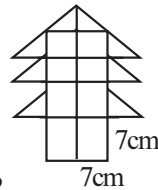


14. Perimeter of a rectangle is 70cm and length is 20cm then area is[]

a) 15 cm² b) 220 cm² c) 300 cm² d) 400 cm²

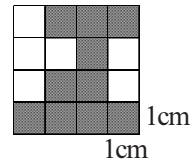
15. Find the area of the following figure []

a) 488 cm² b) 498 cm²
c) 588 cm² d) 688 cm²



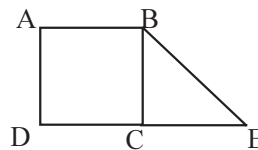
16. What is the Perimeter of the shaded figure?

a) 17 cm b) 10 cm []
c) 40 cm d) 18 cm



17. ABCD is a square of Perimeter 40cm. Then area of $\triangle BCE$ is $\frac{3}{4}$ that of the square what is the length of CE ? []

a) 10 cm b) 15 cm
c) 25 cm d) $13\sqrt{5}$ cm

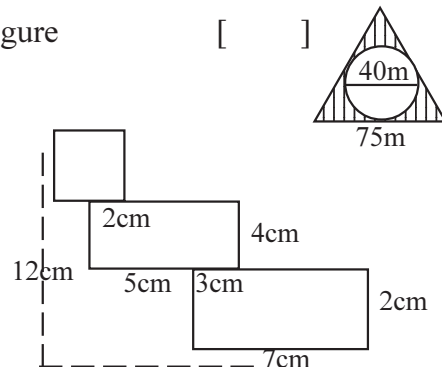


18. A rectangle and a square are equal in area. The side of the square is 24m. Find the width of the rectangle if it is 36m long []

a) 16 cm b) 18 cm c) 24 cm d) 20 cm

19. Find the area of the shaded portion of the figure []

a) 894 m² b) 994 m²
c) 984 m² d) 498 m²

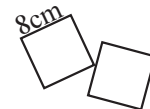


20. The perimeter of the figure is []

a) 56 cm b) 58 cm
c) 62 cm d) 66 cm

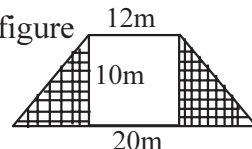
21. What is the total Area of the 2 identical squares shown? []

a) 32 cm² b) 64cm²
c) 128 cm² d) 135 cm²



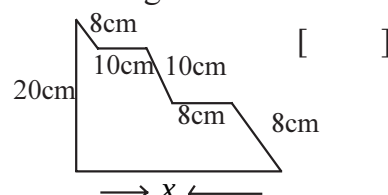
22. Find the area of the shaded part in the given figure []

a) 20 m² b) 116 m²
c) 40 m² d) 160 m²



23. The figure has a perimeter at 125cm. Find the missing number 'x' in the box.

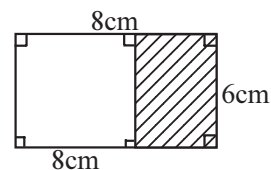
a) 55cm b) 70cm
c) 80cm d) 195cm



24. Find the area of the shaded portion in the figure

a) 12cm^2 b) 20cm^2 []

c) 36cm^2 d) 48cm^2



25. Find the area of a hexagon whose perimeter is 24cm

a) $5\sqrt{3}\text{cm}^2$ b) $2\sqrt{3}\text{cm}^2$ c) $3\sqrt{3}\text{cm}^2$ d) $4\sqrt{3}\text{cm}^2$ []

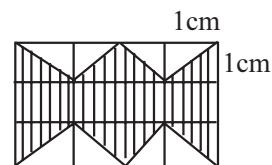
LEVEL -2 PROBLEMS

1. Find the Area of a the shaed portion

in the following figure []

a) 4 cm^2 b) 6 cm^2

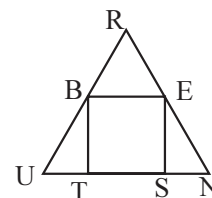
c) 8 cm^2 d) 10 cm^2



2. BEST is a square . Given the RUN is a right angled isosceles triangle of area 81cm^2 . find the area of BEST

a) 81cm^2 b) 40.5 cm^2 []

c) 162cm^2 d) 27cm^2

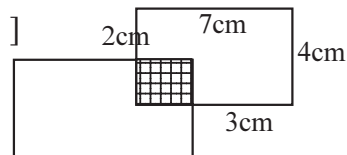


3. The figure is made up of two identical rectangles.

Find the area of the shaded part []

a) 12 cm^2 b) 10 cm^2

c) 8 cm^2 d) 16 cm^2



4. The figure shows a circle in a square.

Find the total area of the unshaed part

a) 420 cm^2 b) 392 cm^2 []

c) 86 cm^2 d) 94 cm^2



5. The base of a parallelogram is thrice its height. If the area of the parallelogram is 108 m^2 . Find the base and height respectively []

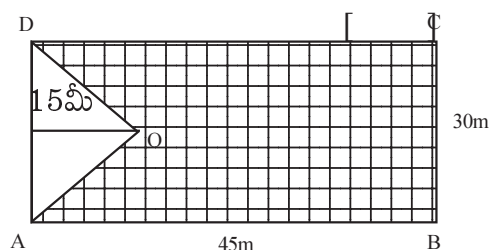
a) 18 cm,6 cm b) 4 cm, 12 cm

c) 12 cm, 4 cm d) 6cm, 18 cm

6. Find the area of the shaded region

a) 995 m^2 b) 1015 m^2

c) 1125 m^2 d) 1250 m^2

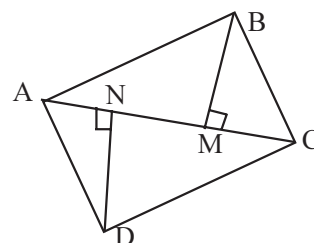


7. Find the area of the quadrilateral ABCD.

Here $AC = 22\text{cm}$, $BM = 3\text{cm}$, $DN = 3\text{cm}$,

and $\overline{BM} \perp \overline{AC}$, $\overline{DN} \perp \overline{AC}$ []

- a) 55cm^2 b) 66cm^2
c) 39cm^2 d) 89cm^2



8. How many times 132 cm logn wire can be wrapped around a circle with diameter 7cm? []

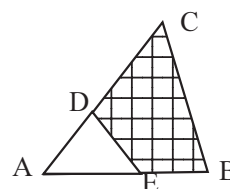
- a) 6 b) 10 c) 15 d) 8

9. A wire is in the shape of a rectangle of length 40cm and breadth 22cm. If the same wire is rebent into the shape of a square. What will be the measure of each side?: []

- a) 30 cm b) 31 cm c) 32 cm d) 33 cm

10. In the figure, $AB = 20\text{cm}$, $BC = 21\text{cm}$, $AD = 10\text{cm}$ and $DE = 10.5\text{cm}$. $\angle ABC$ and $\angle ADE$ are right angles. Find the area of the shaded region as shown in the figure.

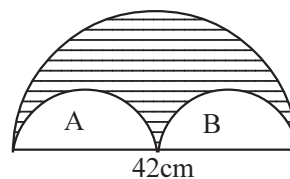
- a) 175.7cm^2 b) 157.7cm^2 []
c) 157.5cm^2 d) 185.7cm^2



11. A running track is a circular ring of outer diameter 168 m. The track is 7 m wide. Find the circumference of the inner ring. []

- a) 844 m b) 484 m c) 488 m d) 485 m

12. The figure is made up of 1 big semi circle and 2 identical smaller semi circles as shown in the figure. Taking $\pi = \frac{22}{7}$, find the perimeter of the shaded figure.



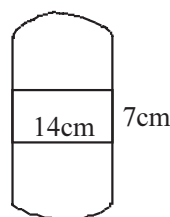
- a) 132cm^2 b) 122cm^2
c) 142cm^2 d) 152cm^2

13. A cow is tied to a pole, fixed to the midpoint of a square field of dimensions 40mX40m, by 14m long rope. Find the area that the cow can graze. []

- a) 137.5m^2 b) 136.75m^2 c) 173.5m^2 d) 134.75m^2

14. Find the area of the given shape ? []

- a) 252cm^2 b) 352cm^2
c) 252.5cm^2 d) 352.5cm^2

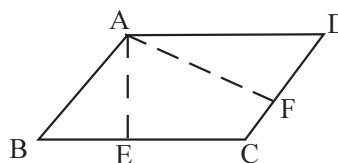


15. A circular path of width 2 m. Runs around a circular field whose circumference is 88 m. Find the area of the circular path []

a) 187.88cm^2 b) 188.57cm^2 c) 188.97cm^2 d) 188.44cm^2

16. Find the area of the parallelogram ABCD whose base BC is 27 cm and altitude AE is 8 cm . If the length of altitude AE to the base CD is 12 cm . Then find CD. []

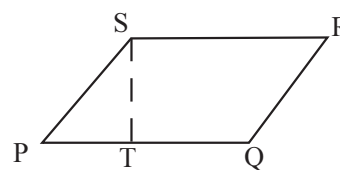
a) 18 cm b) 9cm
c) 3cm d) 6cm



17. In the given parallelogram PQRS , $\overline{ST}$ is an altitude to the base $\overline{PQ}$, the area of PQRS is 120 cm^2 .

If $PQ=15\text{ cm}$ and $PT=6\text{ cm}$ then find SP []

a) 15 cm b) 8 cm
c) 12 cm d) 10 cm

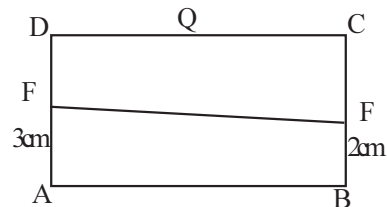


18. The perimeter of a rectangle is 168 m . If the length is 46 cm ,find its area []

a) 1746 m^2 b) 1890 m^2 c) 1680 m^2 d) 1748 m^2

19. Ravi wants to grow two crops in his rectangle field . He divides this field in to two equal parts as shown. Find the area of one of equal parts.

a) 10 cm^2 b) 20 cm^2 []
c) 30 cm^2 d) 40 cm^2



20. If the area of an equilateral triangle is $144\sqrt{3}\text{ cm}^2$ then find its height []

a) 24 cm b) $44\sqrt{3}$ c) $12\sqrt{3}$ d) $8\sqrt{3}$

21. If the perimeter of a triangle is $5y+2x$ and two sides of that triangle are $2y+3x$ and $x-y$ then find third side ? []

a) $5y-6x$ b) $5y+6x$ c) $4y-2x$ d) $5y-2x$

22. Length of diagonal of a right angled isosceles triangle is $9\sqrt{2}\text{ cm}$. Find the area of triangle []

a) cannot measure b) $\frac{81}{2}\text{ cm}^2$ c) 81 cm^2 d) 80 cm^2

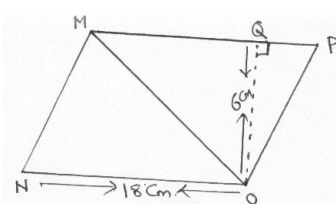
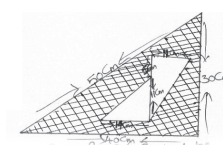
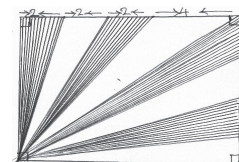
23. If the area of a rectangular park is 3392 m^2 and its width is 53 m . Then find the perimeter of the park []

a) 220 m b) 234 m c) 243 m d) 216 m

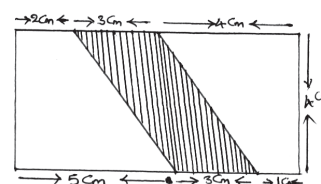
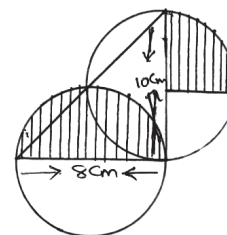
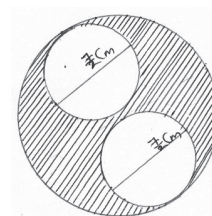
24. Diameter of a circular wheel of a cart is 44 cm. If it moves 7260 cm distance then find the no of revolutions done by the wheel. []
 a) 156 b) 651 c) 165 d) 615
25. If a wire is bent in to a circle of radius 20 cm. then find its length []
 a) 157.14 cm b) 157.41 cm c) 175.14 cm d) 175.41 cm

LEVEL-3

1. Find the area of shaded region in the figure
 a) 35 sq.units b) 70 sq.units
 c) 34 sq.units d) 36 sq.units
2. Find the area of shaed portion in the figure
 a) 435 cm² b) 1200 cm²
 c) 358 cm² d) 400 cm²
3. Ratio of Areas of Δ MNO and parallelogram MNOP is 1 : m then find the value of m ?



4. Find the unit digit of area of shaded part of given figure, it radius of larger circle is 21 cm
 a) 0 b) 5
 c) 7 d) 9
5. The figure is formed by two circles. Find the total area of the shaded part? ($\pi=3.14$) []
 a) 64.424cm² b) 58.64 cm²
 c) 40.336 cm² d) 44.745 cm²
6. What is the shaded area of the rectangle []
 a) 20 cm² b) 16 cm²
 c) 14 cm² d) 12 cm²



7. A swimming pool of 25m by 10m has a concrete boarder. Find the perimeter of the out side of the concrete boarders. If it is 5m wide at both sides and 5m at top and bottom []

a) 80 M b) 90 M c) 95 M d) 100 M

8. If perimeter of a right angle triangle is 60cm and its diagonal is 26cm then find its area []

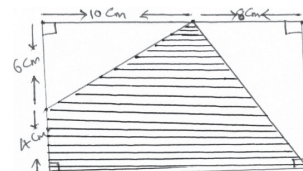
a) 170 cm² b) 240 cm² c) 390 cm² d) 780 cm²

9. Smitha wrapped a cord around a circular pipe of radius 4cm and cut off the length required of the cord. Then she wrapped it around a square box of side 4cm. Then find the remaining length of cord? []

a) 10.5 cm b) 9.12 cm c) 9.15 cm d) 10.5 cm

10. Find the area of shaded region []

a) 100 cm² b) 110 cm²
c) 125 cm² d) 150 cm²



11. A circle of radius 2cm is cut out from a square piece of an aluminium sheet of side 6cm. What is the area of the left over aluminium sheet? ($\pi=3.14$) []

a) 23.33 cm² b) 22.44 cm² c) 24.44 cm² d) 24.33 cm²

12. The minute hand of a circular clock is 15cm long. How far does the tip of the minutes hand move in 1 hour? ($\pi=3.14$) []

a) 92.34 cm b) 94.20 cm c) 92.25 cm d) 94.33 cm

13. From a circular card sheet of radius 14 cm two circles of radius 3.5 cm and a rectangle of length 3cm and breadth 1cm are removed. Find the area of the remaining sheet []

a) 534.50 cm² b) 534.51 cm²
c) 535.50 cm² d) 535.51 cm²

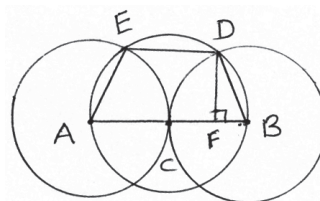


14. A circular flower garden has an area of 314 m². A sprinkler at the centre of the garden can cover an area within a radius of 12m. How much area should be left over other than the garden under the coverage of sprinkler []

a) 148.14 m² b) 138.50 m² c) 138.14 m² d) 148.50 m²

15. Two circles of radii 2 cm with centres A and B meet at point C. A third circle of radius 2 cm with centre C intersecting the first two circles at D and E then find Area of quadrilateral ABDE. []

a) $2\sqrt{2}$ cm² b) $3\sqrt{3}$ cm²
c) $3\sqrt{2}$ cm² d) $2\sqrt{3}$ cm²



2.SURFACE AREAS AND VOLUMES OF

3-D FIGURES

- 1) **Volume** : - Space occupied by a three dimensional figure is called volume

Note : Volume always measures in cubic units

(M. M^3 : CM^3 , M^3 , KM^3 )

- 1) **Cuboid**

→ Lateral surface Area = $2h(l+b)$

→ Total surface Area = $2(lb+ bh+ hl)$

→ Volume $v = lbh$

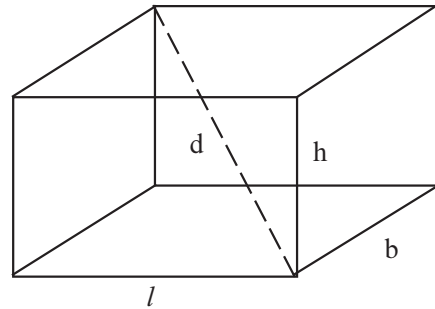
→ Diagonal, $d = \sqrt{l^2 + b^2 + h^2}$

→ l = length

→ b = breadth

→ h = height

→ d = diagonal



- 2) **Cube**

→ Lateral surface Area = $4a^2$

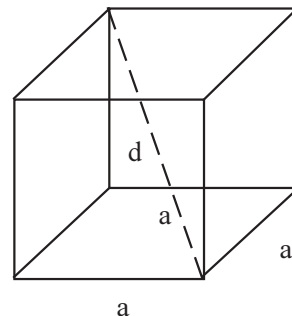
→ Total surface Area = $6a^2$

→ Volume . $V = a^3$

→ Diagonal, $d = \sqrt{3} a$

→ a = side of the cube

→ d = diagonal



- 3) **Cylinder**

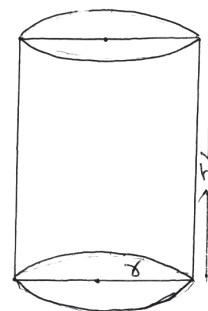
→ Lateral / curved surface Area = $2\pi r h$

→ Total surface Area = $2\pi r (h+r)$

→ Volume, $V = \pi r^2 h$

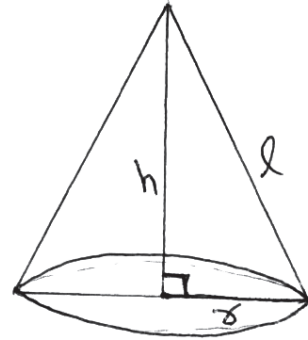
→ r = Radius

→ h = height



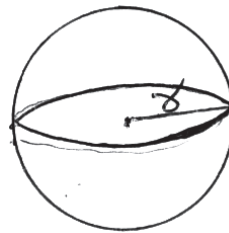
4) Cone

- Curved surface Area = $\pi r l$
- Total surface Area = $\pi r (1 + r)$
- Volume, $V = \frac{1}{3} \pi r^2 h$
- slant height, $l = \sqrt{h^2 + r^2}$
 - r = radius
 - h = height
 - l = slant height



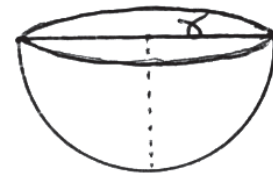
5) Sphere :-

- Lateral surface Area = $4 \pi r^2$
- Total surface Area = $4 \pi r^2$
- Volume = $\frac{4}{3} \pi r^3$
- r = radius



6) Hemi Sphere :-

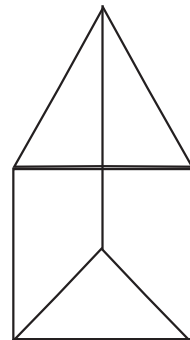
- Lateral surface Area = $2 \pi r^2$
- Total surface Area = $3 \pi r^2$
- Volume = $\frac{2}{3} \pi r^3$



→ r = radius

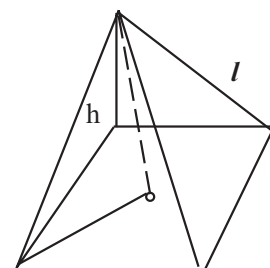
7) Prism :-

- Lateral surface Area = Perimeter of base x height
- Total surface Area = Lateral surface Area + 2 x Base area
- Volume = Area of base x height



8) Pyramid

- Lateral surface Area
 - = $\frac{1}{2}$ (Circumference of base) x slant height
- Total surface Area
 - = Lateral surface area + Area of base
- Volume
 - = $\frac{1}{3}$ x Area of base x height



Solved problems

1. Find the total surface area of a cuboid whose length is 15cm, breadth is 12cm and height is 10cm.

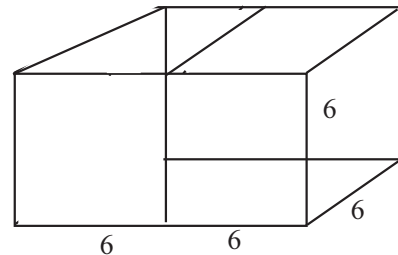
a) 100 cm^2 b) 900 cm^2 c) 800 cm^2 d) 700 cm^2

$$\begin{aligned}\text{Sol : Total surface Area of a cuboid} &= 2 (lh + bh + hl) \\ &= 2 (15 \times 12 + 12 \times 10 + 10 \times 15) \\ &= 2 (450) \\ &= 900 \text{ cm}^2\end{aligned}$$

2. Two cubes of side 6 cm joined as shown in figure. Find the total surface area of cuboid formed.

a) 260 cm^2 b) 280 cm^2
c) 360 cm^2 d) 380 cm^2

$$\begin{aligned}\text{Sol : Total surface Area} &= 2 (lb + bh + hl) \\ &= 2 (12 \times 6 + 6 \times 6 + 6 \times 12) \\ &= 2 (180) \\ &= 360 \text{ cm}^2\end{aligned}$$



3. Prameela painted a box of 1m x 2m x 1.5m measurements. Find the area of face except upper and bottom faces.

a) 6 m^2 b) 9 m^2 c) 12 m^2
d) 15 m^2

$$\begin{aligned}\text{Sol : Area of remaining faces} &= \text{Lateral surface Area} \\ &= 2h (l + b) \\ &= 2 \times 1.5 (1 + 2) \\ &= 3 \times 3 = 9 \text{ m}^2\end{aligned}$$

4. A water tank is in the shape of cuboid with length 1.4m, breadth 1m and depth 0.7m, then find the volume of the tank in liters.

a) 1000 lt b) 980 lt c) 900 lt d) 1080 lt

$$\begin{aligned}\text{Sol : Volume of the tank} &= lbh \\ &= 1.4 \times 1 \times 0.7 \\ &= 0.98 \text{ m}^3 \\ &= 0.98 \times 1000 \text{ lt} \\ &= 980 \text{ liters}\end{aligned}$$

5. Dimensions of a box are 1.8 m x 90 cm x 60 cm. Dimensions of a soap are 6cm x 4.5 cm x 40 mm. If no space was left in the box after arrange the soaps. Then find the number of soaps arranged in the box.

a) 7000 b) 9000 c) 8000 d) 6000

$$\text{Sol : Total soaps arranged} = \frac{\text{Volume of box}}{\text{Volume of each soap}}$$

$$= \frac{1.8m \times 90cm \times 60cm}{6cm \times 4.5cm \times 40mm}$$

$$= \frac{180cm \times 90cm \times 60cm}{6cm \times 4.5cm \times 4cm}$$

$$= \frac{180 \times 90 \times 60}{6 \times 4.5 \times 4}$$

$$= 9000$$

6. If the length of a cuboid is double to its breadth and height is twice of its length then find the volume of the cuboid. (length = x)

a) x^3 cube units b) x^2 cube units
c) $8x^3$ cubic units d) $4x^3$ cubic units

$$\text{Sol : } l = x, b = x/2, h = 2x$$

$$\text{Volume} = lbh$$

$$= x \times \frac{x}{2} \times 2x$$

$$= x^3 \text{ cubic units}$$

7. 60 lt of water was pumping into a reservoir per minute. If the volume of the reservoir is 108 m^3 then find the time taken to fill the reservoir ?

a) 25 hr b) 28 hr c) 30 hr
d) 33 hr

$$\text{Sol : Volume of reservoir} = 108 \text{ m}^3$$

$$= 108 \times 1000 \text{ lt}$$

$$\text{time taken to fill 60 lt of water} = 1 \text{ min}$$

$$\text{Total time taken} = \frac{108 \times 1000}{60 \times 60} \text{ hr}$$

$$= 30 \text{ hr}$$

8. How many bricks required to construct a wall with dimensions 8m x 22.5 cm x 6m. If the dimension of each brick is 25 cm x 11.25 cm x 6 cm

a) 3200 b) 4400 c) 5600 d) 6400

$$\text{Sol: No. of bricks required} = \frac{\text{Volume of wall}}{\text{Volume of brick}}$$

$$= \frac{800 \times 22.5 \times 600}{25 \times 11.25 \times 6}$$

$$= 6400$$

9. If the measurement of a rectangular paper are 11cm x 4 cm. If it moulded as a cylinder with out overlapping its edges with height 4cm. Find the volume of cylinder

a) 37.5 cm³ b) 39.5 cm² c) 38.5 cm² d) 35.7 cm³

Sol : If the paper moulded as a cylinder then length of paper = Perimeter of cylidner

$$\therefore 11 = 2\pi r$$

$$\Rightarrow 2 \times \frac{22}{7} \times r = 11$$

$$\Rightarrow r = \frac{11}{2} \times \frac{7}{22} = \frac{7}{4} \text{ cm}$$

Given height h = 4cm

$$\therefore \text{Volume of cylinder} = \pi r^2 h$$

$$= \frac{22}{7} \times \frac{7}{4} \times \frac{7}{4} \times 4$$

$$= \frac{77}{2}$$

$$= 38.5 \text{ cm}^3$$

10. Base diameter of a conical vessal is 10m. and its slant height is 13m. If water is pumping into the vessel at the rate of 1.74 m³ per minute. Then find in how many hours the vessel will be filled

a) 2 hr b) 3 hr c) 4 hr
d) 5 hr

$$\text{Sol: } r = \frac{10}{2} = 5m$$

$$l = 13 \text{ m}$$

$$l^2 = h^2 + r^2$$

$$\Rightarrow h^2 = l^2 - r^2$$

$$\Rightarrow h = \sqrt{l^2 - r^2}$$

$$= \sqrt{13^2 - 5^2}$$

$$= \sqrt{169 - 25}$$

$$= 12 \text{ m}$$

$$\text{Volume of the vessel} = \frac{1}{3} \pi r^2 h$$

$$= \frac{1}{3} \times \frac{22}{7} \times 5 \times 5 \times 12$$

$$= 314.285 \text{ m}^3$$

$$\text{Time taken to fill } 1.74 \text{ m}^3 = 1 \text{ minute}$$

$$\text{Total time taken} = \frac{314.285}{1.74 \times 60} \text{ hr}$$

$$= 3 \text{ hr (Nearly)}$$

11. A hemi sphere of inner radius 15cm is with liquid. This liquid filled into cylindrical vessels of diameter 5cm and height 6 cm. How many vessels are required to fill the total liquid.

a) 50

b) 60

c) 70

d) 80

Sol : Volume of liquid in hemisphere = volume of cylindrical vessels

Let Number of vessels = n

$$\therefore \frac{2}{3} \pi r_1^3 = n \times \pi r_2^2 h$$

$$\Rightarrow \frac{2}{3} \times 15 \times 15 \times 15 = n \times \frac{5}{2} \times \frac{5}{2} \times 6$$

$$\Rightarrow n = \frac{2}{3} \times 15 \times 15 \times 15 \times \frac{2}{3} \times \frac{2}{5} \times \frac{1}{6}$$

$$= 60$$

$$\therefore \text{No. of vessels required} = 60$$

12. How many spheres of diameter 4cm. Can be made from a lead cube of side 44cm?

a) 2540

b) 2541

c) 2545

d) 4525

$$\text{Sol : No. of sphere} = \frac{\text{Volume of cube}}{\text{Volume of sphere}}$$

$$= \frac{44 \times 44 \times 44}{\frac{4}{3} \times \frac{22}{7} \times 2 \times 2 \times 2}$$

$$= \frac{44 \times 44 \times 44}{2 \times 2 \times 2} \times \frac{3}{4} \times \frac{7}{22}$$

$$= 2541$$

LEVEL -1 PROBLEMS

- Find the length of the longest pole that can be placed in a room 30m long, 24m broad and 18m height? []
 a) $30\sqrt{2}$ b) $40\sqrt{2}$ c) $45\sqrt{2}$ d) $49\sqrt{2}$
- A brick measure 20cm x 10 cm x 7.5 cm. How many bricks will be required for a wall 20m x 2m x 0.75 m? []
 a) 25000 b) 20000 c) 15000 d) 10000
- If the heights of two cones are in the ratio 1 : 4 and their diameters are in the ratio 4 : 5 .What is the ratio of their volumes? []
 a) 4 : 25 b) 25 : 4 c) 29 : 27 d) 28 : 25
- Two spheres each of 10m diameter are melted down and recast into a cone at height equal to the radius of its base. find the height of the cone? []
 a) 20m b) 30m c) 10m d) 15m
- The circumference of the base of a cylidner is 6π cm. The height of the cylidner is equal to the diameter of the base. How many liters of water can it hold? []
 a) 54π CC b) 36π CC c) 0.054π CC d) 0.54π CC
- 12 spheres of the same size are made by melting a solid cylinder of 16cm diameter and 2cm height The diameter of each sphere is ? []
 a) 2cm b) 4cm c) 3cm d) $\sqrt{3}$ cm
- If the ratio of radius of two spheres is 4 : 7 the ratio of their volume is
 a) 4 : 7 b) 64 : 343 c) 49 : 16 d) 16 : 49 []

8. The slant height of a right circular cone is 13m and its height is 5m. Find area of the curved surface []
 a) 490.28m² b) 288.28 m² c) 450 m² d) 200 m²
9. Three cubes of volume 1 cm³, 216 cm³ and 512 cm³ are melted to form a new cube. Find the diagonal of the new cube? []
 a) 15.6 cm b) 16.6 cm c) 17.6 cm d) 18.6 cm
10. A Prism has as the base a right angled triangle whose sides adjacent to right angle are 10cm and 12cm long. The height of the prism is 20cm. The density of the material of the prism is 6 gm/cubic cm. The weight of the prism is []
 a) 6.4 kg b) 7.2 kg c) 3.4 kg d) 4.8 kg

LEVEL-2 PROBLEMS

1. The radius of a sphere is 2r, then its volume will be []
 a) $\frac{4}{3} \pi r^3$ b) $4 \pi r^3$ c) $8 \pi r^3 / 3$ d) $\frac{32}{3} \pi r^3$
2. The total surface area of a cube is 96 cm². The volume of cube is []
 a) 8 cm³ b) 512 cm³ c) 64 cm³ d) 27 cm³
3. A cone is 84 cm height and the radius of its base is 2.1 cm. It is melted and recast into a sphere. The radius of sphere is []
 a) 4.2 cm b) 2.1 cm c) 2.4 cm d) 1.6 cm
4. In a cylinder, radius is doubled and height is halved, Curved surface area will be []
 a) halved b) doubled c) same d) four times
5. The total surface area of a cone whose radius is $\frac{r}{2}$ and slant height 2l is
 a) $2 \pi r (l+r)$ b) $\pi r (1 + r/h)$ c) $\pi r (1+r)$ d) $2 \pi rl$ []
6. The radii of two cylinders are in the ratio 2 : 3 and their heights are in the ratio at 5 : 3. The ratio of their volumes is []
 a) 10 : 17 b) 20 : 27 c) 17 : 27 d) 20 : 37
7. The lateral surface area of a cube is 256m². The volume of cube is
 a) 512 m³ b) 64 m³ c) 216m³ d) 256 m³ []

8. The number of planks of dimensions (4 m x 50 cm x 20 cm) that can be stored in a pit which is 16m long, 12m wide and 4m deep is []
- a) 1900 b) 1920 c) 1800 d) 1840
9. The length of the longest pole that can be inserted in a room of dimensions 10m x 10m x 5m is []
- a) 15m b) 16m c) 10m d) 12m
10. The radius of a hemispherical balloon increases from 6cm to 12cm as air being pumped into the ratio of the surface areas of the balloon in the two cases is []
- a) 1 : 4 b) 1 : 3 c) 2 : 3 d) 2 : 1

LEVEL-3 PROBLEMS

1. If a cube of side 5cm is cut out into a possible no. of small cubes of side 1cm. Then the ratio of surface area large cube to the surface area of all small cubes is . []
- a) 1 : 6 b) 1 : 5 c) 1 : 25 d) 1 : 125
2. The sum of three dimensions and surface area of a cuboid box are 12cm and 96 cm² respectively. Find the largest stick can be kept in that box []
- a) $5\sqrt{2}$ cm b) 5 cm c) 6 cm d) $2\sqrt{5}$ cm
3. The sum of length, breadth and height of a cuboid is 25cm and the length of its diagonal is 15cm. Then the T.S.A of cuboid is []
- a) 500 cm² b) 700 cm² c) 800 cm² d) 400 cm²
4. A cylindrical vessel of base diameter 14 decimeters is filled with 2310 lit of water. If 1 lit of water occupies 1000 c.c of space. What is the height of the vessel []
- a) 15 decimeter b) 16 decimeters c) 17 decimeters d) 18 decimeters
5. The diameter of a cylindrical tank is 24.5m and its depth is 32m then how much metric tons of water can be filled in that tank? (weight of 1 cubic meter of water = 1000 kg) []
- a) 15091 b) 15092 c) 15093 d) 15094
6. Find the weight of an iron cylinder having outer radius of 13cm and inner radius of 10cm and the weight of 1c.c of iron is 5 gms []
- a) 8.016 kg b) 5.016 kg c) 6.016 kg d) 7.016 kg

7. From a cone of height 30cm, a small cone is cut from it parallel to its base. The volume of small cone is $\frac{1}{27}$ th of volume of large cone. Then at what height the small cone is separated from the base? []
- a) 6 cm b) 8 cm c) 10 cm d) 20 cm
8. Water flows at the rate of 5m/sec from a cylindrical pipe of radius 7cm. How much time will be taken to fill an empty tank of dimensions 3m x 5m x 1.54 m []
- a) 6 min b) 5 min c) 10 min d) 9 min
9. A cylindrical vessel of base radius 24m is partially filled. If a spherical marble of radius 6cm is dropped in it. What is then rise in level of water []
- a) 1.5cm b) 2cm c) 3 cm d) 4.2 cm
10. The speed of flow of water in a river of 10m depth and 100m wide is 4.5 km/hr. What is the amount of water flowing to the sea from the river in 1 second (hint: $v=ast$, a is cross section area, s is speed, t is time and v is volume of water) []
- a) 1200 m³ b) 1250 m³ c) 1300 m³ d) 1350 m³

MENSURATION - KEY

LEVEL - 1

1	B
2	A
3	C
4	A
5	A
6	B
7	A
8	B
9	A
10	C
11	D
12	B
13	D
14	B
15	C
16	D
17	B
18	A
19	C
20	D
21	C
22	C
23	A
24	A
25	D

LEVEL - 2

1	C
2	B
3	C
4	B
5	A
6	C
7	B
8	A
9	B
10	C
11	B
12	A
13	C
14	A
15	B
16	A
17	B
18	D
19	B
20	C
21	C
22	B
23	B
24	C
25	A

LEVEL - 3

1	C
2	A
3	B
4	D
5	D
6	D
7	D
8	A
9	B
10	B
11	B
12	B
13	D
14	D
15	B

2.SURFACE AREAS AND VOLUMES OF 3-D FIGURES

KEY

LEVEL - 1

1	A
2	B
3	A
4	C
5	A
6	B
7	B
8	A
9	A
10	B

LEVEL - 2

1	D
2	C
3	B
4	C
5	B
6	B
7	A
8	B
9	A
10	A

LEVEL - 3

1	B
2	A
3	D
4	A
5	B
6	B
7	D
8	B
9	B
10	B