MENSURATION

A figure made up of straight line segments is called a **rectilinear figure**.

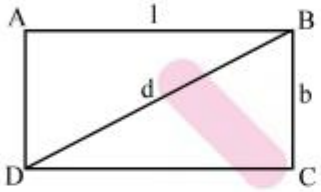
Area of Rectangle and Square

◈ **Rectangle :**

Area = length × breadth or A = $\ell \times b$

Perimeter = 2 (length + breadth) or

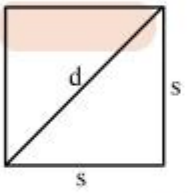
P = $2(\ell + b)$



◈ **Square :**

Area = $(\text{side})^2$ or $A = s^2$

Perimeter = 4 × side or P = 4s

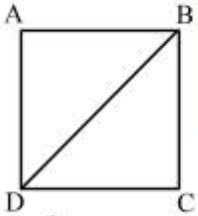


❖ EXAMPLES ❖

Ex.1 : Show that area of a square $= \frac{1}{2} \times (\text{diagonal})^2$. Find the area of a square whose diagonal = 2.5 cm.

Sol. : In right triangle BCD

$(\text{diagonal})^2 = DC^2 + CB^2 = s^2 + s^2 = 2s^2$



But area of square $= s^2$

$\therefore \quad (\text{diagonal})^2 = 2 \times \text{area}$

or $\text{area} = \frac{1}{2} \times (\text{diagonal})^2$

If diagonal = 2.5 cm

$\text{area} = \frac{1}{2} \times (2.5)^2 \text{ cm}^2 = \frac{6.25}{2} \text{ cm}^2 = 3.125 \text{ cm}^2.$

Ex.2 : The area of a square is 42.25 m^2. Find the side of the square. If tiles measuring 13 cm × 13 cm area paved on the square area. find how many such tiles are used for paving it.

Sol. : The area of the square = 42.25 m^2 = 422500 cm^2

The side of the square = $\sqrt{\text{area}} = \sqrt{422500}$ cm

= 650 cm

The area of 1 tile = 13 cm × 13 cm = 169 cm^2

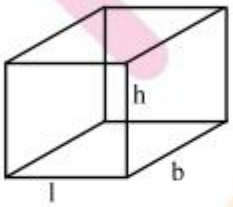
Number of tiles required = 422500 ÷ 169 = 2500

Ex.3 : A room is 5 metres long. 4 metres broad and 3 metres high. Find the area of the four walls. Also find the area of the ceiling and the area of the floor. If it costs Re 0.30 to whitewash 1 dm^3 of wall, find the cost of whitewashing the four walls and the ceiling.

Sol. : Area of four walls = $\ell h + bh + \ell h + bh = 2h(\ell + b)$

$= 6 \times 9\ m^2 = 54\ m^2$

Area of ceiling = Area of floor = 20 m^2



Since 1 m^2 = 100 dm^2,

∴ 54 m^2 = 5400 dm^2 and

20 m^2 = 2000 dm^2

Cost of whitewashing the four walls at the rate of Re 0.30 per dm^2

= Rs (5400 × 0.30) = Rs 1620

Cost of whitewashing the ceiling at the rate of Re 0.30 per dm^2

= Rs (2000 × 0.30) = Rs 600

Total cost of white washing = Rs 1620 + Rs 600

= Rs 2220

Ex.4 : The length and breadth of a rectangular field is in the ratio 4 : 3. If the area is 3072 m^2, find the cost of fencing the field at the rate of Rs 4 per metre.

Sol. : Let the length and breadth of the field be 4x and 3x metres respectively. The area of the field

$= 4x \times 3x = 12x^2 = 3072\ m^2$

Hence $x^2 = 3072 \div 12 = 256$

or $x = \sqrt{256} = 16$

Length = 4x = 64 m; Breadth = 3x = 48 m

Length of fencing = Perimeter of the field

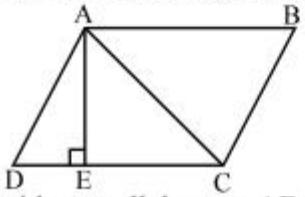
= 2 (64 + 48) m = 224 m

Cost of fencing at Rs 4 per meter

= Rs (224 × 4) = Rs 896

Area of Quadrilaterals

◈ **Area of a Parallelogram :**

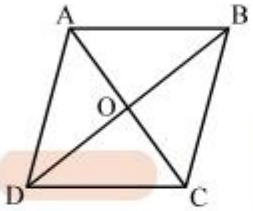


Consider parallelogram ABCD.

Let AC be a diagonal
In ΔADC and ΔCBA
AD = CB, CD = AB
AC is common
∴ ΔADC ≅ ΔCBA
∴ Area of parallelogram ABCD
= Area of ΔADC + Area of ΔABC
= 2 × Area of ΔADC
= 2 × (½ CD × AE) (where AE ⊥ DC)
= DC × AE
i.e. Area of parallelogram = base × height

◈ **Area of a Rhombus :**

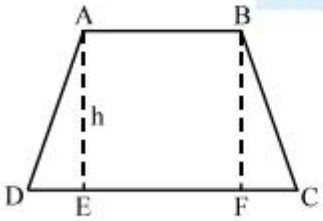
Since a rhombus is also a prallelogram, its area is given by
Area of rhombus = base × height
The area of a rhombus can also be found if the length of the diagonals are given. Let ABCD be a rhombus. We know that its diagonals AC and BD bisect each other at right angles.



Area of rhombus ABCD = area of ΔABD + area of ΔCBD
= ½ (BD × AO) + ½(BD × CO)
(since AO ⊥ BD and CO ⊥ BD)
= ½ BD (AO + CO)
= ½ BD × AC
i.e. Area of rhombus = ½ × product of diagonals

◈ **Area of a Trapezium :**

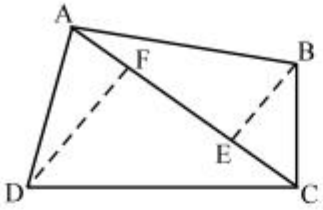
Let ABCD be a trapezium with AB || DC. Draw AE and BF perpendicular to DC.
Then AE = BF = height of trapezium = h
Area of trapezium ABCD = Area of ΔADE
+ Area of rectangle ABFE
+ Area of ΔBCF



= ½ × DE × h + EF × h + ½ FC × h
= ½ h (DE + 2EF + FC)
= ½ h (DE + EF + FC + EF)
= ½ h (DC + AB) (since EF = AB)
i.e. Area of trapezium = ½ × (sum of parallel sides)
× (distance between parallel sides)

◈ **Area of a Quadrilateral :**

Let ABCD be a quadrilateral, and AC be one of its diagonals. Draw perpendiculars BE and DF from B and D respectively to AC.



Area of quadrilateral ABCD

= Area of ΔABC + Area of ΔADC

= ½ AC × BE + ½ AC × DF

= ½ AC (BE + DF)

If AC = d, BE = h_1 and DF = h_2 then

Area of quadrilateral = ½d (h_1 + h_2)

❖ EXAMPLES ❖

Ex.1 : A rectangle and a parallelogram have the same area of 72 cm^2. The breadth of the rectangle is 8 cm. The height of the parallelogram is 9 cm. Find the base of the parallelogram and the length of the rectangle.

Sol. : Area of rectangle = $\ell \times b = \ell \times 8 = 72$

$\therefore$ ℓ = 9 cm

Area of parallelogram = base × height

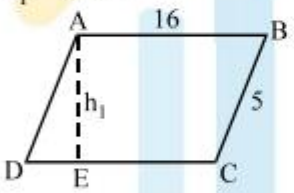
= base × 9 = 72

$\therefore$ Base = 8 cm

Ex.2 : The area of a parallelogram is 64 cm^2. Its sides are 16 cm and 5 cm. Find the two heights of the parallelogram.

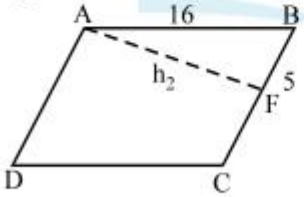
Sol. : (i) Area = base × height = $16 \times h_1 = 64$

$\therefore$ h_1 = 4cm



(ii) Area = base × height = $5 \times h_2 = 64$

$\therefore$ h_2 = 12.8 cm

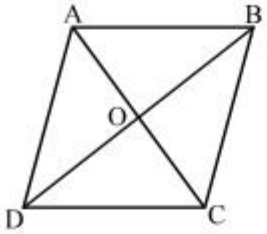


Ex.3 : The diagonals of a rhombus measure 10 cm and 24 cm. Find its area. Also find the measure of its side.

Sol. : AC = 10 cm, BD = 24 cm

Area = ½ $(d_1 \times d_2)$ = ½ × 10 × 24 cm^2

= 120 cm^2



In ΔABO, ∠AOB = 90°, AO = ½ AC = 5 cm,

BO = ½ BD = 12 cm.

∴ $AB^2 = AO^2 + OB^2 = 25 + 144 = 169 = 13 \times 13$

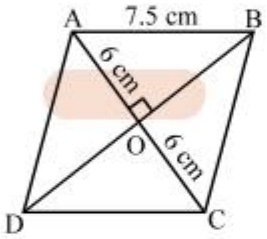
∴ AB = 13 cm

∴ Measure of ℓ side = 13 cm

Ex.4 : In rhombus ABCD, AB = 7.5 cm, and AC = 12 cm. Find the area of the rhombus.

Sol. : In ΔABO, ∠AOB = 90°, AO = ½ AC = 6 cm,

AB = 7.5 cm



∴ $OB^2 = AB^2 - OA^2$

$= (7.5)^2 - 6^2 = 56.25 - 36 = 20.25$

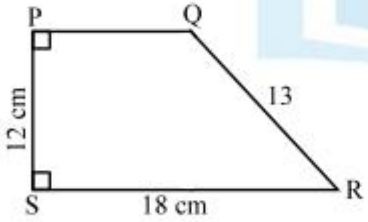
∴ OB = $\sqrt{20.25}$ = 4.5 cm

∴ BD = 2 × OB = 9 cm

Area of rhombus = ½ $d_1 \times d_2$ = ½ × 9 × 12 cm^2 = 54cm^2

Ex.5 : In the trapezium PQRS, ∠P = ∠S = 90°, PQ = QR = 13 cm, PS = 12 cm and SR = 18 cm. Find the area of the trapezium.

Sol. : The parallel sides are PQ and SR, and the distance between them is PS, since ∠P = ∠S = 90°



∴ Area = ½ × sum of parallel sides × heights

= ½ × (13 + 18) × 12 cm^2

= 186 cm^2

Ex.6 : In trapezium ABCD, AB = AD = BC = 13 cm and CD = 23 cm. Find the area of the trapezium.

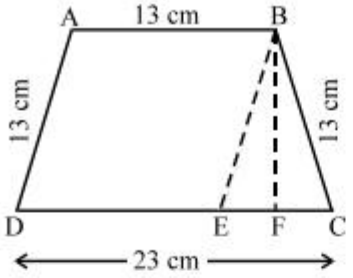
Sol. : From B draw BE || AD, and BF ⊥ DC

Since ABED is a parallelogram, DE, = 13 cm.

∴ EC = 23 cm – 13 cm = 10 cm

Also BE = 13 cm.

Therefore BEC is an isosceles triangle.



Since BF ⊥ EC, therefore F is the midpoint of EC

∴ FC = ½ × 10 cm = 5 cm

In the right triangle BFC

$BF^2 = BC^2 - FC^2 = 13^2 - 5^2 = 144$

∴ BF = 12 cm

Area of trapezium = ½ sum of parallel sides × height

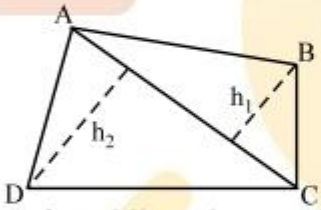
= ½ (13 + 23) × 12 cm^2

= 216 cm^2

Note: We can also say : Area of ABCD = Area of ABED + Area of ΔBCE can be found by Hero's formula as all its sides are known.

Ex.7 : In a quadrilateral ABCD, AC = 15 cm, The perpendiculars drawn from B and D respectively to AC measure 8.2 cm and 9.1 cm. Find the area of the quadrilateral.

Sol. :



Area of quadrilateral = ½ d $(h_1 + h_2)$

= ½ × 15 × (8.2 + 9.1) cm^2

= ½ × 15 × 17.3 cm^2

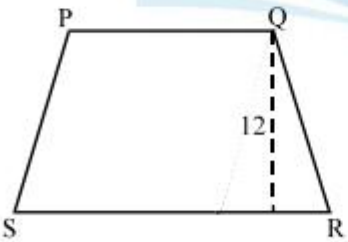
= 129.75 cm^2

Ex.8 : PQRS is a trapezium, in which SR || PQ, and SR is 5 cm longer than PQ. If the area of the trapezium is 186 cm^2 and the height is 12 cm, find the lengths of the parallel sides.

Sol. : Let PQ = x cm; then SR = (x + 5)

Area of PQRS = ½ × 12 × (x + x + 5) cm^2

= 186 cm^2



∴ 6(2x + 5) = 186

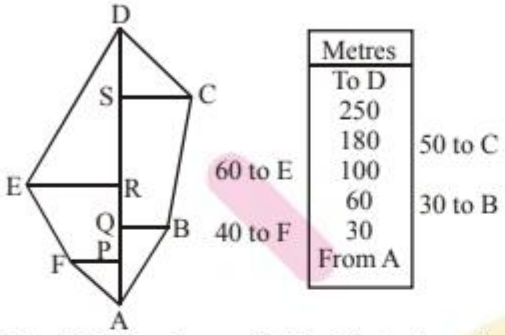
or 2x + 5 = 31 ∴ x = 13

∴ PQ = 13 cm, SR = 13 cm 5 cm = 18 cm

Area of Irregular Rectilinear Figures

For field ABCDEF, to find its area, we proceeds as follows :

1. Select two farthest corners (A and D) such that the line joining them does not intersect any of the sides. Join the corners. The line joining them is called the **base line**. In this case the base line is AD.
2. From each corner draw perpendiculars FP, BQ, ER and CS to AD. These are called **offsets**.
3. Measure and record the following lengths: AP and PF, AQ and QB, AR and RE, AS and SC.
4. Record these measurements as shown.



The field has been divided into four right triangles and two trapezia. In the trapezia, the parallel sides are perpendicular to the base line.

The area of the field is the sum of the areas of the triangles and trapezia.

$\Delta APF = \frac{1}{2} \times AP \times FP = \frac{1}{2} \times 30 \times 40\ m^2$
$= 600\ m^2$

Area of $\Delta AQB = \frac{1}{2} \times AQ \times QB = \frac{1}{2} \times 60 \times 30\ m^2$
$= 900\ m^2$

Area of trapezium PREF
$= \frac{1}{2} \times PR\ (PF + RE)$
$= \frac{1}{2} \times 70 \times 100\ m^2 = 3500\ m^2$

Area of trapezium BQSC
$= \frac{1}{2} \times QS\ (BQ + SC)$
$= \frac{1}{2} \times 120 \times 80\ m^2 = 4800\ m^2$

Area of $\Delta SCD = \frac{1}{2} \times SD \times SC$
$= \frac{1}{2} \times 70 \times 50\ m^2 = 1750\ m^2$

Area of $\Delta ERD = \frac{1}{2} \times RD \times ER$
$= \frac{1}{2} \times 150 \times 60\ m^2 = 4500\ m^2$

Total area $= (600 + 900 + 3500 + 4800 + 1750 + 4500)\ m^2$
$= 16050\ m^2$

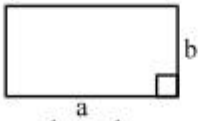
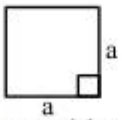
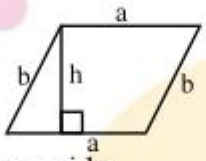
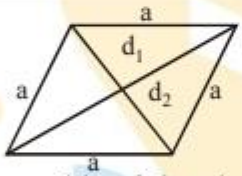
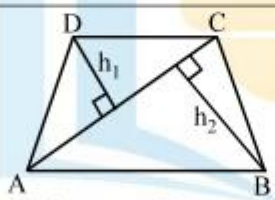
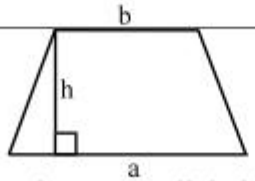
Points to Remember :

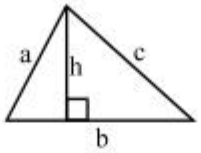
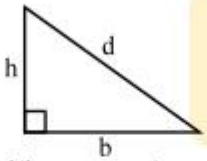
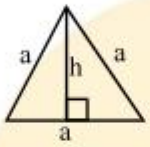
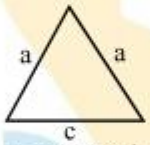
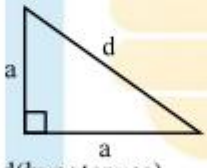
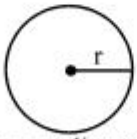
1. Area of rectangle = length × breadth
2. Perimeter of rectangle = 2 (length + breadth)
3. Area of parallelogram = base × height
4. Area of rhombus = ½ × product of diagonals.
5. Area of trapezium = ½ × (sum of parallel sides) × (distance between parallel sides)
6. Area of quadrilateral = ½ × d ($h_1 + h_2$) where d is a diagonal and h_1, h_2 are the lengths of perpendiculars from the remaining vertices on the diagonal.

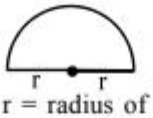
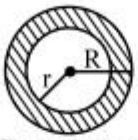
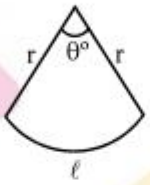
◈ **Introduction :**

Triangles, quadrilaterals, circles etc. lie in one plane. They have two dimensions only—a length and a breadth. They are called "**two dimensional**" figures. Solids do not lie in one plane. They have three dimensions—length, breadth and height. They occupy space. Solids are called "**three dimensional**" figures.

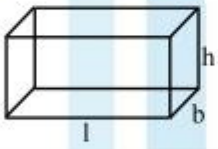
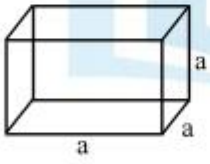
FORMULAE TO CALCULATE AREA OF SOME GEOMETRICAL FIGURES :

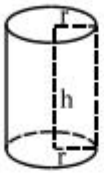
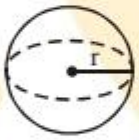
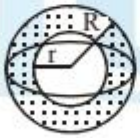
S.No.	Name	Figure	Perimeter in units of length	Area in square units
1.	Rectangle	 a = length b = breadth	2(a + b)	ab
2.	Square	 a = side	4a	a^2 $\frac{1}{2}(\text{diagonal})^2$
3.	Parallelogram	 a = side b = side adjacent to a h = distance between the opp. parallel sides	2(a + b)	ah
4.	Rhombus	 a = side of rhombus; $d_1 d_2$ are the two diagonals	4a	$\frac{1}{2} d_1 d_2$
5.	Quadrilateral	 AC is one of its diagonals and h_1, h_2 are the altitudes on AC from D, B respectively.	Sum of its four sides	$\frac{1}{2}(AC)(h_1 + h_2)$
6.	Trapezium	 a, b, are parallel sides and h is the distance between parallel sides	Sum of its four sides	$\frac{1}{2} h (a + b)$

S.No.	Name	Figure	Perimeter in units of length	Area in square units
7.	Triangle	 b is the base and h is the altitude a, b, c are three sides of Δ.	a + b + c = 2s where s is the semi perimeter.	$\frac{1}{2}$ b × h or $\sqrt{s(s-a)(s-b)(s-c)}$
8.	Right triangle	 d(hypotenuse) $=\sqrt{b^2+h^2}$	b + h + d	$\frac{1}{2}$ bh
9.	Equilateral triangle	 a = side h = altitude $=\frac{\sqrt{3}}{2}$ a	3a	(i) $\frac{1}{2}$ ah (ii) $\frac{\sqrt{3}}{4}a^2$
10.	Isosceles triangle	 c = unequal side a = equal side	2a + c	$\frac{c\sqrt{4a^2-c^2}}{4}$
11.	Isosceles right triangle	 d(hypotenuse) = a $\sqrt{2}$, a = Each of equal sides. The angles are 90°, 45°, 45°.	2a + d	$\frac{1}{2}a^2$
12.	Circle	 r = radius of the circle $\pi=\frac{22}{7}$ or 3.1416	2πr	πr²

S.No.	Name	Figure	Perimeter in units of length	Area in square units
13.	Semicircle	 r = radius of the circle	$\pi r + 2r$	$\frac{1}{2}\pi r^2$
14.	Ring (shaded region)	 R = outer radius r = inner radius	.....	$\pi(R^2 - r^2)$
15.	Sector of a circle	 θ° = central angle of the sector, r = radius of the sector ℓ = length of the arc	$\ell + 2r$ where $\ell = \frac{\theta}{360} \times 2\pi r$	$\frac{\theta}{360} \times \pi r^2$

VOLUME OF SOME SOLID FIGURES :

S.No.	Nature of the solid	Shape of the solid	Lateral/curved surface area	Total surface area	Volume	Abbreviations used
1.	Cuboid		2h (l + b)	2(lb + bh + lh)	lbh	l = length b = breadth h = height
2.	Cube		$4a^2$	$6a^2$	a^3	a = length of edge
3.	Right prism		(perimeter of base) × Height	2(area of one end) + lateral surface area	Area of base × height	

S.No.	Nature of the solid	Shape of the solid	Lateral/curved surface area	Total surface area	Volume	Abbreviations used
4.	Right circular cylinder		$2\pi rh$	$2\pi r(r + h)$	$\pi r^2 h$	r = radius of base h = height of the cylinder
5.	Right pyramid		$\frac{1}{2}$(Perimeter of the base) × (slant height)	Area of the base + lateral surface area	$\frac{1}{3}$(Area of base) × height	
6.	Right circular cone		$\pi r\, l$	$\pi r(l + r)$	$\frac{1}{3}\pi r^2 h$	h = height r = radius l = slant height
7.	Sphere		–	$4\pi r^2$	$\frac{4}{3}\pi r^3$	r = radius
8.	Hemi-sphere		$2\pi r^2$	$3\pi r^2$	$\left(\frac{2}{3}\pi r^3\right)$	r = radius
9.	Spherical shell		–	$4\pi(R^2 - r^2)$	$\frac{4}{3}\pi(R^3 - r^3)$	R = outer radius r = inner radius
10.	Volume of Bucket				$\frac{\pi h}{3}(R^2+r^2+Rr)$	R = larger radius r = smaller radius h = height

❖ EXAMPLES ❖

Ex.1 : Find the volume and surface area of a cuboid of $\ell = 10$ cm, b = 8 cm and h = 6 cm.

Sol. : $V = \ell \times b \times h = 10 \text{ cm} \times 8 \text{ cm} \times 6 \text{ cm} = 480 \text{ cm}^3$

Surface area = $2(\ell b + \ell h + bh)$

$= 2(10 \text{ cm} \times 8 \text{ cm} + 10 \text{ cm} \times 6 \text{ cm} + 8 \text{ cm} \times 6 \text{ cm})$

$= 2(80 + 60 + 48) \text{ cm}^2 = 376 \text{ cm}^2$

Ex.2 : How many matchboxes of size 4 cm × 3 cm × 1.5 cm can be packed in a cardbord box of size 30 cm × 30 cm × 20 cm ?

Sol. : Volume of cardboard box = 30 cm × 30 cm × 20 cm

$= 18000 \text{ cm}^3$

Volume of each matchbox = 4 cm × 3 cm × 1.5 cm

$= 18 \text{ cm}^3$

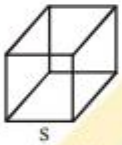
∴ Number of matchboxes that can fit in the cardboard box

$= 18000 \text{ cm}^3 \div 18 \text{ cm}^3 = 1000$

Ex.3 : The dimensions of a cube are doubled. By how many times will its volume and surface area increase ?

Sol. : Let the side of the original cube be s

Then side of the new cube = 2s



(i) Volume of original cube = s × s × s

$= s^3$ cubic units

Volume of new cube = 2s × 2s × 2s

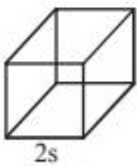
$= 8s^3$ cubic units

∴ Volume increases eight times if the side is doubled.

(ii) Surface area of original cube = $6s^2$

Surface area of new cube = $6(2s)^2 = 24s^2$

$= 4(6s^2)$



∴ Surface area increases four times.

Ex.4 : The outer surface of a cube of edge 5m is painted. if the cost of painting is Re 1 per 100 cm^2, find the total cost of painting the cube.

Sol. : Surface area of cube = $6s^2 = 6 \times 5\text{m} \times 5\text{m} = 150\text{m}^2$

$= 150 \times 10000 \text{ cm}^2$

Cost of painting 100 cm^2 is Re 1.

∴ Cost of painting $150 \times 10000 \text{ cm}^2$ is

$$\text{Rs } \frac{1}{100} \times 150 \times 10000$$

$$= \text{Rs } 15{,}000$$

Ex.5 : A right circular cylinder has a height of 1 m and a radius of 35 cm. Find its volume, area of curved surface and total area.

Sol. : h = 1m, r = 35 cm = 0.35 m

Volume $= \pi r^2 h = \frac{22}{7} \times 0.35 \times 0.35 \times 1 \text{ m}^3$

$= 0.385 \text{ m}^3$

Area of curved surface $= 2\pi rh = 2 \times \frac{22}{7} \times 0.35 \times 1\text{m}^2$

$= 2.2 \text{ m}^2$

Total surface area $= 2\pi r(h + r)$

$= 2 \times \frac{22}{7} \times 0.35 \ (1 + 0.35) \text{ m}^2$

$= \frac{2 \times 22 \times 0.35 \times 1.35}{7} \text{m}^2 = 2.97 \text{ m}^2$

Ex.6 : An open cylindrical tank is of radius 2.8m and height 3.5m. What is the capacity of the tank ?

Sol. : Capacity = volume of cylinder

$= \pi r^2 h = \frac{22}{7} \times 2.8 \times 2.8 \times 3.5 \text{ m}^3$

$= 86.24 \text{ m}^3$

Ex.7 : A metal pipe 154 cm long, has an outer radius equal to 5.5 cm and an inner radius of 4.5 cm. what is the volume of metal used to make the pipe ?

Sol. Outer volume $= \pi r^2 h = \frac{22}{7} \times (5.5)^2 \times 154 \text{ cm}^3$

Inner volume $= \frac{22}{7} \times (4.5)^2 \times 154 \text{ cm}^3$

$\therefore$ Volume of metal = outer volume – inner volume

$= \frac{22}{7} \times 154 \times (5.5)^2 - \frac{22}{7} \times 154 \times (4.5)^2$

$= \frac{22}{7} \times 154 \ [(5.5)^2 - (4.5)^2]$

$= \frac{22}{7} \times 154 \ (5.5 + 4.5) \ (5.5 - 4.5)$

$= \frac{22}{7} \times 154 \times 10 \times 1 = 4840 \text{ cm}^2$

Ex.8 : A cylindrical roller is used to level a rectangular playground. The length of the roller is 3.5 m and its diameter is 2.8 m. if the roller rolls over 200 times to completely cover the playground, find the area of the playground.

Sol. : When the roller rolls over the ground once completely, It covers a ground area equal to its curved surface area.

Area of curved surface $= 2\pi rh$

$= 2 \times \frac{22}{7} \times 1.4 \times 3.5 \text{ m}^2$

$\therefore$ Area of ground $= \frac{200 \times 2 \times 22 \times 1.4 \times 3.5}{7} \text{m}^2$

$= 6160 \text{ m}^2$

Ex.9 : A cylindrical pipe has an outer diameter of 1.4m and an inner diameter of 1.12m. Its length is 10m. It has to be painted on the outer and inner surfaces as well as on the rims at the top and bottom. If the rate of painting is 0.01 per cm^2, find the cost of painting the pipe.

Sol. : Outer surface area $= 2\pi rh = 2 \times \frac{22}{7} \times 0.7 \times 10m^2$

$= 44m^2$

Inner surface area $= 2\pi rh = 2 \times \frac{22}{7} \times 0.56 \times 10m^2$

$= 35.2m^2$

Area of two rims $= 2 \times \frac{22}{7} \times (0.7^2 - 0.56^2)$

$= 1.1088m^2$

$\therefore$ Total area to be painted

$= 44m^2 + 35.2m^2 + 1.1088m^2$

$= 80.3088\ m^2$

Rate of painting $=$ Re 0.01 per cm^2

$=$ Re 0.01 $\times$ 10000 per m^2

$=$ Rs 100 per m^2

$\therefore$ Total cost $=$ Rs 80.3088 $\times$ 100

$=$ Rs 8030.88

Ex.10: Earth is dug out to a depth of 15 m from a circular plot of land of radius 7 m. The earth is then spread out evenly on an adjacent rectangular plot of dimensions 16 m $\times$ 7 m. Find the height of the earth on the rectangular plot.

Sol. : Volume of dug out earth $= \pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 15m^3$

$= 2310m^3$

Let the height of the earth on the rectangular plot be h

Then volume of earth on the plot

$= \ell \times b \times h$

$= 16 \times 7 \times h\ m^3$

$= 112h\ m^3$

Since volume of earth on the plot = volume of dug out earth

$\therefore$ $112\ h = 2310$

or $h = \frac{2310}{112} m = 20.625m$

Ex.11: A rectangular piece of paper of width 20 cm and length 44 cm is rolled along its width to form a cylinder. What is the volume of the cylinder so formed ?

Sol. : The length of the rectangle becomes the circumference of the base of the cylinder.

$\therefore$ $2\pi r = 44$, where r is the radius of the cylinder.

$\therefore$ $r = \frac{44 \times 7}{2 \times 22} = 7$ cm

The width of the rectangle becomes the height of the cylinder.

$\therefore$ Volume $= \pi r^2\ h = \frac{22}{7} \times 7 \times 7 \times 20\ cm^3$

$= 3080\ cm^2$

EXERCISE-1

Q.1 One side of a rectangular field is 15 m and one of its diagonals is 17 m. Find the area of the field.

Q.2 A lawn is in the form of a rectangle having its sides in the ratio 2 : 3. the area of the lawn is $\frac{1}{6}$ hectares. Find the length and breadth of the lawn.

Q.3 Find the cost of carpeting a room 13 m long and 9 m broad with a carpet 75 cm wide at the rate of Rs. 12.40 per square metre.

Q.4 If the diagonal of a rectangle is 17 cm long and its perimeter is 46 cm, find the area of the rectangle.

Q.5 The length of a rectangle is twice its breadth. If its length is decreased by 5 cm and breadth is increasded by 5 cm, the area of the rectangle is increased by 75 sq. cm. Find the length of the rectangle.

Q.6 In measuring the sides of a rectangle, one side is taken 5% in excess, and the other 4% in deficit. Find the error percent in the area calculated from these measurements.

Q.7 A rectangular grassy plot 110 m by 65 m has a gravel path 2.5 m wide all round it on the inside. Find the cost of greavelling the path at 80 paise per sq. metre.

Q.8 The perimeters of two squares are 40 cm and 32 cm. Find the perimeter of a third square whose area is equal to the difference of the areas of the two squares.

Q.9 A room 5 m 55 cm long and 3m 74 cm broad is to be paved with square tiles. Find the least number of square tiles required to cover the floor.

Q.10 Find the area of a square, one of whose diagonals is 3.8 m long.

Q.11 The diagonals of two squares are in the ratio of 2 : 5. Find the ratio of their areas.

Q.12 If each side of a square is increased by 25%, find the percentage change in its area.

Q.13 If the length of a certain rectangle is decreased by 4 cm and the width is increased by 3 cm, a square with the same area as the original rectangle would result. Find the perimeter of the original rectangle.

Q.14 A room is half as long again as it is broad. The cost of carpeting the room at Rs. 5 per sq. m is Rs. 270 and the cost of papering the four walls at Rs. 10 per m^2 is Rs. 1720. If a door and 2 windows occupy 8 sq. m, find the dimensions of the room.

Q.15 Find the area of a triangle whose sides measure 13 cm, 14 cm and 15 cm.

Q.16 Find the area of a right-angled triangle whose base is 12 cm and hypotenuse 13 cm.

Q.17 The base of a triangular field is three times its altitude. If the cost of cultivating the field at Rs. 24.68 per hectare be Rs. 333.18, find its base and height.

Q.18 The altitude drawn to the base of an isosceles triangle is 8 cm and the perimeter is 32 cm. Find the area of the triangle.

Q.19 Find the length of the altitude of an equilateral triangle of side $3\sqrt{3}$ cm.

Q.20 In two triangles, the ratio of the areas is 4 : 3 and the ratio of their heights is 3 : 4. Find the ratio of their bases.

Q.21 The base of a parallelogram is twice its height. If the area of the parallelogram is 72 sq. cm, find its height.

Q.22 Find the area of a rhombus one side of which measures 20 cm and one diagonal 24 cm.

Q.23 The difference between two parallel sides of a trapezium is 4 cm. The perpendicular distance between them is 19 cm. If the area of the trapezium is 475 cm^2, find the lengths of the parallel sides.

Q.24 Find the length of arope by which a cow must be tethered in order that it may be able to graze an area of 9856 sq. metres.

Q.25 The area of a circular field is 13.86 hectares. Find the cost of fencing it at the rate of Rs. 4.40 per metre.

Q.26 The diameter of the driving wheel of a bus is 140 cm. How many revolutions per minute must the wheel make in order to keep a speed of 66 kmph ?

Q.27 A wheel makes 1000 revolutions in covering a distance of 88 km. Find the radius of the wheel.

Q.28 The inner circumference of a circular race trak, 14 m wide, is 440 m. Find the radius of the outer circle.

Q.29 Two concentric circles form a ring. The inner and outer circumferences of the ring are $50\frac{2}{7}$ m and $75\frac{3}{7}$ m respectively. Find the width of the ring.

Q.30 A sector of 120°, cut out from a circle, has an area of $9\frac{3}{7}$ sq. cm. Find the radius of the cirlce.

Q.31 Find the ratio of the areas of the incircle and circumcircle of a square.

Q.32 If the radius of a circle is decreased by 50%, find the percentage decrease in its area.

Q.33 Find the volume and surface area of a cuboid 16 m long, 14 m broad and 7 m high.

Q.34 Find the length of the longest pole that can be placed in a room 12 m long, 8 m broad and 9 m high.

Q.35 The volume of a wall, 5 times as high as it is borad and 8 times as long as it is high, is 12.8 cu. metres. Find the breadth of the wall.

Q.36 Find the number of bricks, each measuring 24 cm × 12 cm × 8 cm, required to construct a wall 24 m long, 8 m high and 60 cm thick, if 10% of the wall is filled with mortar ?

Q.37 Water flows into a tank 200 m × 150 m through a rectangular pipe 1.5 m × 1.25 m @ kmph. In what time (in minutes) will the water rise by 2 metres ?

Q.38 The dimensions of an open box are 50 cm, 40 cm and 23 cm. Its thickness is 3 cm. If 1 cubic cm of metal used in the box weighs 0.5 gms, find the weight of the box.

Q.39 The diagonal of a cube is $6\sqrt{3}$ cm. Find its volume and surface area.

Q.40 The surface area of a cube is 1734 sq. cm. Find its volume.

Q.41 A rectangular block 6 cm by 12 cm by 15 cm is cut up into an exact number of eqaul cubes. Find the least possible number of cubes.

Q.42 A cube of edge 15 cm is immersed completely in a rectangular vessel containing water. If the dimensions of the base of vessel are 20 cm × 15 cm, find the rise in water level.

Q.43 Three solid cubes of sides 1 cm, 6 cm and 8 cm are melted to form anew cube. Find the surface area of the cube so formed.

Q.44 If each edge of a cube is increased by 50%, find the percentage increase in its surface area.

Q.45 Two cubes have their volumes in the ratio 1 : 27. Find the ratio of their surface areas.

Q.46 Find the volume, curved surface area and the total surface area of a cylinder with diameter of base 7 cm and height 40 cm.

Q.47 If the capacity of a cylindrical tank is 1848 m^3 and the diameter of its base is 14 m, then find the depth of the tank.

Q.48 2.2 cubic dm of lead is to be drawn into a cylindrical wire 0.50 cm in diameter. Find the length of the wire in metres.

Q.49 How many iron rods, each of length 7 m and diameter 2 cm can be made out of 0.88 cubic metre of iron ?

Q.50 The radii of two cylinders are in the ratio 3 : 5 and their heights are in the ratio of 2 : 3. Find the ratio of their curved surface areas.

Q.51 If 1 cubic cm of cast iron weighs 21 gms, then find the weight of a cast iron pipe of length 1 metre with a bore of 3 cm and in which thickness of the metal is 1 cm.

Q.52 Find the slant height, volume, curved surface area and the whole surface area of a cone of radius 21 cm and height 28 cm.

Q.53 Find the length of canvas 1.25 m wide required to build a conical tent of base radius 7 metres and height 24 metres.

Q.54 The heights of two right circular cones are in the ratio 1 : 2 and the permieters of their bases are in the ratio 3 : 4. Find the ratio of their volumes.

Q.55 The radii of the bases of a cylinder and a cone are in the ratio of 3 : 4 and their heights are in the ratio 2 : 3. Find the ratio of their volumes.

Q.56 A conical vessel, whose internal radius is 12 cm and height 50 cm, is full of liquid. The contents are emptied into a cylindrical vessel with internal radius 10 cm. Find the height to which the liquid rises in the cylindrical vessel.

Q.57 Find the volume and surface area of a sphere of radius 10.5 cm.

Q.58 If the radius of a sphere is increassed by 50%, find the increase percent in volume and the increase percent in the surface area.

Q.59 Find the number of lead balls, each 1 cm in diameter that can be made from a sphere of diameter 12 cm.

Q.60 How many spherical bullets can be made out of a lead cylinder 28 cm high and with base radius 6 cm, each bullet being 1.5 cm in diameter ?

Q.61 A copper sphere of diameter 18 cm is drawn into a wire of diameter 4 mm. Find the length of the wire.

Q.62 Two metallic right circular cones having their heights 4.1 cm and 4.3 cm and the radii of their bases 2.1 cm each, have been melted together and recast into a sphere. Find the diameter of the sphere.

Q.63 A cone and a sphere have equal radii and equal volumes. Find the ratio of the diameter of the sphere to the height of the cone.

Q.64 Find the volume, curved surface area and the total surface area of a hemisphere of radius 10.5 cm.

Q.65 TA hemispherical bowl of internal radius 9 cm contains a liquid. This liquid is to be filled into cylindrical shaped small bottles of diameter 3 cm and height 4 cm. How may bottles will be needed to empty the bowl ?

Q.66 A cone, a hemisphere and a cylinder stand on equal bases and have the same height. Find the ratio of their volumes.

ANSWERS

1. 120 m^2 **2.** 50 m. **3.** 1934.4 **4.** 120 cm^2

5. 20 cm **6.** 0.8% **7.** 680 **8.** 24 cm

9. 176 **10.** 7.22 m^2 **11.** 4 : 5 **12.** 56.25%

13. 50 cm **14.** L = 9, B = 6, H = 6 **15.** 84 cm^2 **16.** 30 cm^2

17. B = 900 m, H = 300 m. **18.** 60 cm^2 **19.** 4.5 cm **20.** 16 : 9

21. 6 cm **22.** 384 cm^2 **23.** 27 cm, 23 cm **24.** 56 m

25. 5808 **26.** 250 **27.** 14 m **28.** 84 m

29. 4 m **30.** 3 cm **31.** 1 : 2 **32.** 75%

33. 868 m^2 **34.** 17 m **35.** 40 cm **36.** 45000

37. 96 min. **38.** 8.04 kg. **39.** 216 cm^3, 216 cm^2 **40.** 4913 cm^3

41. 40 **42.** 11.25 cm **43.** 486 cm^2 **44.** 125%

45. 1 : 9 **46.** 1540 cm^3, 880 cm^2, 957 cm^2 **47.** 12 m **48.** 112 m

49. 400 **50.** 2 : 5 **51.** 26.4 kg **52.** 12936 cm^3, 2310 cm^2, 3696 cm^2

53. 440 m **54.** 9 : 32 **55.** 9 : 8 **56.** 24 cm

57. 4581 cm^3, 1386 cm^2 **58.** 237.5%, 125% **59.** 1728 **60.** 1792

61. 243 m **62.** 4.2 cm **63.** 1 : 2

64. 2425.5 cm^3, 693 cm^2, 1039.5 cm^2 **65.** 54 **66.** 1 : 2 : 3

EXERCISE-2

Q.1 The length of a room is 5.5 m and width is 3.75 m. Find the cost of paving the floor by slabs at the rate of Rs 800 per sq. metre.
(A) Rs. 15,000 (B) Rs. 15,550
(C) Rs. 15600 (D) Rs. 16,500

Q.2 The length of a rectangle is 18 cm and its breadth is 10 cm. When the length is increased to 25 cm, what will be the breadth of the rectangle if the area remains the same?
(A) 7cm (B) 7.1 cm
(C) 7.2 cm (D) 7.3 cm

Q.3 A rectangular plot measuring 90 meters by 50 meters is to be enclosed by wire fencing. If the poles of the fence are kept 5 metres apart, how many poles will be needed?
(A) 55 (B) 56
(C) 57 (D) 58

Q.4 A length of a rectangular plot is 60% more than its breadth. If the difference between the length and the breadth of that rectangle is 24 cm, what is the area of that rectangle?
(A) 2400 s q. cm (B) 2480 sq. cm
(C) 2560 sq. cm (D) Data inadequate
(E) None of these

Q.5 A rectangular parking space is marked out by painting three of its sides. If the length of the unpainted side is 9 feet, and the sum of the lengths of the painted sides is 37 feet, then what is the area of the parking space in square feet?
(A) 46 (B) 81
(C) 126 (D) 252

Q.6 The difference between the length and breadth of a rectangle is 23m. If its perimeter is 206 m then its area is:
(A) 1520 m^2 (B) 2420 m^2
(C) 2480 m^2 (D) 2520 m^2

Q.7 The length of a rectangular plot is 20 metres more than its breadth. If the cost of fencing the plot @ Rs. 26.50 per metre is Rs. 5300, what is the length of the plot in meters?
(A) 40 (B) 50
(C) data inadquete (D) none of these

Q.8 The breadth of a rectangular field is 60% of its length. If the perimeter of the field is 800 m., what is the area of the field?
(A) 18750 sq. m (B) 37500sq. m
(C) 40000 sq. m (D) 48000 sq. m

Q.9 The ratio between the length and the perimeter of a rectangular plot is 1 : 3. What is the ratio between the length and breadth of the plot ?
(A) 1 : 2 (B) 2 : 1
(C) 3 : 2 (D) Data inadequate

Q.10 The ratio between the length and the breadth of a rectangular park is 3 : 2. If a man cycling along the boundary of the park at the speed of 12 km/hr completes one round in 8 minutes, then the area of the park (in sq.) is:
(A) 15360 (B) 153600
(C) 30720 (D) 307200

Q.11 The length of a rectangular hall is 5m more than its breadth. The area of the hall is 750 m^2. The length of the hall is:
(A) 15 m (B) 22.5 m
(C) 25 m (D) 30 m

Q.12 The area of a rectangle is 460 square metres. If the length is 15% more than the breadth, what is the breadth of the rectangular field?
(A) 15 metres
(B) 26 metres
(C) Cannot be determined
(D) None of these

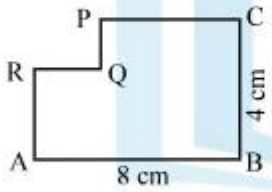
Q.13 A rectangular field is to be fenced on three sides leaving a side of 20 feet uncovered. If the area of the field is 680 sq. feet. How many feet of fencing will be required?
(A) 34 (B) 40
(C) 68 (D) 88

Q.14 The ratio between the perimeter and the breadth of a rectangular is 5 : 1. If the area of the rectangle is 216 sq. cm, what is the length of the rectangle?
(A) 16 cm (B) 18 cm
(C) 24 cm (D) Data inadequate
(E) None of these

Q.15 A Farmer wishes to start a 100 sq. m rectangular vegetable garden. Since he has only 30 m barbed wire, he fences three sides of the garden letting his house compound wall act as the fourth side fencing. The dimension of the garden is:
(A) 15 m × 6.67 m (B) 20 m × 5 m
(C) 30 m × 3.33 m (D) 40 m × 2.5 m

Q.16 The sides of a rectangular field are in the ratio 3 : 4. If The area of the field is 7500 sq. m, the cost of fencing the field @ 25 paise per metre is:
(A) Rs. 55.50 (B) Rs. 67.50
(C) Rs. 86.50 (D) Rs. 87.50

Q.17 A rectangle of certain dimensions is chopped off from one corner of a larger rectangle as shown. AB = 8 cm and BC = 4 cm. The perimeter of the figure ABCPQRA (in cm) is:



(A) 24 (B) 28
(C) 36 (D) 48

Q.18 A large field of 700 hectares is divided into two parts. The difference of the areas of the two parts is on-fifth of the average of the two areas. What is the area of the smaller part in hectares?
(A) 225 (B) 280
(C) 300 (D) 315

Q.19 A rectangular paper, when folded into two congruent parts had a perimeter of 34 cm for each part folded along one set of sides and the same is 38 cm when folded along the other set of sides. What is the area of the paper?
(A) 140 cm^2 (B) 240 cm^2
(C) 560 cm^2 (D) None of these

Q.20 A rectangular plot is half as long again as it is broad and its area is $\frac{2}{3}$ hectares. Then, its length is:
(A) 100 m (B) 33.33 m
(C) 66.66 m (D) $\frac{100\sqrt{3}}{3}$

Q.21 The areas of two circular fields are in the ratio 16 : 49. If the radius of the latter is 14 m, then what is the radius of the former:
(A) 4 m (B) 8 m
(C) 18 m (D) 32 m

Q.22 If the ratio of areas of two circles is 4 : 9, then the ratio of their circumferences will be:
(A) 2 : 3 (B) 3 : 2
(C) 4 : 9 (D) 9 : 4

Q.23 The perimeter of a circle is equal to the perimeter of a square. Then, their areas are in the ratio:
(A) 4 : 1 (B) 11 : 7
(C) 14 : 11 (D) 22 : 7

Q.24 The diameter of a wheel is 1.26 m. How far will it travel in 500 revolutions?
(A) 1492 m (B) 1980 m
(C) 2530 m (D) 2880 m

Q.25 The number of revolutions a wheel of diameter 40 cm makes in travelling a distance of 176 m, is:
(A) 140 (B) 150
(C) 160 (D) 166

Q.26 The radius of a wheel is 0.25 m. The number of revolutions it will make to travel a distance of 11 km will be:
(A) 2800 (B) 4000
(C) 5500 (D) 7000

Q.27 The wheel of an engine, $7\frac{1}{2}$ meters in circumference makes 7 revolutions in 9 seconds. The speed of the train in km per hour is:
(A) 130 (B) 132
(C) 135 (D) 150

Q.28 The wheel of a motorcycle, 70 cm in diameter, makes 40 revolutions in every 10 seconds. What is the speed of the motorcycle in km/hr?
(A) 22.32 (B) 27.68
(C) 31.68 (D) 36.24

Q.29 Wheels of diameters 7 cm and 14 cm start rolling simultaneously from X and Y, which are 1980 cm apart, towards each other in opposite directions. Both of them make the same number of revolutions per second. If both of them meet after 10 seconds, the speed of the smaller wheel is:
(A) 22 cm/sec (B) 44 cm/sec
(C) 66 cm/sec (D) 132 cm/sec

Q.30 A toothed wheel of diameter 50 cm is attached to a smaller wheel of diameter 30 cm. How many revolutions will the smaller wheel make when the larger one makes 15 revolutions?
(A) 18 (B) 20
(C) 25 (D) 30

Q.31 Find the diameter of a wheel that makes 113 revolutions to go 2 km 26 decametres.

(A) $4\frac{4}{13}$ m (B) $6\frac{4}{11}$ m

(C) $12\frac{4}{11}$ m (D) $12\frac{8}{11}$ m

Q.32 The font wheels of a wagon are 2π feet in circumference and the rear wheels are 3π feet in circumference. When the front wheels have made 10 more revolutions than the rear wheels, how many feet has the wagon travelled?

(A) 30π (B) 60π
(C) 90π (D) $150\ \pi$

Q.33 A circular ground whose diameter is 35 meters, has a 1.4 m broad garden around it. What is the area of the garden in square metres?

(A) 160.16 (B) 176.16
(C) 196.16 (D) Data inadequate

Q.34 A circular garden has a circumference of 440 m. These is a 7 m wide border inside the garden along its periphery. The area of the border is:

(A) 2918 m^2 (B) 2921 m^2
(C) 2924 m^2 (D) 2926 m^2

Q.35 The area of two concentric circles forming a ring are 154 sq. cm and 616 sq. cm. The breadth of the ring is:

(A) 7 cm (B) 14 cm
(C) 21 cm (D) 28 cm

Q.36 A circular park has a path of uniform width around it. The difference between outer and inner circumferences of the circular path is 132 m. Its width is:

(A) 20 m (B) 21 m
(C) 22 m (D) 24 m

Q.37 A circular swimming pool is surrounded by a concrete wall 4 ft. wide. If the area of the concrete wall surrounding the pool is $\frac{11}{25}$ that of the pool, then the radius of the pool is:

(A) 8 ft (B) 16 ft
(C) 20 ft (D) 30 ft

Q.38 The ratio of the outer and the inner perimeters of a circular path is 23 : 22. If the path is 5 meters wide, The diameter of the inner circle is:

(A) 55 m (B) 110 m
(C) 220 m (D) 230 m

Q.39 What will be the area of a semi-circle of 14 m diameter?

(A) 22 m^2 (B) 77 m^2
(C) 154 m^2 (D) 308 m^2

Q.40 A semi-circular shaped window has diameter of 63 cm. Its perimeter equals:

(A) 126 cm (B) 162 cm
(C) 198 cm (D) 251 cm

Q.41 What will be the area of a semi-circle whose perimeter is 36 cm?

(A) 154 cm^2 (B) 168 cm^2
(C) 308 cm^2 (D) None of these

Q.42 If a wire is bent into the shape of a square, then the area of the square is 81 sq. cm. When the wire is bent into a semi-circular shape, then the area of the semi-circle will be:
(A) 22 cm^2 (B) 44cm^2
(C) 77cm^2 (D) 154 cm^2

Q.43 The area of a sector of a circle of radius 5 cm, formed by an arc of length 3.5 cm, is :
(A) 7.5 cm^2 (B) 7.75 cm^2
(C) 8.5 cm^2 (D) 8.75 cm^2

Q.44 In a circle of radius 7 cm, an arc subtends an angle of 108° at the centre. The area of the sector is:
(A) 43.2 cm^2 (B) 44.2 cm^2
(C) 45.2 cm^2 (D) 46.2 cm^2

Q.45 The area of the greatest circle which can be inscribed in a square whose perimeter is 120 cm, is:
(A) $\frac{22}{7}\times\left(\frac{7}{2}\right)^2 cm^2$ (B) $\frac{22}{7}\times\left(\frac{9}{2}\right)^2 cm^2$
(C) $\frac{22}{7}\times\left(\frac{15}{2}\right)^2 cm^2$ (D) $\frac{22}{7}\times(15)^2 cm^2$

Q.46 The area of the largest circle, that can be drawn inside a rectangle with sides 18 cm by 14 cm, is:
(A) 49 cm^2 (B) 154 cm^2
(C) 378 cm^2 (D) 1078 cm^2

Q.47 The area of a circle is 220 sq. cm. The area of a square inscribed in this circle will be:
(A) 49 cm^2 (B) 70 cm^2
(C) 140 cm^2 (D) 150 cm^2

Q.48 A square is inscribed in a circle whose radius is 4 cm. The area of the portion between the circle and the square is:
(A) $(8\pi - 16)$ (B) $(8\pi - 32)$
(C) $(16\pi - 16)$ (D) $(16\pi - 32)$

Q.49 The circumference of a circle is 100cm. The side of a square inscribed in the circle is:
(A) $50\sqrt{2}$ cm (B) $\frac{100}{\pi}$ cm
(C) $\frac{50\sqrt{2}}{\pi}$ cm (D) $\frac{100\sqrt{2}}{\pi}$ cm

Q.50 Four equal sized maximum circular plates are cut off from a square paper sheet of area 784 cm^2. The circumference of each plate is:
(A) 22 cm (B) 44 cm
(C) 66 cm (D) 88 cm

Q.51 There are 4 semi-circular gardens on each side of a square-shaped pond with each side 21m. The cost of fencing the entire plot at the rate of Rs 12.50 per metre is:
(A) Rs. 1560 (B) Rs. 1650
(C) Rs. 3120 (D) Rs. 3300

Q.52 The ratio of the area of the incircle and circumcircle of an equilateral triangle is:
(A) 1 : 2 (B) 1 : 3
(C) 1 : 4 (D) 1 : 9

Q.53 The radius of the circumcircle of an equilateral triangle of side 12 cm is:

(A) $\frac{4\sqrt{2}}{3}$ cm (B) $4\sqrt{2}$ cm

(C) $\frac{4\sqrt{3}}{3}$ cm (D) $4\sqrt{3}$ cm

Q.54 The area of the incircle of an equilateral triangle of side 42 cm is:

(A) $22\sqrt{3}$ cm^2 (B) 231 cm^2

(C) 462 cm^2 (D) 924 cm^2

Q.55 The area of a circle inscribed in an equilateral triangle is 154 cm^2. Find the perimeter of the triangle.

(A) 71.5 cm (B) 71.7 cm

(C) 72.3 cm (D) 72.7 cm

Q.56 The sides of a triangle are 6 cm, 11 cm and 15 cm. The radius of its incircle is:

(A) $3\sqrt{2}$ cm (B) $\frac{4\sqrt{2}}{5}$ cm

(C) $\frac{5\sqrt{2}}{4}$ cm (D) $6\sqrt{2}$ cm

Q.57 The perimeter of a triangle is 30 cm and the circumference of its incircle is 88cm. The area of the triangle is:

(A) 70 cm^2 (B) 140 cm^2

(C) 210 cm^2 (D) 420 cm^2

Q.58 If in a triangle, the area is numerically equal to the perimeter, then the radius of the inscribed circle of the triangle is:

(A) 1 (B) 1.5

(C) 2 (D) 3

Q.59 An equilateral triangle, a square and a circle have equal perimeters. If T denotes the are of the triangle , S the area of the square and C, the area of the circle, then:

(A) $S < T < C$ (B) $T < C < S$

(C) $T < S < C$ (D) $C < S < T$

Q.60 If an area enclosed by a circle or a square or an equilateral triangle is the same, then the maximum perimeter is possessed by:

(A) circle

(B) square

(C) equilateral triangle

(D) triangle and square have equal perimeters greater than of circle

Q.61 The area of the largest triangle that can be inscribed in a semi-circle of radius r, is:

(A) r^2 (B) $2r^2$

(C) r^3 (D) $2r^3$

Q.62 ABC is a right-angled triangle with right at B. If the semi-circle on AB with AB as diameter encloses an area of 81 sq. cm and the semicircle on BC with BC as diameter encloses an area of 36 sq. cm, then the area of the semi-circle on AC with AC as diameter will be:

(A) 117 cm^2 (B) 121 cm^2

(C) 217 cm^2 (D) 221 cm^2

Q.63 If the radius of a circle is increased by 75%, then its circumference will increase by:
(A) 25% (B) 50%
(C) 75% (D) 100%

Q.64 A can go round a circular path 8 times in 40 minutes. If the diameter of the circle is increased to 10 times the original diameter, then the time required by A to go round the new path once, travelling at the same speed as before, is:
(A) 20 min. (B) 25 min.
(C) 50 min. (D) 100 min.

Q.65 If the radius of a circle is increased by 6%, Then the area is increased by:
(A) 6% (B) 12%
(C) 12.36% (D) 16.64%

Q.66 The capacity of a tank of dimensions
(8m × 6m × 2.5m) is:
(A) 120 litres (B) 1200 litres
(C) 12000 litres (D) 120000 litres

Q.67 Find the surface area of a 10cm × 4cm × 3cm brick.
(A) 84 sq. cm (B) 124 sq. cm
(C) 164 sq. cm (D) 180 sq. cm

Q.68 A cistern 6m long and 4 m wide contains water up to a depth of 1m 25 cm. The total area of the wet surface is:
(A) 49 m^2 (B) 50 m^2
(C) 53.5 m^2 (D) 55 m^2

Q.69 A boat having a length 3 m and breadth 2 m is floating on a lake. The boat sinks by 1cm when a man gets on it. The mass of man is:
(A) 12 kg (B) 60 kg
(C) 72 kg (D) 96 kg

Q.70 The area of the base of a rectangular tank is 6500 cm^2 and the volume of water contained in it is 2.6 cubic metres. The depth of water in the tank is:
(A) 3.5 m (B) 4 m
(C) 5 m (D) 6 m

Q.71 Given that I cu. cm of marble weighs 25 gms, the weight of a marble block 28 cm in width and 5 cm thick is 112 kg. The length of the block is:
(A) 26.5 cm (B) 32 cm
(C) 36 cm (D) 37.5 cm

Q.72 Half cubic metre of gold sheet is extended by hammering so as to cover an area of 1 hectare. The thickness of the sheet is:
(A) 0.0005 cm (B) 0.005 cm
(C) 0.05 cm (D) 0.5 cm

Q.73 In a shower, 5 cm of rain falls. The volume of water that falls on 1.5 hectares of ground is:
(A) 75 cu. m (B) 750 cu. m
(C) 7500 cu. m (D) 75000 cu. m

Q.74 The height of a wall is six times its width and the length of the wall is seven times its height. If volume of the wall be 16128 cu. m, its width is:
(A) 4 m (B) 4.5 m
(C) 5 m (D) 6 m

Q.75 The volume of a rectangular block of stone is 10368 dm^3. Its dimensions are in the ratio of 3 : 2 : 1. If its entire surface is polished at 2 paise per dm^2, then the total cost will be:
(A) Rs. 31.50 (B) Rs. 31.68
(C) Rs. 63 (D) Rs. 63.36

Q.76 The edges of a cuboid are in the ratio 1 : 2 : 3 and its surface area in 88 cm^2. The volume of the cuboid is:
(A) 24 cm^3 (B) 48 cm^3
(C) 64 cm^3 (D) 120 cm^3

Q.77 The maximum length of a pencil that can be kept in a rectangular box of dimensions 8 cm × 6 cm × 2 cm, is:
(A) $2\sqrt{3}$ cm (B) $2\sqrt{14}$ cm
(C) $2\sqrt{26}$ cm (D) $10\sqrt{2}$ cm

Q.78 Find the length of the longest rod that can be placed in a room 16 m long, 12 m broad and $10\frac{2}{3}$ m high.
(A) $22\frac{1}{3}$ m (B) $22\frac{2}{3}$ m
(C) 23 m (D) 68 m

Q.79 How many bricks, each measuring 25cm × 11.25cm × 6cm, will be needed to build a wall 8m × 6m × 22.5cm?
(A) 5600 (B) 6000
(C) 6400 (D) 7200

Q.80 The number of bricks, each measuring 25cm × 12.5cm × 7.5cm, required to construct a wall 6 m long, 5m high and 0.5 m thick, while the mortar occupies 5% of the volume of the wall, is:
(A) 3040 (B) 5740
(C) 6080 (D) 8120

Q.81 50 men took a dip in a water tank 40 m long and 20 m broad on a religious day. If the average displacement of water by a man is 4 m^3 , then the rise in the water level in the tank will be:
(A) 20 cm (B) 25 cm
(C) 35 cm (D) 50 cm

Q.82 A tank 4 m long, 2.5 m wide and 1.5 m deep is dug in a field 31 m long and 10 m wide. If the earth dug out is evenly spread out over the field, the rise in level of the field is:
(A) 3.1 cm (B) 4.8 cm
(C) 5 cm (D) 6.2 cm

Q.83 A river 1.5 m deep and 36 m wide is flowing at the rate of 3.5 km per hour. The amount of water that runs into the sea per minute (in cubic metres) is:
(A) 3150 (B) 31500
(C) 6300 (D) 63000

Q.84 A rectangular water tank is 80m × 40m. Water flows into it through a pipe 40 sq. cm at the opening at a speed of 10 km/hr. By how much, the water level will rise in the tank in half an hour?

(A) $\frac{3}{2}$ cm (B) $\frac{4}{9}$ cm

(C) $\frac{5}{8}$ cm (D) none of these

Q.85 A hall is 15 m long and 12 m broad. If the sum of the areas of the floor and the ceiling is equal to the sum of areas of four wall the volume of the hall is:

(A) 720 (B) 900

(C) 1200 (D) 1800

Q.86 A closed metallic cylindrical box is 1.25 m high and its base radius is 35 cm. If the sheet metal costs Rs 80 per m^2, the cost of the material used in the box is:

(A) Rs. 281.60 (B) Rs. 290

(C) Rs. 340.50 (D) Rs. 500

Q.87 The curved surface area of a right circular cylinder of base radius r is obtained by multiplying its volume by:

(A) 2r (B) $\frac{2}{r}$

(C) $2r^2$ (D) $\frac{2}{r^2}$

Q.88 The ratio of total surface area to lateral surface area of a cylinder whose radius is 20cm and height 60cm, is:

(A) 2 : 1 (B) 3 : 2

(C) 4 : 3 (D) 5 : 3

Q.89 A powder tin has a square base with side 8 cm and height 14 cm another tin has circular base of with diameter 8 cm and height 14 cm. The difference in their capacities is:

(A) 0 (B) 132 cm^3

(C) 137.1 cm^3 (D) 192 cm^3

Q.90 The ratio between the radius of the base and the height of a cylinder is 2 : 3. If its volume is 12936 cu. cm, the total surface area of the cylinder is:

(A) 2587. cm^2 (B) 3080 cm^2

(C) 25872 cm^2 (D) 38808 cm^2

Q.91 The radius of the cylinder is half its height and area of the inner part is 616 sq. cms. Approximately how many litres of milk can it contain?

(A) 1.4 (B) 1.5

(C) 1.7 (D) 1.9

Q.92 The sum of the radius of the base and the height of a solid cylinder is 37 metres. If the total surface area of the cylinder be 1628 sq. metres, its volume is:

(A) 3180 m^3 (B) 4620 m^3

(C) 5240 m^3 (D) none of these

Q.93 The curved surface area of a cylinder pillar is 264 m^2 and its volume is 924 m^3. Find the ratio of its diameter to its height.

(A) 3 : 7 (B) 7 : 3

(C) 6 : 7 (D) 7 : 6

Q.94 The height of a closed cylinder of given volume and the minimum surface area is:
(A) equal to its diameter
(B) half of its diameter
(C) double of its diameter
(D) None of these

Q.95 If the radius of the base of a right circular cylinder is halved, keeping the height same, what is the ratio of the volume of the reduced cylinder to that of the original one?
(A) 1 : 2 (B) 1 : 4
(C) 1 : 8 (D) 8 : 1

Q.96 Two cones have their height in the ratio of 1 : 3 and radii 3 : 1 . The ratio of their volumes is:
(A) 1 : 1 (B) 1 : 3
(C) 3 : 1 (D) 2 : 3

Q.97 The radii of two cones are in the ratio 2 : 1, their volumes are equal. Find the ratio of their heights.
(A) 1 : 8 (B) 1 : 4
(C) 2 : 1 (D) 4 : 1

Q.98 If the volumes of two cones are in the ratio of 1 : 4 and their diameters are in the ratio of 4 : 5, then the ratio of their heights is:
(A) 1 : 5 (B) 5 : 4
(C) 5 : 16 (D) 25 : 64

Q.99 The volume of the largest right circular cone that can be cut out of a cube of edge 7 cm is:
(A) 13.6 cm^3 (B) 89.8 cm^3
(C) 121 cm^3 (D) 147.68 cm^3

Q.100 A cone of height 7 cm and base radius 3 cm is carved from a rectangular block of wood 10cm × 5cm × 2cm. The percentage of wood wasted is:
(A) 34% (B) 46%
(C) 54% (D) 66%

Q.101 A right circular cone and a right circular cylinder have equal base and equal height. If the radius of the base and the height are in the ratio 5 : 20, then the ratio of the total surface area of the cylinder to that of the cone is:
(A) 3 : 1 (B) 13 : 9
(C) 17 : 9 (D) 34 : 9

Q.102 A cylinder with base radius of 8 cm and height of 2 cm is melted to form a cone of height 6 cm. The radius of the cone will be:
(A) 4 cm (B) 5 cm
(C) 6 cm (D) 8 cm

Q.103 A right cylindrical vessel is full of water. How many right cones having the same radius and height as those of the right cylinder will be needed to store that water ?
(A) 2 (B) 3
(C) 4 (D) 8

Q.104 A solid metallic cylinder of base radius 3 cm and height 5 cm is melted to form cones, each of height 1 cm and base radius 1 mm. The number of cone is:

(A) 450 (B) 1350

(C) 4500 (D) 13500

Q.105 Water flows at the rate of 10 meters per minute from a cylindrical pipe 5 mm in diameter. How long will it take to fill up a conical vessel whose diameter at the base is 40 cm and depth 24 cm?

(A) 48 min. 15 sec. (B) 51 min. 12 sec.

(C) 52 min. 1sec. (D) 55 min.

Q.106 A solid cylindrical block of radius 12 cm and height 18 cm is mounted with a conical block of radius 12 cm and height 5 cm. The total lateral surface of the solid thus formed is:

(A) 528 cm^2 (B) $1357\frac{5}{7}$ cm^2

(C) 1848 cm^2 (D) None of these

Q.107 Consider the volume of the following:

1. A parallelopiped of length 5 cm, breadth 3 cm and height 4 cm
2. A cube of each side 4 cm
3. A cylinder of radius 3 cm and length 3 cm
4. A sphere of radius 3 cm

The volume of these in the decreasing order is:

(A) 1, 2, 3, 4 (B) 1, 3, 2, 4

(C) 4, 2, 3, 1 (D) 4, 3, 2, 1

Q.108 The volume of a sphere is 4851 cu. cm. Its curved surface area is:

(A) 1386 cm^2 (B) 1625 cm^2

(C) 1716 cm^2 (D) 3087 cm^2

Q.109 The curved surface area of a sphere is 5544 sq. cm. Its volume is:

(A) 22176 cm^3 (B) 33951 cm^3

(C) 38808 cm^3 (D) 42304 cm^3

Q.110 The volume of a sphere if radius r is obtained by multiplying its surface area by:

(A) $\frac{4}{3}$ (B) $\frac{r}{3}$ (C) $\frac{4r}{3}$ (D) 3r

Q.111 If the volume of a sphere is divided by its surface area, the result is 27 cm. The radius of the sphere is:

(A) 9 cm (B) 36 cm

(C) 54 cm (D) 81 cm

Q.112 Spheres A and B have their radii 40 cm and 10 cm respectively. The ratio of the surface area of A to the surface area of B is:

(A) 1 : 4 (B) 1 : 16

(C) 4 : 1 (D) 16 : 1

Q.113 Surface area of a sphere is 2464 cm^2. If its radius be doubled, then the surface area of the new sphere will be:

(A) 4928 cm^2 (B) 9856 cm^2

(C) 19712 cm^2 (D) Data insufficient

Q.114 If the radius of a sphere is doubled, how many times does its volume become?

(A) 2 times (B) 4 times

(C) 6 times (D) 8 times

Q.115 If the radius of a sphere is increased by 2 cm, then its surface area increases by 352 cm^2. The radius of the sphere before the increase was:

(A) 3 cm (B) 4 cm

(C) 5 cm (D) 6 cm

Q.116 How many lead shots each 3 mm in diameter can be made from a cuboid of dimensions 9 cm × 11 cm × 12 cm?

(A) 7200 (B) 8400

(C) 72000 (D) 84000

Q.117 A sphere and a cube have equal surface areas. The ratio of the volume of the sphere to that of the cube is:

(A) $\sqrt{\pi} : \sqrt{6}$ (B) $\sqrt{2} : \sqrt{\pi}$

(C) $\sqrt{\pi} : \sqrt{3}$ (D) $\sqrt{6} : \sqrt{\pi}$

Q.118 The ratio of the volume of a cube to that of a sphere which will fit inside the cube is:

(A) 4 : π (B) 4 : 3π

(C) 6 : π (D) 2 : π

Q.119 The surface area of a sphere is same as the curved surface area of a right circular cylinder whose height and diameter are 12 cm each. The radius of the sphere is :

(A) 3 cm (B) 4 cm

(C) 6 cm (D) 12 cm

Q.120 The diameter of the iron ball used for the shot-put game is 14 cm. It is melted and then a solid cylinder of height $2\frac{1}{3}$ cm is made. What will be the diameter of the base of the cylinder?

(A) 14 cm (B) $\frac{14}{3}$ cm

(C) 28 cm (D) $\frac{28}{3}$ cm

Q.121 The volume of the greatest sphere that can be cut off from a cylindrical log of wood of base radius 1 cm and height 5 cm is:

(A) $\frac{4}{3}\pi$ (B) $\frac{10}{3}\pi$

(C) 5π (D) $\frac{20}{3}\pi$

Q.122 How many spherical bullets can be made out of a lead cylinder 15 cm high and with base radius 3 cm, each bullet being 5 mm in diameter?

(A) 6000 (B) 6480

(C) 7260 (D) 7800

Q.123 A cylindrical rod of iron whose height is eight times its radius is melted and cast into spherical balls each of half the radius of the cylinder. The number of spherical balls is:

(A) 12 (B) 16 (C) 24 (D) 48

Q.124 The diameter of a sphere is 8 cm. It is melted and drawn into a wire of diameter 3 mm. The length of the wire is:

(A) 36.9 m (B) 37.9 m

(C) 38.9 m (D) 39.9 m

Q.125 A cylindrical vessel of radius 4 cm contains water. A solid sphere of radius 3 cm is lowered into the water until it is completely immersed. The water level in the vessel will rise by:

(A) $\frac{2}{9}$ cm (B) $\frac{4}{9}$ cm

(C) $\frac{9}{4}$ cm (D) $\frac{9}{2}$ cm

ANSWER KEY

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	D	C	B	C	C	D	D	B	B	B	D	D	D	B	B	D	A	D	A	A
Ques.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	B	A	C	B	A	D	B	C	C	C	B	B	A	D	A	B	C	C	B	B
Ques.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	D	C	D	D	D	B	C	D	C	B	B	C	D	C	D	C	C	C	C	C
Ques.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	A	A	C	C	C	D	C	A	B	B	B	B	B	A	D	B	C	B	C	C
Ques.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	B	C	A	C	C	A	B	C	D	B	B	B	B	A	B	C	B	D	B	A
Ques.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans.	C	D	B	D	B	D	D	A	C	B	D	D	B	D	D	D	D	C	C	C
Ques.	121	122	123	124	125															
Ans.	A	B	D	B	C															

HINTS & SOLUTION - 1

Sol.1 Other side $=\sqrt{(17)^2-(15)^2}=\sqrt{289-225}$

$=\sqrt{64}=8$ m.

Area $= (15 \times 8)\ m^2 = 120\ m^2$.

Sol.2 Let lenth = 2x metres and breadth = 3x metres.

Now, area $=\left(\frac{1}{6}\times 1000\right) m^2 = \left(\frac{5000}{3}\right) m^2$.

So, $2x \times 3x = \frac{5000}{3} \Leftrightarrow x^2 = \frac{2500}{9} \Leftrightarrow x = \left(\frac{50}{3}\right)$

$\therefore$ length $= 2x = \frac{100}{3}$ m $= 33\frac{1}{3}$ and

Breadth $= 3x = \left(3\times\frac{50}{3}\right)$ m $= 50$ m.

Sol.3 Area of the carpet= Area of the room

$= (13 \times 9)m^2 = 117\ m^2$.

Length of the carpet $=\left(\frac{\text{Area}}{\text{Width}}\right)=\left(117\times\frac{4}{3}\right)$m

$= 156$ m.

$\therefore$ Cost of carpeting = Rs. (156×12.40)

= Rs. 1934.40

Sol.4 Let length = x and breadth = y. Then,

$2(x + y) = 46$ or $x + y = 23$ and

$x^2 + y^2 = (17)^2 = 289$.

Now, $(x + y)^2 = (23)^2 \Leftrightarrow (x^2 + y^2) + 2xy = 259$

$\Leftrightarrow 289 + 2xy = 529 \Leftrightarrow xy = 120$.

$\therefore$ Area $= xy = 120\ cm^2$.

Sol.5 Let breadth = x. Then, length = 2x. Then,

$(2x - 5)(x + 5) - 2x \times x = 75 \Leftrightarrow 5x - 25 = 75$

$\Leftrightarrow x = 20$.

$\therefore$ Length of the rectangle = 20 cm.

Sol.6 Let x and y be the sides of the rectangle. Then, Correct area = xy.

Calculated area $=\left(\frac{105}{100}x\right)\times\left(\frac{96}{100}y\right)=\frac{504}{500}$ xy.

Error in measurement $=\left(\frac{504}{500}xy\right)-xy=\frac{4}{500}xy$.

$\therefore$ Error % $=\left[\frac{4}{500}xy\times\frac{1}{xy}\times 100\right]\% = \frac{4}{5}\% = 0.8\%$.

Sol.7 Area of the plot = $(110 \times 65)m^2 = 7150\ m^2$

Area of the plot excluding the path

$= [110 - 5) \times 65 - 5)]\ m^2 = 6300\ m^2$

$\therefore$ Area of the path = $(7150 - 6300)\ m^2 = 850\ m^2$.

Cost of gravelling the path

$= \text{Rs.}\left(850 \times \frac{80}{100}\right) = \text{Rs. } 680.$

Sol.8 Side of first square $= \left(\frac{40}{4}\right)\text{cm} = 10\text{ cm};$

side of second square $= \left(\frac{32}{4}\right)\text{cm} = 8\text{ cm}.$

Area of third square $= [(10)^2 - (8)]\ cm^2$

$= (100 - 64)\ cm^2 = 36\ cm^2.$

Side of third square $= \sqrt{36}\text{ cm} = 6\text{ cm}.$

$\therefore$ Required perimeter = (6×4) cm = 24 cm.

Sol.9 Area of the room = $(544 \times 374)\ cm^2$.

Size of largest square tile = H.C.F. of 544 cm and 374 cm = 34 cm.

Area of 1 tile = $(34 \times 34)\ cm^2$.

$\therefore$ Number of tiles required $= \left(\frac{544 \times 374}{34 \times 34}\right) = 176.$

Sol.10 Area of the square $= \frac{1}{2} \times (\text{diagonal})^2$

$= \left(\frac{1}{2} \times 3.8 \times 3.8\right) m^2 = 7.22\ m^2.$

Sol.11 Let the diagonals of the squares be 2x and 5x respectively.

$\therefore$ Ratio of their areas $= \frac{1}{2} \times (2x)^2 : \frac{1}{2} \times (5x)^2$

$= 4x^2 : 25x^2 = 4 : 25.$

Sol.12 Let each side of the square be a. Then, area = a^2.

Now side $= \frac{125a}{100} = \frac{5a}{4}.$

New area $= \left(\frac{5a}{4}\right)^2 = \frac{25a^2}{16}.$

Increase in area $= \left(\frac{25a^2}{16} - a^2\right) = \frac{9a^2}{16}.$

$\therefore$ Increase $\left(\frac{9a^2}{16} \times \frac{1}{a^2} \times 100\right)\% = 56.25\%.$

Sol.13 Let x and y be the length and breadth of the rectangle respectively.

Then, $x - 4 = y + 3$ or $x - y = 7$ ... (i)

Area of the rectangle = xy;

Area of the square = $(x - 4)(y + 3)$

$\therefore (x - 4)(y + 3) = xy \Leftrightarrow 3x - 4y = 12$ ... (ii)

Solving (i) and (ii), we get $x = 16$ and $y = 9$.

$\therefore$ Perimeter of the rectangle

$= 2(x + y) = [2(16 + 9)]$ cm $= 50$ cm.

Sol.14 Let breadth = x metres, length $= \frac{3x}{2}$ metres,

height = H metres.

Area of the floor $= \left(\frac{\text{Total cost of carpeting}}{\text{Rate}/m^2}\right) m^2$

$= \left(\frac{270}{5}\right) m^2 = 54\ m^2.$

$\therefore x \times \frac{3x}{2} = 54 \Leftrightarrow x^2 = \left(54 \times \frac{2}{3}\right) = 36 \Leftrightarrow x = 6.$

So, breadth = 6 m and length $= \left(\frac{3}{2} \times 6\right) m = 9$ m.

Now, papered area $= \left(\frac{1720}{10}\right) m^2 = 172\ m^2.$

Area of 1 door and 2 windows $= 8\ m^2.$

Total area of 4 walls $= (172 + 8)\ m^2 = 180\ m^2.$

$\therefore 2(9 + 6) \times H = 180 \Leftrightarrow H = \left(\frac{180}{30}\right) = 6$ m.

Sol.15 Let $a = 13$, $b = 14$ and $c = 15$. Then,

$s = \frac{1}{2}(a + b + c) = 21.$

$\therefore (s - a) = 8$, $(s - b) = 7$ and $(s - c) = 6.$

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

$= \sqrt{21 \times 8 \times 7 \times 6} = 84\ cm^2.$

Sol.16 Height of the triangle $= \sqrt{(13)^2 - (12)^2}$ cm

$= \sqrt{25}$ cm $= 5$ cm.

$\therefore$ Its area $= \frac{1}{2} \times$ Base $\times$ Height

$= \left(\frac{1}{2} \times 12 \times 5\right) cm^2 = 30\ cm^2.$

Sol.17 Area of the field $= \frac{\text{Total cost}}{\text{Rate}}$

$= \left(\frac{333.18}{24.68}\right)$ hectares $= 13.5$ hectares

$= (13.5 \times 10000)\ m^2 = 135000\ m^2.$

Let altitude = x metres and base = 3x metres.

Then, $\frac{1}{2} \times 3x \times x = 135000 \Leftrightarrow x^2 = 90000$

$\Leftrightarrow x = 300.$

$\therefore$ Base = 900 m and Altitude = 300 m.

Sol.18 Let ABC be the isosceles triangle and AD be the altitude.

Let AB = AC = x. Then, BC = (32 – 2x).

Since, in an isosceles triangle, the altitude bisects the base,

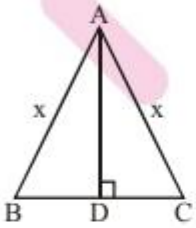
so BD = DC = (16 – x).

In ΔADC, $AC^2 = AD^2 + DC^2$

$\Rightarrow x^2 = (8)^2 + (16 - x)^2$

$\Rightarrow 32x = 320 \Rightarrow x\ 10.$

$\therefore$ BC = (32 – 2x) = (32 – 20) cm = 12 cm.



Hence, required area $= \left(\frac{1}{2} \times BC \times AD\right)$

$= \left(\frac{1}{2} \times 12 \times 10\right) cm^2 = 60\ cm^2.$

Sol.19 Area of the triangle $= \frac{\sqrt{3}}{4} \times (3\sqrt{3})^2 = \frac{27\sqrt{3}}{4}.$

Let the height be h.

Then, $\frac{1}{2} \times 3\sqrt{3} \times h = \frac{27\sqrt{3}}{4} \Leftrightarrow h = \frac{27\sqrt{3}}{4} \times \frac{2}{3\sqrt{3}}$

$= \frac{9}{2} = 4.5$ cm.

Sol.20 Let the bases of the two triangles be x and y and their heights be 3h and 4h respectively. Then,

$$\frac{\frac{1}{2} \times x \times 3h}{\frac{1}{2} \times y \times 4h} = \frac{4}{3} \Leftrightarrow \frac{x}{y} = \left(\frac{4}{3} \times \frac{4}{3}\right) = \frac{16}{9}.$$

$\therefore$ Required ratio = 16 : 9.

Sol.21 Let the height of the parallelogram be x cm. Then, base = (2x) cm.

$\therefore 2x \times x = 72 \Leftrightarrow 2x^2 = 72 \Leftrightarrow x^2 = 36 \Leftrightarrow x = 6.$

Hence, height of the parallelogram = 6 cm.

Sol.22 Let other diagonal = 2x cm.

Since diagonals of a rhombus bisect each other at right angles, we have :

$(20)^2 = (12)^2 + x^2 \Leftrightarrow x = \sqrt{(20)^2 - (12)^2}$

$= \sqrt{256} = 16$ cm.

So, other diagonal = 32 cm.

$\therefore$ Area of rhombus $= \frac{1}{2} \times$ (Product of diagonals)

$= \left(\frac{1}{2} \times 24 \times 32\right) \text{cm}^2 = 384 \text{ cm}^2.$

Sol.23 Let the two parallel sides of the trapezium be a cm and b cm.

Then, $a - b = 4$ ... (i)

And,

$\frac{1}{2} \times (a + b) \times 19 = 475 \Leftrightarrow$

$(a + b) = \left(\frac{475 \times 2}{19}\right) \Leftrightarrow a + b = 50$ ... (ii)

Solving (i) and (ii), we get : a = 27, b = 23.

So, the two parallel sides are 27 cm and 23 cm.

Sol.24 Clearly, the cow will graze a circular field of area 9856 sq. metres and radius equal to the length of the rope.

Let the length of the rope be R metres.

Then, $\pi R^2 = 9856 \Leftrightarrow R^2 = \left(9856 \times \frac{7}{22}\right)$

$= 3136 \Leftrightarrow R = 56.$

$\therefore$ Length of the rope = 56 m.

Sol.25 Area = (13.86×10000) m^2 = 138600 m^2.

$\pi R^2 = 138600 \Leftrightarrow R^2 = \left(138600 \times \frac{7}{22}\right)$

$\Leftrightarrow R = 210$ m.

Circumference $= 2\pi R = \left(2 \times \frac{22}{7} \times 210\right) \text{m} = 1320$ m.

$\therefore$ Cost of fencing = Rs. (1320×4.40)

= Rs. 5808 m.

Sol.26 Distance to be covered in 1 min. $= \left(\frac{66 \times 1000}{60}\right)$ m

= 1100 m.

Circumference of the wheel $= \left(2 \times \frac{22}{7} \times 0.70\right)$ m

= 4.4 m.

$\therefore$ Number of revolutions per min. $= \left(\frac{1100}{4.4}\right)$

= 250.

Sol.27 Distance covered in one revolution $=\left(\frac{88\times1000}{1000}\right)$m

$= 88$ m.

$\therefore\ 2\pi R = 88 \Leftrightarrow 2\times\frac{22}{7}\times R = 88$ m.

$\Leftrightarrow R = \left(88\times\frac{7}{44}\right) = 14$ m.

Sol.28 Let inner radius be r metres. Then $2\pi r = 440$

$\Rightarrow r = \left(440\times\frac{7}{44}\right) = 70$ m.

$\therefore$ Radius of outer circle $= (70 + 14)$ m $= 84$ m.

Sol.29 Let the inner and outer radii be r and R metres.

Then, $2\pi r = \frac{352}{7} \Rightarrow r = \left(\frac{352}{7}\times\frac{7}{22}\times\frac{1}{2}\right) = 8$ m.

$2\pi r = \frac{528}{7} \Rightarrow R = \left(\frac{528}{7}\times\frac{7}{22}\times\frac{1}{2}\right) = 12$ m.

$\therefore$ Width of the ring $= (R - r) = (12 - 8)$ m $= 4$ m.

Sol.30 Let the radius of the circle be r cm. Then,

$\frac{\pi r^2\theta}{360} = \frac{66}{7} \Leftrightarrow \frac{22}{7}\times r^2\times\frac{120}{360}$

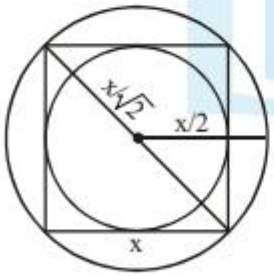
$= \frac{66}{7} \Leftrightarrow r^2 = \left(\frac{66}{7}\times\frac{7}{22}\times3\right) = 9 \Leftrightarrow r = 3.$

Hence, radius $= 3$ cm.

Sol.31 Let the side of the square be x. Then, its diagonal $= \sqrt{2}\,x$.

Radius of incircle $= \frac{x}{2}$ and

radius of circumcircle $= \frac{\sqrt{2}x}{2} = \frac{x}{\sqrt{2}}$.



$\therefore$ Required ratio $\left(\frac{\pi x^2}{4} : \frac{\pi x^2}{2}\right) = \frac{1}{4} : \frac{1}{2} = 1 : 2.$

Sol.32 Let original radius = R. New radius = $\frac{50}{100}R = \frac{R}{2}$.

Original area = πR^2 and New area

$$= \pi\left(\frac{R}{2}\right)^2 = \frac{\pi R^2}{4}.$$

$\therefore$ Decrease in area $= \left(\frac{3\pi R^2}{4} \times \frac{1}{\pi R^2} \times 100\right)\%$

$= 75\%$.

Sol.33 Volume = $(16 \times 14 \times 7)\ m^3 = 1568\ m^3$.

Surface area $= [2\ (16 \times 14 + 14 \times 7 + 16 \times 7)]\ m^2$

$= (2 \times 434)\ m^2 = 868\ m^2$.

Sol.34 Length of longest pole = Length of the diagonal of the room

$$= \sqrt{(12)^2 + 8^2 + 9^2} = \sqrt{289} = 17\ m.$$

Sol.35 Let the breadth of the wall be x metres.

Then, Height = 5x metres and

Length = 40 x metres.

$\therefore$ $x \times 5x \times 40x = 12.8$

$$\Leftrightarrow x^3 = \frac{12.8}{200} = \frac{128}{2000} = \frac{64}{1000}.$$

So, $x = \frac{4}{10}\ m = \left(\frac{4}{10} \times 100\right)\ cm = 40\ cm.$

Sol.36 Volume of the wall = $(2400 \times 800 \times 60)$ cu. cm.

Volume of bricks = 90% of the volume of the wall

$$= \left(\frac{90}{100} \times 2400 \times 800 \times 60\right) \text{cu. cm.}$$

Volume of 1 brick = $(24 \times 12 \times 8)$ cu. cm.

$\therefore$ Number of bricks $= \left(\frac{90}{100} \times \frac{2400 \times 800 \times 60}{24 \times 12 \times 8}\right)$

$= 45000$.

Sol.37 Volume required in the tank = $(200 \times 150 \times 2)\ m^3 = 60000\ m^3$

Volume of water column flown in 1 min.

$$= \left(\frac{20 \times 1000}{60}\right) m = \frac{1000}{3}\ m.$$

Volume flown per minute

$$= \left(1.5 \times 1.25 \times \frac{1000}{3}\right) m^3 = 625\ m^3.$$

$\therefore$ Required time $= \left(\frac{60000}{625}\right)$ min. = 96 min.

Sol.38 Volume of the metal used in the box

= External Volume – Internal Volume

= $[(150 \times 40 \times 23) - (44 \times 34 \times 20)]\ cm^3$

$= 16080\ cm^3.$

$\therefore$ Weight of the metal $= \left(\frac{16080 \times 0.5}{1000}\right) kg$

$= 8.04\ kg.$

Sol.39 let the edge of the cube be a

$\sqrt{3}\,a = 6\sqrt{3} \Rightarrow a = 6.$

So, Volume $= a^3 = (6 \times 6 \times 6)\ cm^3 = 216\ cm^3.$

Surface area $= 6a^2 = (6 \times 6 \times 6)\ cm^2 = 216\ cm^2.$

Sol.40 Let the edge of the cube be a. Then,

$6a^2 = 1734 \Rightarrow a^2 = 289 \Rightarrow a = 17\ cm.$

$\therefore$ Volume $= a^3 = (17)^3\ cm^3 = 4913\ cm^3.$

Sol.41 Volume of the block $= (6 \times 12 \times 15)\ cm^3$

$= 1080\ cm^3.$

Side of the largest cube

= H.C.F. of 6 cm, 12 cm, 15 cm = 3 cm.

volume of this cube $= (3 \times 3 \times 3)\ cm^3 = 27\ cm^3.$

Number of cubes $= \left(\frac{1080}{27}\right) = 40.$

Sol.42 Increase in volume

= Volume of the cube $= (15 \times 15 \times 15)\ cm^3.$

$\therefore$ Rise in water level $= \left(\frac{\text{Volume}}{\text{Area}}\right)$

$= \left(\frac{15 \times 15 \times 15}{20 \times 15}\right) cm = 11.25\ cm.$

Sol.43 Volume of new cube $= (1^3 + 6^3 + 8^3)\ cm^3$

$= 729\ cm^3.$

Edge of new cube $= \sqrt[3]{729}\ cm = 9\ cm.$

$\therefore$ Surface area of the new cube

$= (6 \times 9 \times 9)\ cm^2 = 486\ cm^2.$

Sol.44 Let original length of each edge = a.

Then, original surface area $= 6a^2.$

New edge = (150% of a) $= \left(\frac{150}{100}a\right) = \frac{3a}{2}.$

New surface area $= 6 \times \left(\frac{3a}{2}\right)^2 = \frac{27}{2}a^2.$

Increase percent in surface area

$= \left(\frac{15}{2}a^2 \times \frac{1}{6a^2} \times 100\right)\% = 125\%.$

Sol.45 Let their edges be a and b. Then,

$$\frac{a^3}{b^3}=\frac{1}{27} \text{ or } \left(\frac{a}{b}\right)^3=\left(\frac{1}{3}\right)^3 \text{ or } \frac{a}{b}=\frac{1}{3}.$$

$\therefore$ Ratio of their surface areas $=\frac{6a^2}{6b^2}=\frac{a^2}{b^2}$

$$=\left(\frac{a}{b}\right)^2=\frac{1}{9}, \text{ i.e., } 1:9.$$

Sol.46 Volume $= \pi r^2 h = \left(\frac{22}{7}\times\frac{7}{2}\times\frac{7}{2}\times 40\right) cm^3 = 1540\ cm^3.$

Curved surface area $= 2\pi rh$

$$=\left(2\times\frac{22}{7}\times\frac{7}{2}\times 40\right) cm^2 = 880\ cm^2.$$

Total surface area $= 2\pi rh + 2\pi r^2 = 2\pi r\ (h+r)$

$$=\left[2\times\frac{22}{7}\times\frac{7}{2}\times(40+3.5)\right] cm^2 = 957\ cm^2.$$

Sol.47 Let the depth of the tank be h metres. Then,

$$\pi \times (7)^2 \times h = 1848 \Leftrightarrow h = \left(1848\times\frac{7}{22}\times\frac{1}{7\times 7}\right)$$

$= 12$ m.

Sol.48 Let the length of the wire be h metres. Then,

$$\pi\times\left(\frac{0.50}{2\times 100}\right)^2\times h = \frac{2.2}{1000}$$

$$\Leftrightarrow h = \left(\frac{2.2}{1000}\times\frac{100\times 100}{0.25\times 0.25}\times\frac{7}{22}\right) = 112 \text{ m}.$$

Sol.49 Volume of 1 rod $= \left(\frac{22}{7}\times\frac{1}{100}\times\frac{1}{100}\times 7\right)$ cu. m

$$=\frac{11}{5000} \text{ cu. m}.$$

Volume of iron = 0.88 cu. m

Number of rods $= \left(0.88\times\frac{5000}{11}\right) = 400.$

Sol.50 Let the radii of the cylinders be 3x, 5x and their heights be 2y, 3y respectively. Then,
Ratio of their curved surface areas

$$=\frac{2\pi\times 3x\times 2y}{2\pi\times 5x\times 3y}=\frac{2}{5}=2:5.$$

Sol.51 Inner radius $= \left(\frac{3}{2}\right)$ cm = 1.5 cm,

Outer radius = (1.5 + 1) = 2.5 cm.

$\therefore$ Volume of iron

$$= [\pi \times (2.5)^2 \times 100 - \pi \times (1.5)^2 \times 100]\ cm^3$$

$$= \frac{22}{7} \times 100 \times [(2.5)^2 - (1.5)^2] \text{ cm}^3$$

$$= \left(\frac{8800}{7}\right) \text{cm}^3.$$

$\therefore$ Weight of the pipe $= \left(\frac{8800}{7} \times \frac{21}{1000}\right)$ kg

$= 26.4$ kg.

Sol.52 Here, r = 21 cm and h = 28 cm.

$\therefore$ Slant height, $l = \sqrt{r^2 + h^2}$

$$= \sqrt{(21)^2 + (28)^2} = \sqrt{1225} = 35 \text{ cm}.$$

$$\text{Volume} = \frac{1}{3}\pi r^2 h = \left(\frac{1}{3} \times \frac{22}{7} \times 21 \times 21 \times 28\right) \text{cm}^3$$

$= 12936 \text{ cm}^3$.

$$\text{Curved surface area} = \left(\frac{22}{7} \times 21 \times 35\right) \text{cm}^2$$

$= 2310 \text{ cm}^2$.

Total surface area $= (\pi r l + \pi r^2)$

$$= \left(2310 + \frac{22}{7} \times 21 \times 21\right) \text{cm}^2 = 3696 \text{ cm}^2.$$

Sol.53 Here, r = 7m and h = 24 m.

So, $l = \sqrt{r^2 + h^2} = \sqrt{7^2 + (24)^2} = \sqrt{625} = 25$ m.

Area of canvas $= \pi r l = \left(\frac{22}{7} \times 7 \times 25\right) \text{m}^2 = 550 \text{ m}^2$.

$\therefore$ Length of canvas

$$= \left(\frac{\text{Area}}{\text{Width}}\right) = \left(\frac{550}{1.25}\right) \text{m} = 440 \text{ m}.$$

Sol.54 Let the radii of their bases be r and R and their heights be h and 2h respectively.

Then, $\frac{2\pi r}{2\pi R} = \frac{3}{4} \Rightarrow \frac{r}{R} = \frac{3}{4} \Rightarrow R = \frac{4}{3} r.$

$\therefore$ Ratio of volumes $= \dfrac{\frac{1}{3}\pi r^2 h}{\frac{1}{3}\pi\left(\frac{4}{3}r\right)^2 (2h)}$

$$= \frac{9}{32} = 9 : 32.$$

Sol.55 Let the radii of the cylinder and the cone be 3r and 4r and their heights be 2h and 3h respectively.

$$\therefore \quad \frac{\text{Volume of cylinder}}{\text{Volume of cone}} = \frac{\pi \times (3r)^2 \times 2h}{\frac{1}{3}\pi \times (4r^2) \times 3h}$$

$$= \frac{9}{8} = 9 : 8.$$

Sol.56 Volume of the liquid in the cylindrical vessel
= Volume of the conical vessel

$$= \left(\frac{1}{3}\times\frac{22}{7}\times 12\times 12\times 50\right) cm^3$$

$$= \left(\frac{22\times 4\times 12\times 50}{7}\right) cm^3.$$

Let the height of the liquid in the vessel be h.

Then, $\frac{22}{7}\times 10\times 10\times h = \frac{22\times 4\times 12\times 50}{7}$

or $h = \left(\frac{4\times 12\times 50}{10\times 10}\right) = 24$ cm.

Sol.57 Volume $= \frac{4}{3}\pi r^3 = \left(\frac{4}{3}\times\frac{22}{7}\times\frac{21}{2}\times\frac{21}{2}\times\frac{21}{2}\right) cm^3$

$= 4851\ cm^3.$

Surface area $= 4\pi r^2 = \left(4\times\frac{22}{7}\times\frac{21}{2}\times\frac{21}{2}\right) cm^2$

$= 1386\ cm^2.$

Sol.58 Let original radius = R.

Then, new radius $= \frac{150}{100}R = \frac{3R}{2}$.

Original volume $= \frac{4}{3}\pi R^3$.

New volume $= \frac{4}{3}\pi\left(\frac{3R}{2}\right)^3 = \frac{9\pi R^3}{2}$.

Increase % in volume $= \left(\frac{19}{6}\pi R^3\times\frac{3}{4\pi R^3}\times 100\right)\%$

$= 237.5\%.$

Original surface area $= 4\pi R^2$.

New surface are $= 4\pi\left(\frac{3R}{2}\right)^2 = 9\pi R^2$.

Increase % in surface area $= \left(\frac{5\pi R^2}{4\pi R^2}\times 100\right)\%$

$= 125\%.$

Sol.59 Volume of larger sphere $= \left(\frac{4}{3}\pi\times 6\times 6\times 6\right) cm^3$

$= 288\ \pi\ cm^3.$

Volume of 1 small lead ball $= \left(\frac{4}{3}\pi\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\right) cm^3$

$= \frac{\pi}{6} cm^3.$

$\therefore$ Number of lead balls $= \left(288\pi\times\frac{6}{\pi}\right) = 1728.$

Sol.60 Volume of cylinder = $(\pi \times 6 \times 6 \times 28)\text{cm}^3$

$= (36 \times 28)\ \pi\ \text{cm}^3.$

Volume of each bullet $= \left(\frac{4}{3}\pi \times \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4}\right) \text{cm}^3.$

$= \frac{9\pi}{16}\text{cm}^3.$

Number of bullets $= \frac{\text{Volume of cylinder}}{\text{Volume of each bullet}}$

$= \left[(36 \times 28)\pi \times \frac{16}{9\pi}\right] = 1792.$

Sol.61 Volume of sphere $= \left(\frac{4}{3}\pi \times 9 \times 9 \times 9\right) \text{cm}^3 = 972\pi\ \text{cm}^3.$

olume of wire $(\pi \times 0.2 \times 0.2 \times \text{h})\ \text{cm}^3.$

$\therefore\ 972\pi = \pi \times \frac{2}{10} \times \frac{2}{10} \times \text{h}$

$\Rightarrow\ \text{h} = (972 \times 5 \times 5)\ \text{cm} = \left(\frac{972 \times 5 \times 5}{100}\right) \text{m}$

$= 243\ \text{m}.$

Sol.62 Volume of sphere = Volume of 2 cones

$= \left[\frac{1}{3}\pi \times (2.1)^2 \times 4.1 + \frac{1}{3}\pi \times (2.1)^2 \times 4.3\right] \text{cm}^3$

$= \frac{1}{3}\pi \times (2.1)^2\ (8.4)\ \text{cm}^3.$

Let the radius of the sphere be R.

$\therefore\ \frac{4}{3}\pi R^3 = \frac{1}{3}\pi \times (2.1)^2 \times 4$ or $R = 2.1$ cm.

Hence, diameter of the sphere = 4.2 cm.

Sol.63 Let radius of the each be R and height of the cone be H.

Then, $\frac{4}{3}\pi R^3 = \frac{1}{3}\pi R^2 H$

or $\frac{R}{H} = \frac{1}{4}$ or $\frac{2R}{H} = \frac{2}{4} = \frac{1}{2}.$

$\therefore$ Required ratio = 1 : 2.

Sol.64 Volume $= \frac{2}{3}\pi r^3 = \left(\frac{2}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}\right) \text{cm}^3$

$= 2425.5\ \text{cm}^3.$

Curved surface area $= 2\pi r^2$

$= \left(2 \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2}\right) \text{cm}^3 = 693\ \text{cm}^2.$

Total surface area $= 3\pi r^2$

$$= \left(3 \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2}\right) = \text{cm}^2$$

$$= 1039.5 \text{ cm}^2.$$

Sol.65 Volume of bowl $= \left(\frac{2}{3}\pi \times 9 \times 9 \times 9\right) \text{cm}^3$

$= 486\pi \text{ cm}^3.$

Volume of 1 bottles $= \left(\pi \times \frac{3}{2} \times \frac{3}{2} \times 4\right) \text{cm}^3 = 9\pi \text{ cm}^3.$

Number of bottle $= \left(\frac{486\pi}{9\pi}\right) 54.$

Sol.66 Let R be the radius of each.

Height of hemisphere = Its radius = R.

$\therefore$ Height of each = R.

Ratio of volumes $= \frac{1}{3}\pi R^2 \times R : \frac{2}{3}\pi R^3 : \pi R^2 \times R$

$= 1 : 2 : 3.$