MENSURATION

Mensuration is the branch of mathematics which deals with the study of different geometrical shapes, their areas and volumes in the broadest sense, it is all about the process of measmement. These are two types of geometrical shapes (1) 2D (2) 3D

Perimeter : Perimeter is sum of all the sides. It is measured in cm, m, etc.

Area : The area of any figure is the amount of surface enclosed within its boundary lines. This is measured in square unit like cm^2, m^2, etc.

Volume : If an object is solid, then the space occupied by such an object is called its volume. This is measured in cubic unit like cm^3, m^3, etc.

Basic Conversions :

I. 1 km = 10 hm
1 hm = 10 dam
1 dam = 10 m
1 m = 10 dm
1 dm = 10 cm
1 cm = 10 mm
1 m = 100 cm = 1000 mm
1km = 1000 m

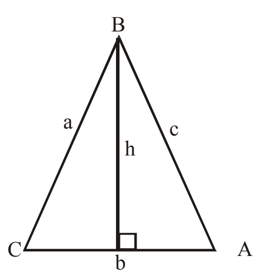
II. 1 km $= \frac{5}{8}$ miles
1 mile = 1.6 km
1 inch = 2.54 cm
1 mile = 1760 yd = 5280 ft.
1 nautical mile (knot) = 6080 ft

III. 100 kg = 1 quintal
10 quintal = 1 tonne
1 kg = 2.2 pounds (approx.)

IV. 1 litre = 1000 cc
1 acre = 100 m^2
1 hectare = 10000 m^2 (100 acre)

Part I : Plane Figures

TRIANGLE



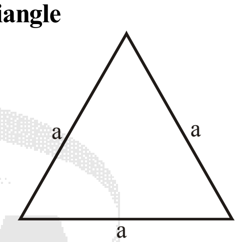
Perimeter (P) = a + b + c

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

where $s = \frac{a+b+c}{2}$ and a, b and c are three sides of the triangle.

Also, $A = \frac{1}{2} \times bh$; where b $\rightarrow$ base
h $\rightarrow$ altitude

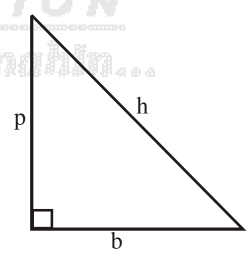
(a) Equilateral triangle



Perimeter = 3a

$A = \frac{\sqrt{3}}{4} a^2$; where a $\rightarrow$ side

(b) Right triangle



$A = \frac{1}{2} pb$ and $h^2 = p^2 + b^2$ (Pythagoras triplet)

where p $\rightarrow$ perpendicular
b $\rightarrow$ base
h $\rightarrow$ hypotenuse

Example 1 :

Find the area of a triangle whose sides are 50 m, 78m, 112m respectively and also find the perpendicular from the opposite angle on the side 112 m.

Solution :

Here a = 50 m, b = 78 m, c = 112m

$s = \frac{1}{2}(50 + 78 + 112) = 120m$

$s - a = 120 - 50 = 70$ m
$s - b = 120 - 78 = 42$ m
$s - c = 120 - 112 = 8$ m

$\therefore$ Area $= \sqrt{120 \times 70 \times 42 \times 8} = 1680$ sq.m.

$\because$ Area $= \frac{1}{2}$ base $\times$ perpendicular

$\therefore$ Perpendicular $= \frac{2\text{Area}}{\text{Base}} = \frac{1680 \times 2}{112} = 30\text{m}.$

Example 2 :

The base of a triangular field is 880 m and its height 550 m. Find the area of the field. Also calculate the charges for supplying water to the field at the rate of ₹ 24.25 per sq. hectometre.

Solution :

Area of the field $= \frac{\text{Base} \times \text{Height}}{2}$

$= \frac{880 \times 550}{2} = 242000$ sq.m. $= 24.20$ sq.hm

Cost of supplying water to 1 sq. hm = ₹ 24.25

$\therefore$ Cost of supplying water to the whole field

$= 24.20 \times 24.25 =$ ₹ 586.85

NOTE :

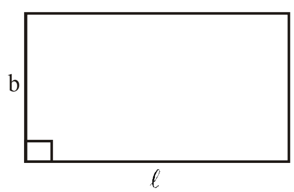
- In a rectangle, $\frac{(\text{Perimeter})^2}{4} = (\text{diagonal})^2 + 2 \times \text{Area}$
- In an isosceles right angled triangle,

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

  where a is two equal side and b is different side
- In a parallelogram,

  Area = Diagonal × length of perpendicular on it
- If area of circle is decreased by x%, then the radius of circle is decreased by $(100 - 10\sqrt{100 - x})\%$

RECTANGLE

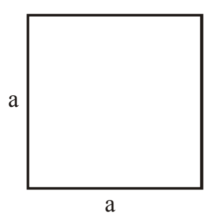


Perimeter $= 2(\ell + b)$

Area $= \ell \times b$; where $\ell \rightarrow$ length

$b \rightarrow$ breadth

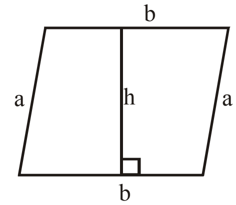
SQUARE



Perimeter $= 4 \times$ side $= 4a$

Area $= (\text{side})^2 = a^2$; where $a \rightarrow$ side

PARALLELOGRAM



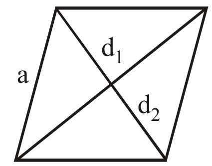
Perimeter $= 2(a + b)$

Area $= b \times h$; where $a \rightarrow$ breadth

$b \rightarrow$ base (or length)

$h \rightarrow$ altitude

RHOMBUS

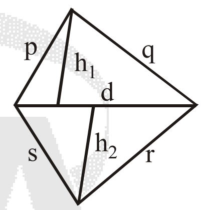


Perimeter $= 4a$

Area $= \frac{1}{2} d_1 \times d_2$ where $a \rightarrow$ side and

d_1 and d_2 are diagonals.

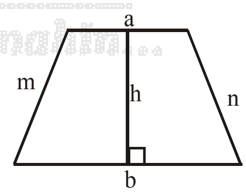
IRREGULAR QUADRILATERAL



Perimeter $= p + q + r + s$

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

TRAPEZIUM



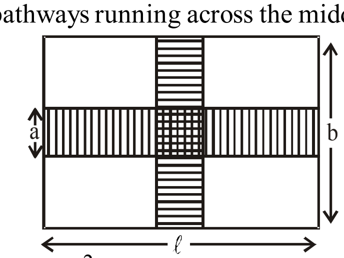
Perimeter $= a + b + m + n$

Area $= \frac{1}{2}(a + b)h$; where a and b are two parallel sides;

m and n are two non-parallel sides;

$h \rightarrow$ perpendicular distance between two parallel sides.

Area of pathways running across the middle of a rectangle

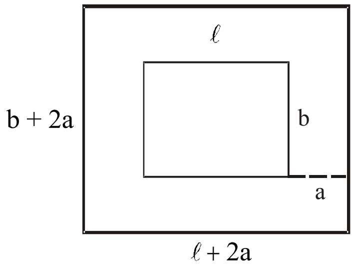


$A = a(\ell + b) - a^2$; where $\ell \rightarrow$ length

$b \rightarrow$ breadth,

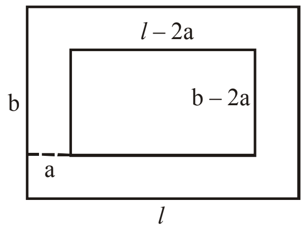
$a \rightarrow$ width of the pathway.

PATHWAYS OUTSIDE



$A = (\ell + 2a)(b + 2a) - \ell b$; where $\ell \to$ length
$b \to$ breadth
$a \to$ width of the pathway

PATHWAYS INSIDE



$A = \ell b - (\ell - 2a)(b - 2a)$; where $\ell \to$ length
$b \to$ breadth
$a \to$ width of the pathway

Example 3 :

A 5100 sq.cm trapezium has the perpendicular distance between the two parallel sides 60 m. If one of the parallel sides be 40m then find the length of the other parallel side.

Solution :

Since, $A = \frac{1}{2}(a + b)h$

$\Rightarrow \quad 5100 = \frac{1}{2}(40 + x) \times 60$

$\Rightarrow \quad 170 = 40 + x$

$\therefore$ other parallel side $= 170 - 40 = 130$ m

Example 4 :

A rectangular grassy plot is 112m by 78 m. It has a gravel path 2.5 m wide all round it on the inside. Find the area of the path and the cost of constructing it at ₹ 2 per square metre?

Solution :

$A = \ell b - (\ell - 2a)(b - 2a)$

$= 112 \times 78 - (112 - 5)(78 - 5)$

$= 112 \times 78 - 107 \times 73 = 8736 - 7811$

$= 925$ sq.m

$\therefore$ Cost of construction = rate × area

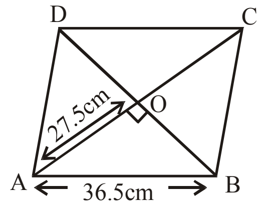
$= 2 \times 925 =$ ₹ 1850

Example 5 :

The perimeter of a rhombus is 146 cm and one of its diagonals is 55 cm. Find the other diagonal and the area of the rhombus.

Solution :

Let ABCD be the rhombus in which AC = 55 cm.



and AB $= \frac{146}{4} = 36.5$ cm

Also, AO $= \frac{55}{2} = 27.5$m

$\therefore \quad BO = \sqrt{(36.5)^2 - (27.5)^2} = 24$ cm

Hence, the other diagonal BD = 48 cm

Now, Area of the rhomhus $= \frac{1}{2} AC \times BD$

$= \frac{1}{2} \times 55 \times 48 = 1320$ sq.cm.

Example 6 :

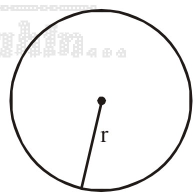
Find the area of a quadrilateral piece of ground, one of whose diagonals is 60 m long and the perpendicular from the other two vertices are 38 and 22m respectively.

Solution :

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

$= \frac{1}{2} \times 60(38 + 22) = 1800$ sq.m.

CIRCLE



Perimeter (Circumference) $= 2\pi r = \pi d$

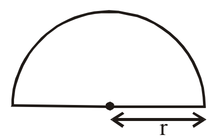
Area $= \pi r^2$; where $r \to$ radius
$d \to$ diameter

and $\pi = \frac{22}{7}$ or 3.14

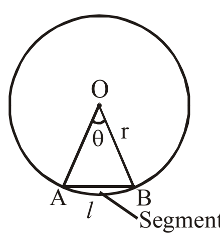
SEMICIRCLE

Perimeter $= \pi r + 2r$

Area $= \frac{1}{2} \times \pi r^2$



SECTOR OF A CIRCLE



Area of sector $OAB = \frac{\theta}{360} \times \pi r^2$

Length of an arc $(l) = \frac{\theta}{360} \times 2\pi r$

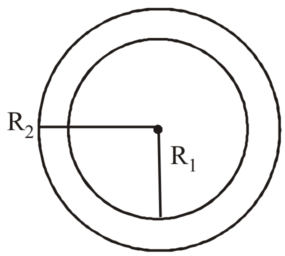
Area of segment = Area of sector – Area of triangle OAB

$$= \frac{\theta}{360°} \times \pi r^2 - \frac{1}{2} r^2 \sin\theta$$

Perimeter of segment = length of the arc + length of segment

$$AB = \frac{\pi r\theta}{180} + 2r \sin\frac{\theta}{2}$$

RING



Area of ring $= \pi\left(R_2^2 - R_1^2\right)$

Example 7 :

A wire is looped in the form of a circle of radius 28 cm. It is re-bent into a square form. Determine the length of a side of the square.

Solution :

(a) Length of the wire = Perimeter of the circle

$= 2\pi \times 28$

$= 176\ cm^2$

Side of the square $= \frac{176}{4} = 44$ cm

Example 8 :

The radius of a wheel is 42 cm. How many revolutions will it make in going 26.4 km ?

Solution :

Distance travelled in one revolution = Circumference of the wheel $= 2\pi r = 2 \times \frac{22}{7} \times 42$cm. = 264 cm

$\therefore$ No. of revolutions required to travel 26.4 km

$$= \frac{26.4 \times 1000 \times 100}{264} = 10000$$

Example 9 :

Find the area of sector of a circle whose radius is 6 cm when–

(a) the angle at the centre is 35°

(b) when the length of arc is 22 cm

Solution :

(a) Area of sector

$$= \pi r^2 . \frac{\theta}{360°} = \frac{22}{7} \times 6 \times 6 \times \frac{35}{360} cm^2 = 11 \text{ sq.cm.}$$

(b) Here length of arc $\ell = 22$ cm.

$$\therefore \quad 2\pi r \frac{\theta}{360°} = 22\text{cm.}$$

Area of sector $= \pi r^2 . \frac{\theta}{360°} = \frac{1}{2} r . 2\pi r \frac{\theta}{360°}$

$$= \frac{1}{2} r.\ell = \frac{1}{2} \times 6 \times 22 \text{ sq.cm} = 66 \text{ sq.cm.}$$

Example 10 :

The radius of a circular wheel is $1\frac{3}{4}$ m. How many revolutions will it make in travelling 11 km ?

Solution :

Distance to be travelled = 11km = 11000 m

Radius of the wheel $= 1\frac{3}{4}$ m $= \frac{7}{4}$ m

$\therefore$ Circumference of the wheel $= 2 \times \frac{22}{7} \times \frac{7}{4} = 11$ m

$\therefore$ In travelling 11 m, wheel makes 1 revolution.

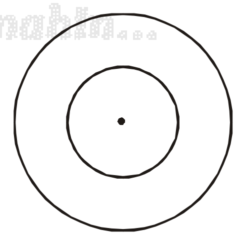
$\therefore$ In travelling 11000 m the wheel makes $\frac{1}{11} \times 11000$ revolutions, i.e., 1000 revolutions.

Example 11 :

The circumference of a circular garden is 1012m. Find the area of outsider road of 3.5 m width runs around it. Calculate the area of this road and find the cost of gravelling the road at ₹ 32 per 100 sqm.

Solution :

$A = \pi r^2$, $C = 2\pi r = 1012$



$\Rightarrow \ r = 1012 \times \frac{1}{2} \times \frac{7}{22} = 161$m

$\therefore$ Area of garden $= \frac{22}{7} \times 161 \times 161 = 81466$ sq. m

Area of the road = area of bigger circle – area of the garden

Now, radius of bigger circle = 161 + 3.5 $= \frac{329}{2}$ m

$\therefore$ Area of bigger circle $= \frac{22}{7} \times \frac{329}{2} \times \frac{329}{2} = 85046\frac{1}{2}$sq.m

Thus, area of the road $= 85046\frac{1}{2} - 81466 = 3580\frac{1}{2}$ sqm.

Hence, cost $=$ Rs.$\frac{7161}{2} \times \frac{32}{100} =$ ₹ 1145.76

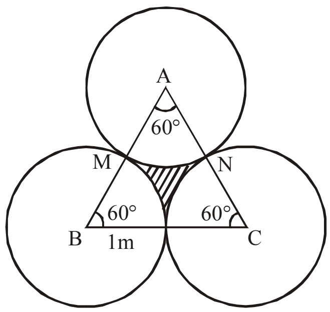
Example 12 :

There is an equilateral triangle of which each side is 2m. With all the three corners as centres, circles each of radius 1 m are described.

(i) Calculate the area common to all the circles and the triangle.

(ii) Find the area of the remaining portion of the triangle.

Solution :



Area of each sector $= \frac{\theta}{360} \times \pi r^2 = \frac{60}{360} \times \frac{22}{7} \times 1 \times 1$

$= \frac{1}{6} \times \frac{22}{7} = \frac{11}{21} m^2$

Area of equilateral triangle $= \frac{\sqrt{3}}{4} a^2$

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

(i) Common area = 3 × Area of each sector

$= 3 \times \frac{11}{21} = \frac{11}{7} = 1.57 m^2$

(ii) Area of the remaining portion of the triangle = Ar. of equilateral triangle – 3(Ar. of each sector)

$\sqrt{3} - 1.57 = 1.73 - 1.57 = 0.16 m^2$

PART-II : SOLID FIGURE

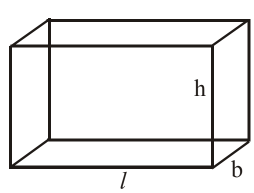
CUBOID

A cuboid is a three dimensional box.

Total surface area of a cuboid = 2 (lb + bh + lh)

Volume of the cuboid = $l$bh

Length of diagonal $\sqrt{l^2 + b^2 + h^2}$



Area of four walls = 2(l + b) × h

Rectangular Parallelpiped box. It is same as cuboid. Formally a polyhedron for which all faces are rectangles.

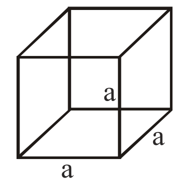
CUBE

A cube is a cuboid which has all its edges equal.

Total surface area of a cube = $6a^2$

Volume of longest the cube = a^3

Length of longest diagonal = $\sqrt{3}a$



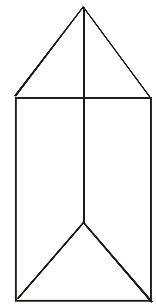
RIGHT PRISM

A prism is a solid which can have any polygon at both its ends.

Lateral or curved surface area = Perimeter of base × height

Total surface area = Lateral surface area + 2 (area of the end)

Volume = Area of base × height



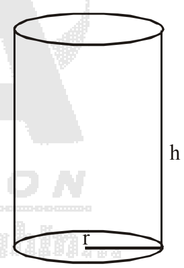
RIGHT CIRCULAR CYLINDER

It is a solid which has both its ends in the form of a circle.

Lateral surface area = $2\pi rh$

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

Volume = $\pi r^2 h$; where r is radius of the base and h is height



PYRAMID

A pyramid is a solid which can have any polygon at its base and its edges converge to single apex.

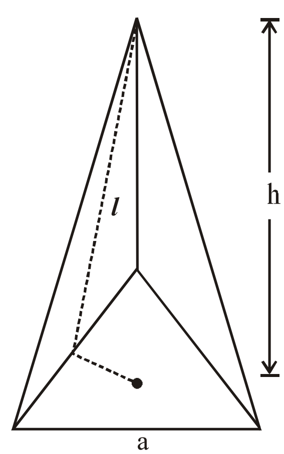
Lateral or curved surface area

$= \frac{1}{2}$ (perimeter of base) × slant height $= \frac{1}{2} pl$

Total surface area = lateral surface area + area of the base

Volume $= \frac{1}{3}$ (area of the base) × height

(i) Triangular Pyramid :



(i) Area of the lateral surface of the pyramid

$$= \frac{1}{2} \times \text{perimeter} \times \text{slant height} = \frac{1}{2} \times 3a \times l = \frac{3}{2} al$$

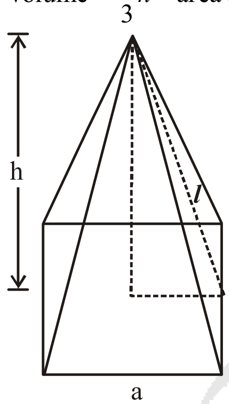
(ii) Volume $= \frac{1}{3} \times h \times$ area of base $= \frac{1}{3} \times h \times \frac{\sqrt{3}}{4} . a^2$

$$= \frac{ha^2}{4\sqrt{3}}$$

(iii) Total Area of the pyramid $= \frac{1}{2} 3al + \frac{\sqrt{3}}{4} a^2$

(ii) Square Pyramid :

(i) Volume $= \frac{1}{3} h \times$ area of base $= \frac{1}{3} h \times a^2$



(ii) Lateral surface area $= \frac{1}{2} \times$ perimeter $\times$ slant height $=$

$\frac{1}{2} \times 4a \times l = 2al$

(iii) Total area of the pyramid $= 2al + a^2 = a\,(2l + a)$

RIGHT CIRCULAR CONE

It is a solid which has a circle as its base and a slanting lateral surface that converges at the apex.

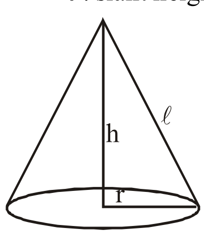
Lateral surface area $= \pi r \ell$

Total surface area $= \pi r\,(\ell + r)$

Volume $= \frac{1}{3} \pi r^2 h$; where r : radius of the base

h : height

ℓ : slant height

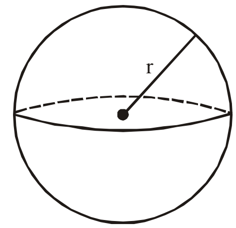


SPHERE

It is a solid in the form of a ball with radius r.

Lateral surface area = Total surface area $= 4\pi r^2$

Volume $= \frac{4}{3} \pi r^3$; where r is radius.



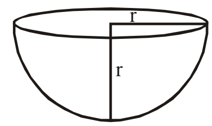
HEMISPHERE

It is a solid half of the sphere.

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

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

Volume $= \frac{2}{3} \pi r^3$; where r is radius



FRUSTUM OF A CONE

When a cone cut the left over part is called the frustum of the cone.

Curved surface area $= \pi \ell\,(r_1 + r_2)$

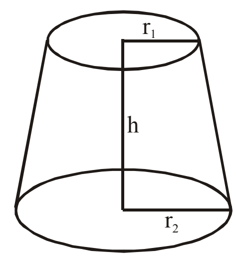
Total surface area $= \pi \ell (r_1 + r_2) + \pi r_1^2 + \pi r_2^2$

where $\ell = \sqrt{h^2 + (r_1 - r_2)^2}$

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

Where r_1 and r_2 : radii

h : height



Example 13 :

The sum of length, breadth and height of a room is 19 m. The length of the diagonal is 11 m. Find the cost of painting the total surface area of the room at the rate of ₹ 10 per m^2.:

Solution :

Let length, breadth and height of the room be ℓ, b and h, respectively. Then,

$\ell + b + h = 19$ ...(i)

and $\sqrt{\ell^2 + b^2 + h^2} = 11$

$\Rightarrow \ell^2 + b^2 + h^2 = 121$ ...(ii)

Area of the surface to be painted

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

$(\ell + b + h)^2 = \ell^2 + b^2 + h^2 + 2\,(\ell b + bh + h\ell)$

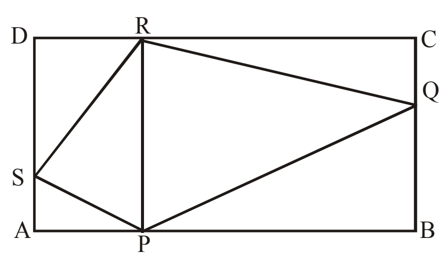
$\Rightarrow 2(\ell b + bh + h\ell) = (19)^2 - 121 = 361 - 121 = 240$

Surface area of the room $= 240\text{ m}^2$.

Cost of painting the required area $= 10 \times 240 =$ ₹ 2400

Example 14 :

ABCD is a parallelogram. P, Q, R and S are points on sides AB, BC, CD and DA, respectively such that AP = DR. If the area of the rectangle ABCD is 16 cm^2, then find the area of the quadrilateral PQRS.



Solution :

Area of the quadrilateral PQRS

$=$ Area of ΔSPR + Area of ΔPQR

$$= \frac{1}{2} \times PR \times AP + \frac{1}{2} \times PR \times PB$$

$$= \frac{1}{2} \times PR(AP + PB) = \frac{1}{2} \times AD \times AB$$

$(\because\ PR = AD \text{ and } AP + PB = AB)$

$$= \frac{1}{2} \times \text{Area of rectangle ABCD} = \frac{1}{2} \times 16 = 8\,\text{cm}^2$$

Example 15 :

A road roller of diameter 1.75 m and length 1 m has to press a ground of area 1100 sqm. How many revolutions does it make ?

Solution :

Area covered in one revolution = curved surface area

$$\therefore \quad \text{Number of revolutions} = \frac{\text{Total area to be pressed}}{\text{Curved surface area}}$$

$$= \frac{1100}{2\pi rh} = \frac{1100}{2 \times \frac{22}{7} \times \frac{1.75}{2} \times 1}$$

$$= 200$$

Example 16 :

The annual rainfall at a place is 43 cm. Find the weight in metric tonnes of the annual rain falling there on a hectare of land, taking the weight of water to be 1 metric tonne to the cubic metre.

Solution :

Area of land = 10000 sqm

$$\text{Volume of rainfall} = \frac{10000 \times 43}{100} = 4300\,\text{m}^3$$

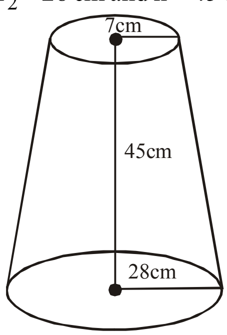
Weight of water = 4300 × 1 m tonnes = 4300 m tonnes

Example 17 :

The height of a bucket is 45 cm. The radii of the two circular ends are 28 cm and 7 cm, respectively. Find the volume of the bucket.

Solution :

Here $r_1 = 7$ cm, $r_2 = 28$ cm and h = 45 cm



$$\text{Volume of the bucket} = \frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$$

Hence, the required volume

$$= \frac{1}{3} \times \frac{22}{7} \times 45(28^2 + 7^2 + 28 \times 7) = 48510\,\text{cm}^3$$

Example 18 :

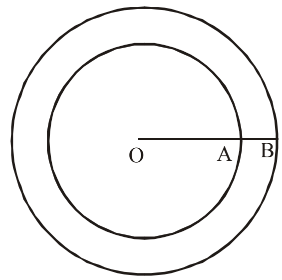
A hollow cylindrical tube open at both ends is made of iron 2 cm thick. If the external diameter be 50 cm and the length of the tube be 140 cm, find the number of cubic cm of iron in it.

Solution :

Height = 140 cm

External diameter = 50 cm

$\therefore$ External radius = 25 cm



Also, internal radius OA = OB – AB = 25 – 2 = 23 cm

$\therefore$ Volume of iron = $V_{external} - V_{internal}$

$$= \frac{22}{7} \times 140\left(25^2 - 23^2\right) = 42240 \text{ cu. cm.}$$

Example 19 :

A cylindrical bath tub of radius 12cm contains water to a depth of 20 cm. A spherical iron ball is dropped into the tub and thus the level of water is raised by 6.75 cm. What is the radius of the ball?

Solution :

Volume of the spherical ball = volume of the water displaced.

$$\Rightarrow \frac{4}{3}\pi r^3 = \pi (12)^2 \times 6.75$$

$$\Rightarrow r^3 = \frac{144 \times 6.75 \times 3}{4} = 729$$

or r = 9 cm

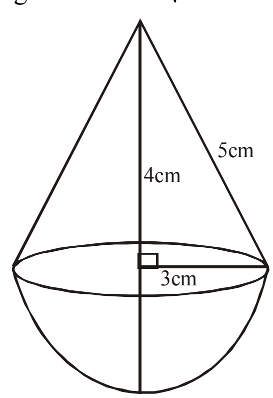
Example 20 :

A toy is in the form of a cone mounted on a hemisphere with the same radius. The diameter of the base of the conical portion is 6 cm and its height is 4 cm. Determine the surface area of the toy. (Use $\pi = 3.14$).

Solution :

$$\text{The radius of the hemisphere} = \frac{1}{2} \times 6 = 3 \text{ cm}$$

$$\text{Now, slant height of cone} = \sqrt{3^2 + 4^2} = 5 \text{ cm}$$



The surface area of the toy

= Curved surface of the conical portion

+ Curved surface of the hemisphere

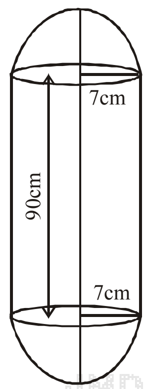
$= (\pi \times 3 \times 5 + 2\pi \times 3^2)\ cm^2$

$= 3.14 \times 3\ (5 + 6)\ cm^2 = 103.62\ cm^2.$

Example 21 :

A solid is composed of a cylinder with hemispherical ends. If the whole length of the solid is 104 cm and the radius of each of the hemispherical ends is 7 cm, find the cost of polishing its surface at the rate of Re. 1 per dm^2.

Solution :



Let the height of the cylinder be h cm.

Then $h + 7 + 7 = 104$

$\Rightarrow h = 90$

Surface area of the solid

= 2 × curved surface area of hemisphere

+ curved surface area of the cylinder

$$= \left(2 \times 2 \times \frac{22}{7} \times 7 \times 7 + 2 \times \frac{22}{7} \times 7 \times 90\right) cm^2$$

$= 616 + 3960\ cm^2 = 4576\ cm^2$

Cost of polishing the surface of the solid

$$= ₹\ \frac{4576 \times 1}{100} = ₹\ 45.76$$

Example 22 :

A regular hexagonal prism has perimeter of its base as 600 cm and height equal to 200 cm. How many litres of petrol can it hold ? Find the weight of petrol if density is 0.8 gm/cc.

Solution :

$$\text{Side of hexagon} = \frac{\text{Perimeter}}{\text{Number of sides}} = \frac{600}{6} = 100 \text{ cm}$$

$$\text{Area of regular hexagon} = \frac{3\sqrt{3}}{2} \times 100 \times 100 = 25950 \text{ sq.cm.}$$

Volume = Base area × height

= 25950 × 200 = 5190000 cu.cm. = 5.19 cu.m.

Weight of petrol = Volume × Density

= 5190000 × 0.8 gm/cc

= 4152000 gm = 4152 kg.

Example 23 :

A right pyramid, 12 cm high, has a square base each side of which is 10 cm. Find the volume of the pyramid.

Solution :

Area of the base = 10 × 10 = 100 sq.cm.

Height = 12 cm

$$\therefore \text{ Volume of the pyramid } = \frac{1}{3} \times 100 \times 12 = 400 \text{ cu.cm.}$$

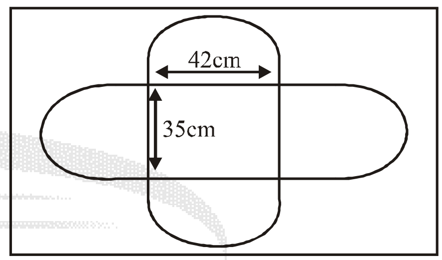
Example 24 :

Semi-circular lawns are attached to both the edges of a rectangular field measuring 42 m × 35m. The area of the total field is :

(a) $3818.5\ m^2$ (b) $8318\ m^2$

(c) $5813\ m^2$ (d) $1358\ m^2$

Solution :



(a) Area of the field

$$= 42 \times 35 + 2 \times \frac{1}{2} \times \frac{22}{7} \times (21)^2 + 2 \times \frac{1}{2} \times \frac{22}{7} \times (17.5)^2$$

$= 1470 + 1386 + 962.5 = 3818.5\ m^2$

Example 25 :

A frustum of a right circular cone has a diameter of base 10 cm, top of 6 cm, and a height of 5 cm; find the area of its whole surface and volume.

Solution :

Here $r_1 = 5$ cm, $r_2 = 3$ cm and $h = 5$ cm.

$$\therefore \quad \ell = \sqrt{h^2 + (r_1 - r_2)^2}$$

$$= \sqrt{5^2 + (5-3)^2} = \sqrt{29} \text{ cm} = 5.385 \text{ cm}$$

$\therefore$ Whole surface of the frustum

$$= \pi\ell(r_1 + r_2) + \pi r_1^2 + \pi r_2^2$$

$$= \frac{22}{7} \times 5.385(5+3) + \frac{22}{7} \times 5^2 + \frac{22}{7} \times 3^2 = 242.25 \text{ sq.cm.}$$

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

$$= \frac{22}{7} \times \frac{5}{3}\left[5^2 + 5 \times 3 + 3^2\right] = 256.67 \text{ cu. cm.}$$

Example 26 :

A cylinder is circumscribed about a hemisphere and a cone is inscribed in the cylinder so as to have its vertex at the centre of one end, and the other end as its base. The volume of the cylinder, hemisphere and the cone are, respectively in the ratio :

(a) 2 : 3 : 2 (b) 3 : 2 : 1

(c) 3 : 1 : 2 (d) 1 : 2 : 3

Solution :

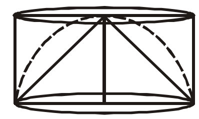
(b) We have,

radius of the hemisphere = raidus of the cone

= height of the cone

= height of the cylinder = r (say)

Then, ratio of the volumes of cylinder, hemisphere and cone



$$= \pi r^3 : \frac{2}{3}\pi r^3 : \frac{1}{3}\pi r^3 = 1 : \frac{2}{3} : \frac{1}{3} = 3 : 2 : 1$$

EXERCISE

1. The length and breadth of a rectangle are in the ratio 9 : 5. If its area is 720 m^2, find its perimeter.
   (a) 112 metre (b) 115 metre
   (c) 110 metre (d) 118 metre
2. A circle and a rectangle have the same perimeter. The sides of the rectangle are 18 cm and 26 cm. What is the area of the circle ?
   (a) 88 cm^2 (b) 154 cm^2
   (c) 1250 cm^2 (d) 616 cm^2
3. If the perimeter and diagonal of a rectangle are 14 and 5 cms respectively, find its area.
   (a) 12 cm^2 (b) 16 cm^2
   (c) 20 cm^2 (d) 24 cm^2
4. In an isoscele right angled triangle, the perimeter is 20 metre. Find its area.
   (a) $100\left(3-2\sqrt{2}\right)$ m^2 (b) $150\left(5-\sqrt{3}\right)m^2$
   (c) 500 m^2 (d) None of these
5. In a parallelogram, the length of one diagonal and the perpendicular dropped on that diagonal are 30 and 20 metres respectively. Find its area.
   (a) 600 m^2 (b) 540 m^2
   (c) 680 m^2 (d) 574 m^2
6. The diameter of a garden roller is 1.4 m and it is 2 m long. How much area will it cover in 5 revolutions ? $\left(\text{use } \pi=\frac{22}{7}\right)$
   (a) 40 m^2 (b) 44 m^2
   (c) 48 m^2 (d) 36 m^2
7. A horse is tethered to one corner of a rectangular grassy field 40 m by 24 m with a rope 14 m long. Over how much area of the field can it graze?
   (a) 154 cm^2 (b) 308 m^2
   (c) 150 m^2 (d) None of these
8. From a square piece of a paper having each side equal to 10 cm, the largest possible circle is being cut out. The ratio of the area of the circle to the area of the original square is nearly :
   (a) $\frac{4}{5}$ (b) $\frac{3}{5}$
   (c) $\frac{5}{6}$ (d) $\frac{6}{7}$
9. A square carpet with an area 169 m^2 must have 2 metres cut-off one of its edges in order to be a perfect fit for a rectangular room. What is the area of rectangular room?
   (a) 180 m^2 (b) 164 m^2
   (c) 152 m^2 (d) 143 m^2
10. A picture 30" × 20" has a frame 2½" wide. The area of the picture is approximately how many times the area of the frame?
    (a) 4 (b) $2\frac{1}{2}$
    (c) 2 (d) 5
11. A rectangular plot 15 m ×10 m, has a path of grass outside it. If the area of grassy pathway is 54 m^2, find the width of the path.
    (a) 4 m (b) 3 m
    (c) 2 m (d) 1 m
12. If the area of a circle decreases by 36%, then the radius of a circle decreases by
    (a) 20% (b) 18%
    (c) 36% (d) 64%
13. The floor of a rectangular room is 15 m long and 12 m wide. The room is surrounded by a verandah of width 2 m on all its sides. The area of the verandah is :
    (a) 124 m^2 (b) 120 m^2
    (c) 108 m^2 (d) 58 m^2
14. A rectangular lawn 70 m × 30 m has two roads each 5 metres wide, running in the middle of it, one parallel to the length and the other parallel to the breadth. Find the cost of gravelling the road at the rate of ₹ 4 per square metre.
    (a) ₹ 2,000 (b) ₹ 1,800
    (c) ₹ 1,900 (d) ₹ 1,700
15. A cylindrical bucket of height 36 cm and radius 21 cm is filled with sand. The bucket is emptied on the ground and a conical heap of sand is formed, the height of the heap being 12 cm. The radius of the heap at the base is :
    (a) 63 cm (b) 53 cm
    (c) 56 cm (d) 66 cm
16. The altitude drawn to the base of an isosceles triangle is 8 cm and the perimeter is 32 cm. The area of the triangle is
    (a) 72 cm^2 (b) 60 cm^2
    (c) 66 cm^2 (d) None of these
17. The cross section of a canal is a trapezium in shape. If the canal is 7 metres wide at the top and 9 metres at the bottom and the area of cross-section is 1280 square metres, find the length of the canal.
    (a) 160 metres (b) 172 metres
    (c) 154 metres (d) None of these
18. It is required to fix a pipe such that water flowing through it at a speed of 7 metres per minute fills a tank of capacity 440 cubic metres in 10 minutes. The inner radius of the pipe should be :
    (a) $\sqrt{2}$ m (b) 2 m
    (c) $\frac{1}{2}$ m (d) $\frac{1}{\sqrt{2}}$ m
19. The area of a rectangular field is 144 m^2. If the length had been 6 metres more, the area would have been 54 m^2 more. The original length of the field is
    (a) 22 metres (b) 18 metres
    (c) 16 metres (d) 24 metres
20. 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

21. 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

22. The length and breadth of the floor of the room are 20 feet and 10 feet respectively. Square tiles of 2 feet length of different colours are to be laid on the floor. Black tiles are laid in the first row on all sides. If white tiles are laid in the one-third of the remaining and blue tiles in the rest, how many blue tiles will be there?
(a) 16 (b) 24
(c) 32 (d) 48

23. Four equal circles are described about the four corners of a square so that each touches two of the others. If a side of the square is 14 cm, then the area enclosed between the circumferences of the circles is :
(a) 24 cm^2 (b) 42 cm^2
(c) 154 cm^2 (d) 196 cm^2

24. 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 12km / hr completes one round in 8 minutes, then the area of the park (in sq. m) is:
(a) 15360 (b) 153600
(c) 30720 (d) 307200

25. The water in a rectangular reservoir having a base 80 metres by 60 metres is 6.5 metres deep. In what time can the water be emptied by a pipe whose cross section is a square of side 20 cm, if the water runs through the pipe at the rate of 15 km per hour?
(a) 52 hrs (b) 26 hrs
(c) 65 hrs (d) 42 hrs

26. The ratio of height of a room to its semi-perimeter is 2 : 5. It costs ₹ 260 to paper the walls of the room with paper 50 cm wide at ₹ 2 per metre alllowing an area of 15 sq. m for doors and windows. The height of the room is:
(a) 2.6m (b) 3.9m
(c) 4m (d) 4.2m

27. 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

28. A metal cube of edge 12 cm is melted and formed into three smaller cubes. If the edges of two smaller cubes are 6 cm and 8 cm, then find the edge of the third smaller cube.
(a) 10 cm (b) 14 cm
(c) 12 cm (d) 16 cm

29. The length, breadth and height of a cuboid are in the ratio 1 : 2 : 3. The length, breadth and height of the cuboid are increased by 100%, 200% and 200%, respectively. Then, the increase in the volume of the cuboid will be :
(a) 5 times (b) 6 times
(c) 12 times (d) 17 times

30. The surface area of a cube is 150 m^2. The length of its diagonal is
(a) $5\sqrt{3}$ m (b) 5m
(c) $\frac{10}{\sqrt{3}}$ m (d) 15m

31. A copper sphere of radius 3 cm is beaten and drawn into a wire of diametre 0.2 cm. The length of the wire is
(a) 9m (b) 12m
(c) 18m (d) 36m

32. A plot of land in the form of a rectangle has a dimension 240 m × 180 m. A drainlet 10 m wide is dug all around it (outside) and the earth drug out is evenly spread over the plot, increasing its surface level by 25 cm. The depth of the drainlet is
(a) 1.225m (b) 1.229m
(c) 1.227m (d) 1.223m

33. The water from a roof, 9 sq metres in area, flows down to a cylinder container of 900 cm^2 base. To what height will the water rise in cylinder if there is a rainfall of 0.1 mm ?
(a) 1 cm (b) 0.1 metre
(c) 0.11 cm (d) 10 cms

34. The length of a cold storage is double its breadth. Its height is 3 metres. The area of its four walls (including the doors) is 108 m^2. Find its volume.
(a) 215 m^3 (b) 216 m^3
(c) 217 m^3 (d) 218 m^3

35. 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?
(a) 1845 (b) 1824
(c) 1792 (d) 1752

36. A rectangular reservoir is 54 m ×44 m × 10 m. An empty pipe of circular cross-section is of radius 3 cms, and the water runs through the pipe at 20 m section. Find the time the empty pipe will take to empty the reservoir full of water.
(a) 116.67 hours (b) 110 .42 hours
(c) 120.37 hours (d) 112 hours

37. A spherical ball of lead, 3 cm in diameter, is melted and recast into three spherical balls. The diameter of two of these balls are 1.5 cm and 2 cm respectively. The diameter of the third ball is
(a) 2.5 cm (b) 2.66 cm
(c) 3 cm (d) 3.5 cm

38. A cube of 384 cm^2 surface area is melt to make x number of small cubes each of 96 mm^2 surface area. The value of x is
(a) 80,000 (b) 8
(c) 8,000 (d) 800

39. 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.
(a) 18 cm (b) 22 cm
(c) 24 cm (d) None of these

40. The trunk of a tree is a right cylinder 1.5 m in radius and 10 m high. The volume of the timber which remains when the trunk is trimmed just enough to reduce it to a rectangular parallelopiped on a square base is
(a) 44 m^3 (b) 46 m^3
(c) 45 m^3 (d) 47 m^3

41. The cost of the paint is ₹ 36.50 per kg. If 1 kg of paint covers 16 square feet, how much will it cost to paint outside of a cube having 8 feet each side?
(a) ₹ 692 (b) ₹ 768
(c) ₹ 876 (d) ₹ 972

42. 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 : 12, 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

43. A reservoir is supplied from a pipe 6 cm in diameter. How many pipes of 3 cms diameter would discharge the same quantity, supposing the velocity of water is same ?
(a) 4 (b) 5
(c) 6 (d) 7

44. A conical cavity is drilled in a circular cylinder of 15 cm height and 16 cm base diameter. The height and the base diameter of the cone are same as those of the cylinder. Determine the total surface area of the remaining solid.
(a) $440\pi \text{ cm}^2$ (b) $215\pi \text{ cm}^2$
(c) $542\pi \text{ cm}^2$ (d) $376\pi \text{ cm}^2$

45. An ice-cream company makes a popular brand of ice-cream in rectangular shaped bar 6 cm long, 5 cm wide and 2 cm thick. To cut the cost, the company has decided to reduce the volume of the bar by 20%, the thickness remaining the same, but the length and width will be decreased by the same percentage amount. The new length L will satisfy :
(a) $5.5 < L < 6$ (b) $5 < L < 5.5$
(c) $4.5 < L < 5$ (d) $4 < L < 4.5$

46. Water flows through a cylindrical pipe of internal diameter 7 cm at 2 m per second. If the pipe is always half full, then what is the volume of water (in litres) discharged in 10 minutes?
(a) 2310 (b) 3850
(c) 4620 (d) 9240

47. 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

48. A semicircular sheet of paper of diameter 28 cm is bent to cover the exterior surface of an open conical ice-cream cup. The depth of the ice-cream cup is
(a) 10.12 cm (b) 8.12 cm
(c) 12.12 cm (d) 14.12 cm

49. The cost of painting the walls of a room at the rate of ₹ 1.35 per square metre is ₹ 340.20 and the cost of matting the floor at the rate of ₹ 0.85 per m^2 is ₹ 91.80. If the length of the room is 12 m, then the height of the room is :
(a) 6m (b) 12m
(c) 1.2m (d) 13.27m

50. A hollow sphere of internal and external diameters 4 cm and 8 cm respectively is melted into a cone of base diamater 8 cm. The height of the cone is:
(a) 12 cm (b) 14 cm
(c) 15 cm (d) 18 cm

51. A cone of height 9 cm with diameter of its base 18 cm is carved out from a wooden solid sphere of radius 9 cm. The percentage of the wood wasted is:
(a) 25% (b) 30%
(c) 50% (d) 75%

52. A hemispherical bowl is filled to the brim with a beverage. The contents of the bowl are transfered into a cylindrical vessel whose radius is 50% more than its height. If the diameter is same for both the bowl and the cylinder, the volume of the beverage in the cylindrical vessel is:
(a) $66\frac{2}{3}\%$ (b) $78\frac{1}{2}\%$
(c) 100% (d) More than 100%

53. A cylindrical container of radius 6 cm and height 15 cm is filled with ice-cream. The whole ice-cream has to be distributed to 10 children in equal cones with hemispherical tops. If the height of the conical portion is four times the radius of its base, then find the radius of the ice-cream cone.
(a) 2 cm (b) 3 cm
(c) 4 cm (d) 5 cm

54. A cylinder is filled to 4/5th its volume. It is then filled so that the level of water coincides with one edge of its bottom and top edge of the opposite side, In the process, 30 cc of the water is spilled. What is the volume of the cylinder?
(a) 75 cc (b) 96 cc
(c) Data insufficient (d) 100 cc

55. There are two concentric circular tracks of radii 100 m and 102 m, respectively. A runs on the inner track and goes once round on the inner track in 1 min 30 sec, while B runs on the outer track in 1 min 32 sec. Who runs faster?
(a) Both A and B are equal (b) A
(c) B (d) None of these

56. A monument has 50 cylindrical pillars each of diameter 50 cm and height 4 m. What will be the labour charges for getting these pillars cleaned at the rate of 50 paise per sq. m?
(use $\pi = 3.14$)
(a) ₹ 237 (b) ₹ 157
(c) ₹ 257 (d) ₹ 353

57. Four sheets 50 cm × 5 cm are arranged without overlapping to form a square having side 55 cm. What is the area of inner square so formed?
(a) 2500 cm^2 (b) 2025 cm^2
(c) 1600 cm^2 (d) None of these

58. A conical vessel of base radius 2 cm and height 3 cm is filled with kerosene. This liquid leaks through a hole in the bottom and collects in a cylindrical jar of radius 2 cm. The kerosene level in the jar is
(a) π cm (b) 1.5 cm
(c) 1 cm (d) 3 cm

59. A garden is 24 m long and 14 m wide. There is a path 1 m wide outside the garden along its sides. If the path is to be constructed with square marble tiles 20 cm × 20 cm, the number of tiles required to cover the path is
(a) 1800 (b) 200
(c) 2000 (d) 2150

60. 2 cm of rain has fallen on a sq. km of land. Assuming that 50% of the raindrops could have been collected and contained in a pool having a 100 m × 10 m base, by what level would the water level in the pool have increased?
(a) 15 m (b) 20 m
(c) 10 m (d) 25 m

61. In a swimming pool measuring 90 m by 40 m, 150 men take a dip. If the average displacement of water by a man is 8 cubic metres, what will be the rise in water level?
(a) 33.33 cm (b) 30 cm
(c) 20 cm (d) 25 cm

62. A square is inscribed in a circle of radius 8 cm. The area of the square is
(a) 16 cm^2 (b) 64 cm^2
(c) 128 cm^2 (d) 148 cm^2

63. The biggest possible circle is inscribed in a rectangle of length 16 cm and breadth 6 cm. Then its area is
(a) 3π cm^2 (b) 4π cm^2
(c) 5π cm^2 (d) 9π cm^2

64. If the diagonal of a square is doubled, then its area will be
(a) three times (b) four times
(c) same (d) none of these

65. A metal pipe of negligible thickness has radius 21 cm and length 90 cm. The outer curved surface area of the pipe in square cm is
(a) 11880 (b) 11680
(c) 11480 (d) 10080

66. The base of a right pyramid is an equilateral triangle of side 4 cm each. Each slant edge is 5 cm long. The volume of the pyramid is
(a) $\frac{4\sqrt{8}}{3}$ cm^3 (b) $\frac{4\sqrt{60}}{3}$ cm^3
(c) $\frac{4\sqrt{59}}{3}$ cm^3 (d) $\frac{4\sqrt{61}}{3}$ cm^3

67. There are two cones. The curved surface are aof one is twice that of the other. The slant height of the latter is twice that of the former. The ratio of their radii is
(a) 4 : 1 (b) 4 : 3
(c) 3 : 4 (d) 1 : 4

68. A wire is bent into the form of a circle, whose area is 154 cm^2. If the same wire is bent into the form of an equilateral triangle, the approximate area of the equilateral triangle is
(a) 93.14 cm^2 (b) 90.14 cm^2
(c) 83.14 cm^2 (d) 39.14 cm^2

69. The radius of a right circular cone is 3 cm and its height is 4 cm. The total surface area of the cone is
(a) 48.4 sq.cm (b) 64.4 sq.cm
(c) 96.4 sq.cm (d) 75.4 sq.cm

70. A wooden box of dimension 8 metre × 7 metre × 6 metre is to carry rectangular boxes of dimensions 8 cm × 7 cm × 6 cm. The maximum number of boxes that can be carried in 1 wooden box is
(a) 7500000 (b) 9800000
(c) 1200000 (d) 1000000

71. Two circular cylinders of equal volume have their heights in the ratio 1 : 2; Ratio of their radii is (Take $\pi = \frac{22}{7}$)
(a) 1 : 4 (b) $1:\sqrt{2}$
(c) $\sqrt{2}:1$ (d) 1 : 2

72. A rectangular piece of paper of dimensions 22 cm by 12 cm is rolled along its length to form a cylinder. The volume (in cm^3) of the cylinder so formed is (use $\pi = \frac{22}{7}$)
(a) 562 (b) 412
(c) 462 (d) 362

73. A sphere is placed inside a right circular cylinder so as to touch the top, base and the lateral surface of the cylinder. If the radius of the sphere is R, the volume of the cylinder is
(a) $2\pi R^3$ (b) $4\pi R^3$
(c) $8\pi R^3$ (d) $\frac{8}{3}\pi R^3$

ANSWER KEY

1	(a)	**9**	(d)	**17**	(a)	**25**	(a)	**33**	(a)	**41**	(c)	**49**	(a)	**57**	(b)	**65**	(a)	**73**	(a)
2	(d)	**10**	(a)	**18**	(a)	**26**	(c)	**34**	(b)	**42**	(c)	**50**	(b)	**58**	(c)	**66**	(c)		
3	(a)	**11**	(d)	**19**	(c)	**27**	(a)	**35**	(c)	**43**	(a)	**51**	(d)	**59**	(c)	**67**	(c)		
4	(a)	**12**	(a)	**20**	(c)	**28**	(a)	**36**	(a)	**44**	(a)	**52**	(c)	**60**	(c)	**68**	(b)		
5	(a)	**13**	(a)	**21**	(a)	**29**	(d)	**37**	(a)	**45**	(b)	**53**	(b)	**61**	(a)	**69**	(d)		
6	(b)	**14**	(c)	**22**	(a)	**30**	(a)	**38**	(c)	**46**	(c)	**54**	(d)	**62**	(c)	**70**	(d)		
7	(a)	**15**	(a)	**23**	(b)	**31**	(d)	**39**	(c)	**47**	(d)	**55**	(b)	**63**	(d)	**71**	(c)		
8	(a)	**16**	(b)	**24**	(b)	**32**	(c)	**40**	(c)	**48**	(d)	**56**	(b)	**64**	(b)	**72**	(c)		

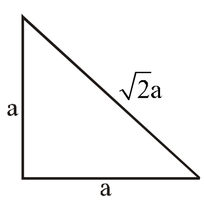
HINTS & SOLUTION

1. (a) Let the length and breadth of a rectangle are 9 xm and 5 xm respectively.
In a rectangle, area = length × breadth
$\therefore \quad 720 = 9x \times 5x$
or $x^2 = 16 \Rightarrow x = 4$
Thus, length = 9 × 4 = 36 m
and breadth = 5 × 4 = 20 m
Therefore, perimeter of rectangle = 2(36 + 20) = 112 m

2. (d) Perimeter of the circle = perimeter of rectangle
$2\pi r = 2(18+26)$
$\Rightarrow \quad 2 \times \frac{22}{7} \times r = 88 \Rightarrow r = 14$
$\therefore$ Area of the circle
$= \pi r^2 = \frac{22}{7} \times 14 \times 14 = 616 \text{ cm}^2$.

3. (a) In a rectangle,
$\frac{(\text{perimeter})^2}{4} = (\text{diagonal})^2 + 2 \times \text{area}$
$\Rightarrow \frac{(14)^2}{4} = 5^2 + 2 \times \text{area}$
$49 = 25 + 2 \times \text{area}$
$\therefore \text{Area} = \frac{49-25}{2} = \frac{24}{2} = 12\text{cm}^2$

4. (a)

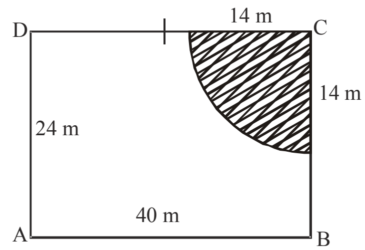


Perimeter of triangle $= a + a + \sqrt{2}\,a = 20\text{m}$
$a(2+\sqrt{2}) = 20$
$a = \frac{20}{2+\sqrt{2}} \times \frac{(2-\sqrt{2})}{(2-\sqrt{2})} = 10(2-\sqrt{2})\text{m}$
Area of triangle $= \frac{1}{2} \times a \times a$
$= \frac{1}{2} \times 10(2-\sqrt{2}) \times 10(2-\sqrt{2})$
$= 50(4 + 2 - 4\sqrt{2})$
$= 100(3 - 2\sqrt{2})\text{m}^2$

5. (a) In a parallelogram.
Area = Diagonal × length of perpendicular on it.
$= 30 \times 20 = 600 \text{ m}^2$

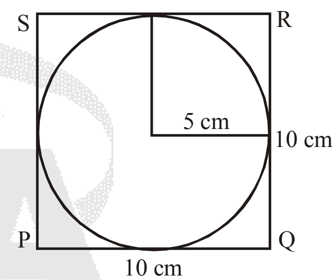
6. (b) Required area covered in 5 revolutions
$= 5 \times 2\pi rh = 5 \times 2 \times \frac{22}{7} \times 0.7 \times 2 = 44 \text{ m}^2$

7. (a)



Area of the shaded portion
$= \frac{1}{4} \times \pi (14)^2 = 154 \text{ m}^2$

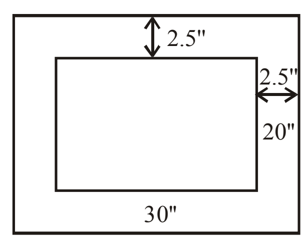
8. (a) Area of the square $= (10)^2 = 100 \text{ cm}^2$
The largest possible circle would be as shown in the figure below :



Area of the circle $= \frac{22}{7} \times (5)^2 = \frac{22 \times 25}{7}$
Required ratio $= \frac{22 \times 25}{7 \times 100} = \frac{22}{28} = \frac{11}{14}$
$= 0.785 \approx 0.8 = \frac{4}{5}$

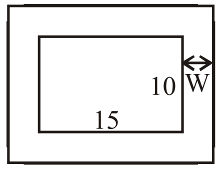
9. (d) Side of square carpet $= \sqrt{\text{Area}} = \sqrt{169} = 13\text{m}$
After cutting of one side,
Measure of one side = 13 – 2 = 11 m
and other side = 13 m (remain same)
$\therefore$ Area of rectangular room = 13 × 11 = 143 m²

10. (a)



Length of frame = 30 + 2.5 × 2 = 35 inch
Breadth of frame = 20 + 2.5 × 2 = 25 inch
Now, area of picture = 30 × 20 = 600 sq. inch
Area of frame = (35 × 2.5) + (25 × 2.5) = 150
$x = \frac{600}{150} = 4\text{times}$

11. (d)



Let the width of the path = W m
then, length of plot with path = (15 + 2W) m
and breadth of plot with path = (10 + 2 W) m
Therefore, Area of rectangular plot (wihout path)
$= 15 \times 10 = 150 \text{ m}^2$
and Area of rectangular plot (with path)
$= 150 + 54 = 204 \text{ m}^2$
Hence, $(15 + 2W) \times (10 + 2W) = 204$
$\Rightarrow 4W^2 + 50 W - 54 = 0$
$\Rightarrow 2W^2 + 25 W - 27 = 0$
$\Rightarrow (W - 1)(2W + 27) = 0$

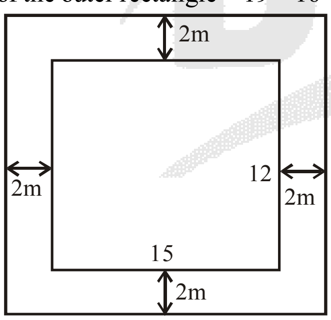
Thus $W = 1$ or $-\frac{27}{2}$

$\therefore$ with of the path = 1 m

12. (a) If area of a circle decreased by x % then the radius of a circle decreases by

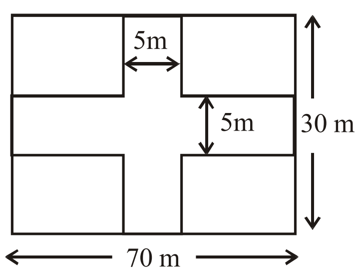
$$(100 - 10\sqrt{100 - x})\% = (100 - 10\sqrt{100 - 36})\%$$
$$= (100 - 10\sqrt{64})\%$$
$$= 100 - 80 = 20\%$$

13. (a) Area of the outer rectangle = $19 \times 16 = 304 \text{ m}^2$



Area of the inner rectangle = $15 \times 12 = 180 \text{ m}^2$
Required area = $(304 - 180) = 124 \text{ m}^2$

14. (c)



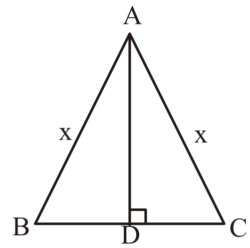
Total area of road
= Area of road which parallel to length + Area of road which parallel to breadth – overlapped road
$= 70 \times 5 + 30 \times 5 - 5 \times 5$
$= 350 + 150 - 25$
$= 500 - 25 = 475 \text{ m}^2$
$\therefore$ Cost of gravelling the road
$= 475 \times 4 =$ ₹ 1900

15. (a) Volume of the bucket = volume of the sand emptied
Volume of sand = $\pi (21)^2 \times 36$
Let r be the radius of the conical heap.

Then, $\frac{1}{3}\pi r^2 \times 12 = \pi (21)^2 \times 36$

or $r^2 = (21)^2 \times 9$ or $r = 21 \times 3 = 63$

16. (b) Let ABC be the isosceles triangle and AD be the altitude.
Let AB = AC = x. Then, BC = (32 – 2x).

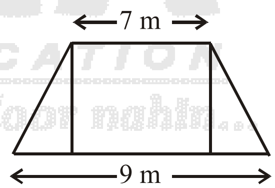


Since, in an isosceles triangle, the altitude bisects the base. So, BD = DC = (16 – x).
In ΔADC, $AC^2 = AD^2 + DC^2$
$\Rightarrow x^2 = (8)^2 + (16 - x)^2$
$\Rightarrow 32x = 320 \Rightarrow x = 10.$
$\therefore$ BC = (32 – 2x) = (32 – 20) cm = 12 cm.

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

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

17. (a)



Let the length of canal = h m.
Then,

area of canal $= \frac{1}{2} \times h(9 + 7)$

or $1280 = \frac{1}{2} h(16)$

$\therefore h = \frac{1280 \times 2}{16} = 160$ m

18. (a) Let inner radius of the pipe be r.

Then, $440 = \frac{22}{7} \times r^2 \times 7 \times 10$

or $r^2 = \frac{440}{22 \times 10} = 2$

or $r = \sqrt{2}$ m

19. (c) Let the length and breadth of the original rectangular field be x m and y m respectively.
Area of the original field $= x \times y = 144 \text{ m}^2$

$\therefore\ x = \dfrac{144}{y}$ ...(i)

If the length had been 6 m more, then area will be

$(x+6)\,y = 144 + 54$

$\Rightarrow\ (x+6)\,y = 198$ ...(ii)

Putting the value of x from eq (i) in eq (ii), we get

$\left(\dfrac{144}{y}+6\right)y = 198$

$\Rightarrow 144 + 6y = 198$

$\Rightarrow 6y = 54 \Rightarrow y = 9$ m

Putting the value of y in eq (i) we get x = 16 m

20. (c) Clearly, we have : $l = 9$ and $l + 2b = 37$ or $b = 14$.

$\therefore$ Area $= (l \times b) = (9 \times 14)$ sq. ft. = 126 sq. ft.

21. (a) When folded along breadth, we have :

$2\left(\dfrac{l}{2}+b\right) = 34$ or $l + 2b = 34$ ...(i)

When folded along length, we have :

$2\left(l+\dfrac{b}{2}\right) = 38$ or $2l + b = 38$ ....(ii)

Solving (i) and (ii), we get :

$l = 14$ and $b = 10$.

$\therefore$ Area of the paper $= (14 \times 10)\ cm^2 = 140\ cm^2$.

22. (a) Area left after laying black tiles

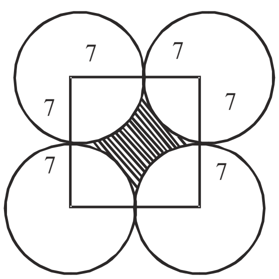
$= [(20-4) \times (10-4)]$ sq. ft. = 96 sq. ft.

Area under white tiles $= \left(\dfrac{1}{3}\times 96\right)$ sq. ft = 32 sq. ft.

Area under blue tiles = (96 – 32) sq. ft = 64 sq. ft.

Number of blue tiles $= \dfrac{64}{(2\times 2)} = 16$.

23. (b)



The shaded area gives the required region.

Area of the shaded region = Area of the square – area of four quadrants of the circles

$= (14)^2 - 4\times\dfrac{1}{4}\pi(7)^2$

$= 196 - \dfrac{22}{7}\times 49 = 196 - 154 = 42\ cm^2$

24. (b) Perimeter = Distance covered in 8 min.

$= \left(\dfrac{12000}{60}\times 8\right)$ m = 1600 m.

Let length = 3x metres and breadth = 2x metres.

Then, $2\,(3x + 2x) = 1600$ or $x = 160$.

$\therefore$ Length = 480 m and Breadth = 320 m.

$\therefore$ Area $= (480 \times 320)\ m^2 = 153600\ m^2$.

25. (a) Volume of the water running through pipe per hour

$= \dfrac{20}{100}\times\dfrac{20}{100}\times 15000 = 600$ *cubic metre*

Required time $= \dfrac{60\times 6.5\times 80}{600} = 52$ hours

26. (c) Let h = 2x metres and $(l + b) = 5x$ metres.

Length of the paper $= \dfrac{\text{Total cost}}{\text{Rate per m}} = \dfrac{260}{2}$ m = 130 m.

Area of the paper $= \left(130\times\dfrac{50}{100}\right) m^2 = 65\ m^2$.

Total area of 4 walls $= (65 + 15)\ m^2 = 80\ m^2$.

$\therefore\ 2(l + b) \times h = 80 \Rightarrow 2 \times 5x \times 2x = 80$

$\Rightarrow x^2 = 4 \Rightarrow x = 2$.

$\therefore$ Height of the room = 4 m.

27. (a) Let each wheel make x revolutions per sec. Then,

$\left[\left(2\pi\times\dfrac{7}{2}\times x\right) + (2\pi\times 7\times x)\right]\times 10 = 1980$

$\Rightarrow \left(\dfrac{22}{7}\times 7\times x\right) + \left(2\times\dfrac{22}{7}\times 7\times x\right) = 198$

$\Rightarrow 66x = 198 \Rightarrow x = 3$.

Distance moved by smaller wheel in 3 revolutions

$= \left(2\times\dfrac{22}{7}\times\dfrac{7}{2}\times 3\right)$ cm = 66 cm.

$\therefore$ Speed of smaller wheel $= \dfrac{66}{3}$ cm/s = 22 cm/s.

28. (a) Let the edge of the third cube be x cm.

Then, $x^3 + 6^3 + 8^3 = 12^3$

$\Rightarrow\ x^3 + 216 + 512 = 1728$

$\Rightarrow\ x^3 = 1000 \Rightarrow x = 10$.

Thus the edge of third cube = 10 cm.

29. (d) Let the length, breadth and height of the cuboid be x, 2x and 3x, respectively.

Therefore, volume $= x \times 2x \times 3x = 6x^3$

New length, breadth and height = 2x, 6x and 9x, respectively.

New volume $= 108x^3$

Thus, increase in volume $= (108 - 6)x^3 = 102\,x^3$

$\dfrac{\text{Increase in volume}}{\text{Original volume}} = \dfrac{102x^3}{6x^3} = 17$

30. (a) In a cube,

Area $= 6\,(\text{side})^2$

or $150 = 6\,(\text{side})^2$

$\therefore$ side $= \sqrt{25} = 5$ m

Length of diagonal $= \sqrt{3}\times\text{side} = 5\sqrt{3}$ m

31. (d) Let the length of the wire be h cm.

and radius of sphere and wire are R and r respectively.

Then, volume of sphere = volume of wire (cylinder)

or $\frac{4}{3}\pi R^3 = \pi r^2 h$

or $\frac{4}{3}R^3 = r^2 h$

or $\frac{4}{3}(3)^3 = (0.1)^2 h$

$\therefore\ h = \frac{4\times(3)^3}{3\times(0.1)^2} = \frac{108}{0.03} = 3600\,\text{cm} = 36\,\text{m}$

32. (c) Let the depth of the drainlet be h metres.
Volume of the earth dug from the drainlet 10 m wide
$= h[260\times200 - 240\times180] = 8800\,h$ cu. m.
Now this is spread over the plot raising its height by 25 cm,

i.e., $\frac{1}{4}$ m.

$\therefore\ 8800\,h = 240\times180\times\frac{1}{4}$

$\Rightarrow\ h = \frac{60\times180}{8800} = \frac{27}{22}$

$\therefore\ h = 1.227$ m.

33. (a) Let height will be h cm.
Volume of water in roof = Volume of water in cylinder

$\Rightarrow \frac{9\times10000\times0.1}{900\times10} = h$

$\therefore h = 1$ cm

34. (b) Let ℓ be the length and b be the breadth of cold storage.
L = 2B, H = 3 metres
Area of four walls = 2[L × H + B × H] = 108
$\Rightarrow$ 6BH = 108 $\Rightarrow$ B = 6
$\therefore$ L = 12, B = 6, H = 3
Volume = 12 × 6 × 3 = 216 m^3

35. (c) Volume of cylinder $= (\pi\times6\times6\times28)\text{cm}^3 = (36\times28)\pi\,\text{cm}^3$.

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

$= \left[(36\times28)\pi\times\frac{16}{9\pi}\right] = 1792.$

36. (a) Volume of water in the reservoir
= area of empty pipe × Empty rate × time to empty

or $54\times44\times10 = \pi\times\left(3\times\frac{1}{100}\right)^2\times20\times\text{empty time}$

or Empty time $= \frac{54\times44\times10\times100\times100\times7}{22\times20\times9}$ sec.

$= \frac{54\times44\times10\times100\times100\times7}{22\times20\times9\times3600}$ hrs = 116.67 hours.

37. (a) Let radius of the 3rd spherical ball be R,

$\therefore\ \frac{4}{3}\pi\left(\frac{3}{2}\right)^3 = \frac{4}{3}\pi\left(\frac{3}{4}\right)^3 + \frac{4}{3}\pi(1)^3 + \frac{4}{3}\pi R^3$

$\Rightarrow\ R^3 = \left[\left(\frac{3}{2}\right)^3 - \left(\frac{3}{4}\right)^3\right] - 1^3$

$= \frac{27}{8} - \frac{27}{64} - 1 = \frac{125}{64} = \left(\frac{5}{4}\right)^3 \Rightarrow R = \frac{5}{4} = 1.25$

$\therefore$ Diameter of the third spherical ball
= 1.25 × 2 = 2.5 cm.

38. (c) Let 'A' be the side of bigger cube and 'a' be the side of smaller cube
Surface area of bigger cube = 6 A^2
or 384 = 6A^2
$\therefore$ A = 8 cm.
Surface area of smaller cube = 6 a^2
96 = 6a^2
$\therefore$ a = 4 mm = 0.4 cm

So, Number of small cube $= \frac{\text{Volume of bigger cube}}{\text{Volume of smaller cube}}$

$= \frac{(8)^3}{(0.4)^3} = \frac{512}{0.064} = 8{,}000$

39. (c) Volume of the liquid in the cylindrical vessel
= Volume of the conical vessel

$= \left(\frac{1}{3}\times\frac{22}{7}\times12\times12\times50\right)\text{cm}^3$

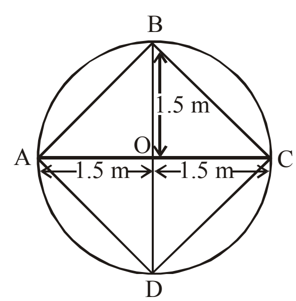
$= \left(\frac{22\times4\times12\times50}{7}\right)\text{cm}^3$.

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

Then, $\frac{22}{7}\times10\times10\times h = \frac{22\times4\times12\times50}{7}$

or $h = \left(\frac{4\times12\times50}{10\times10}\right) = 24$ cm.

40. (c)



From ΔAOB,

$AB = \sqrt{1.5^2 + 1.5^2} = \sqrt{2.25 + 2.25} = \sqrt{4.50}$

$\therefore$ Area of the square base of the trunk of the tree

$= \sqrt{4.50}\times\sqrt{4.50} = 4.50\,\text{m}^2$

$\therefore$ Volume of the timber = Area of base × height
$= 4.50\times10 = 45\,\text{m}^3$

41. (c) Surface area of the cube = (6×8^2) sq. ft. = 384 sq. ft.

Quantity of paint required = $\left(\frac{384}{16}\right)$kg = 24 kg.

$\therefore$ Cost of painting = ₹ (36.50 × 24) = ₹ 876.

42. (c) Let the radius of the base are 5k and 12k respectively

$$\therefore \frac{\text{Total surface area of the cylinder}}{\text{Total surface area of the cone}}$$

$$= \frac{2\pi r \times h + 2\pi r^2}{\pi r\sqrt{r^2 + h^2} + \pi r^2}$$

$$= \frac{2h + 2r}{\sqrt{r^2 + h^2} + r} + \frac{24k + 10k}{\sqrt{25k^2 + 144k^2} + 5k}$$

$$= \frac{34k}{13k + 5k} = \frac{34k}{18k} = \frac{17}{9}$$

43. (a) Number of discharge pipe

$$= \frac{\text{Volume of water supply pipe}}{\text{Volume of water in each discharge pipe}}$$

$$= \frac{\pi \times (3)^2 \times 1}{\pi \times \left(\frac{3}{2}\right)^2 \times 1} = 4 \text{ [Since the velocity of water is same]}$$

44. (a) Total surface area of the remaining solid = Curved surface area of the cylinder + Area of the base + Curved surface area of the cone

$= 2\pi rh + \pi r^2 + \pi r \ell$

$= 2\pi \times 8 \times 15 + \pi \times (8)^2 + \pi \times 8 \times 17$

$= 240\pi + 64\pi + 136\pi$

$= 440\, \pi\, cm^2$

45. (b) $L \times B \times 2 = 48$

$\Rightarrow L \times B = 24$

Now, $6 - 6 \times 10\% = 5.4$,

$5 - 5 \times 10\% = 4.5$ and

Therefore, $5.4 \times 4.5 = 24.3$

Clearly, $5 < L < 5.5$

46. (c) Volume of one coin = $\left(\frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 200\right) cm^3 = 7700\, cm^3$.

Volume of water flown in 10 min. = $(7700 \times 60 \times 10)\, cm^3$

$$= \left(\frac{7700 \times 60 \times 10}{1000}\right) \text{litres}$$

= 4620 litres.

47. (d) $4\pi(r + 2)^2 - 4\pi r^2 = 352$

$$\Rightarrow (r + 2)^2 - r^2 = \left(352 \times \frac{7}{22} \times \frac{1}{4}\right) = 28.$$

$$\Rightarrow (r + 2 + r)(r + 2 - r) = 28$$

$$\Rightarrow 2r + 2 = \frac{28}{2} \Rightarrow 2r + 2 = 14 \Rightarrow r = 6 \text{ cm}$$

48. (d) Circumference of the base of ice-cream cup

= Diameter of the sheet = 28 cm

$2\pi r = 28$

$$r = \frac{14}{\pi} \text{ cm} = 4.45 \text{ cm}$$

Slant height of cone = radius of the sheet = 14 cm

$\therefore\ 14^2 = (4.45)^2 + h^2$

or $h^2 = 196 - 19.80 = 176.20$

$\therefore\ h = 13.27$ cm

49. (a) Let length, breadth and height of the room be ℓ, b and h, respectively.

Then, area of four walls of the room

$$= 2(\ell + b)h = \frac{340.20}{1.35} = 252 m^2$$

$\Rightarrow (\ell + b)h = 126$ ...(i)

And $\ell \times b = \frac{91.8}{0.85} = 108$

$12 \times b = 108$ $(\because \ell = 12 \text{ m})$

$\Rightarrow b = 9$ m

Using (i), we get, $h = \frac{126}{21} = 6$ m

50. (b) Volume of material in the sphere

$$= \left[\frac{4}{3}\pi \times \left\{(4)^3 - (2)^3\right\}\right] cm^3 = \left(\frac{4}{3}\pi \times 56\right) cm^3.$$

Let the height of the cone be h cm.

$$\text{Then, } \frac{1}{3}\pi \times 4 \times 4 \times h = \left(\frac{4}{3}\pi \times 56\right)$$

$$\Rightarrow h = \left(\frac{4 \times 56}{4 \times 4}\right) = 14 \text{ cm.}$$

51. (d) Volume of sphere = $\left(\frac{4}{3}\pi \times 9 \times 9 \times 9\right) cm^3$.

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

Volume of wood wasted

$$= \left[\left(\frac{4}{3}\pi \times 9 \times 9 \times 9\right) - \left(\frac{1}{3}\pi \times 9 \times 9 \times 9\right)\right] cm^3.$$

$= (\pi \times 9 \times 9 \times 9)\, cm^3$

$$\therefore \text{ Required percentage} = \left(\frac{\pi \times 9 \times 9 \times 9}{\frac{4}{3} \times \pi \times 9 \times 9 \times 9} \times 100\right)\%$$

$$= \left(\frac{3}{4} \times 100\right)\% = 75\%.$$

52. (c) Let the height of the vessel be x.

Then, radius of the bowl = radius of the vessel = x/2.

$$\text{Volume of the bowl, } V_1 = \frac{2}{3}\pi\left(\frac{x}{2}\right)^3 = \frac{1}{12}\pi x^3.$$

$$\text{Volume of the vessel, } V_2 = \pi\left(\frac{x}{2}\right)^2 x = \frac{1}{4}\pi x^3.$$

Since $V_2 > V_1$, so the vessel can contain 100% of the beverage filled in the bowl.

53. (b) Volume of the cylinder container

$= \pi \times 6^2 \times 15$ cu. cm ...(1)

Let the radius of the base of the cone be r cm, then, height of the cone = 4r cm

$\therefore$ Volume of the 10 cylindrical cones of ice-cream with hemispherical tops

$$= 10 \times \left[\frac{1}{3} \times \pi \times r^2 \times 4r\right] + 10 \times \frac{2}{3}\pi r^3$$

$$= \frac{40}{3}\pi r^3 + \frac{20}{3}\pi r^3 = 20\pi r^3 \text{ cu. cm} \quad ...(2)$$

Since the whole ice-cream in the cylindrical container is distributed among 10 children in cones with hemispherical tops,

$\therefore$ (1) and (2), gives

$\Rightarrow \pi \times 6^2 \times 15 = 20\pi r^3$

$\Rightarrow r^3 = \frac{36 \times 15}{20} = 27 \Rightarrow r = 3$ cm

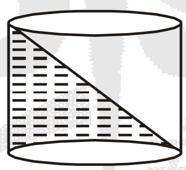
54. (d) Let the original volume of cylinder be V.

When it is filled $\frac{4}{5}$, then it's volume $= \frac{4}{5}$V

When cylinder is filled, the level of water coincides with opposite sides of bottom and top edges then

Volume become $= \frac{1}{2}$V

Since, in this process 30 cc of the water is spilled, therefore



$\frac{4}{5}V - 30 = \frac{1}{2}V$

$\Rightarrow \frac{4}{5}V - \frac{1}{2}V = 30$

$\Rightarrow V(3/10) = 30$

$\Rightarrow V = 100$ cc

55. (b) Radius of the inner track = 100 m

and time = 1 min 30 sec $\equiv$ 90 sec.

Also, Radius of the outer track = 102 m

and time = 1 min 32 sec $\equiv$ 92 sec.

Now, speed of A who runs on the inner track

$= \frac{2\pi(100)}{90} = \frac{20\pi}{9} = 6.98$ m/s

And speed of B who runs on the outer track

$= \frac{2\pi(102)}{90} = \frac{51\pi}{23} = 6.96$ m/s

Since, speed of A > speed of B

$\therefore$ A runs faster than B.

56. (b) Curved surface area of cylinder = $2\pi rh$

$\therefore$ Surface area of 50 cylindrical pillars = $50 \times 2\pi rh$

Now, Diameter of each cylindrical pillar = 50 cm

$\therefore$ Radius $= \frac{50}{2} = 25$ cm $= 0.25$ m

Also, height = 4m

$\therefore$ Surface area $= 50 \times 2 \times 3.14 \times 0.25 \times 4$

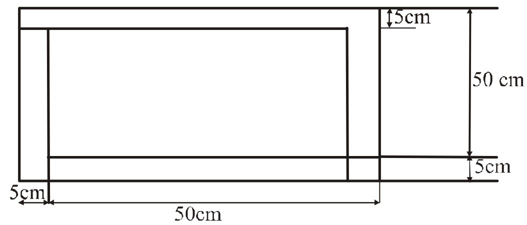
$= 314 \times 1$ sq m.

$= 314$ sq. m.

Now, labour charges at the rate of 50 paise per sq. m = $314 \times 0.5 = 157.0$

$\equiv$ ₹ 157

57. (b)



Side of the inner square = 55 – 10 = 45

$\therefore$ Area of inner square = $45 \times 45 = 2025$ sq. m.

58. (c) Let the kerosene level of cylindrical jar be h.

Now, Volume of conical vessel $= \frac{1}{3}\pi r^2 h$

Since, radius (r) = 2 cm and height(h) = 3cm of conical vessel.

$\therefore$ Volume $= \frac{1}{3}\pi \times 4 \times 3 = 4\pi$

Now, Volume of cylinderical jar $= \pi r^2 h$

$= \pi (2)^2 h$

$= 4\pi h$

Now, Volume of conical vessel = Volume of cylindrical Jar

$\Rightarrow 4\pi = 4\pi h$

$h = 1$cm

Hence, kerosene level in Jar is 1 cm.

59. (c) Given, length of garden = 24 m and breadth of garden = 14 m

$\therefore$ Area of the garden $= 24 \times 14 \text{ m}^2 = 336 \text{ m}^2$.

Since, there is 1 m wide path outside the garden

$\therefore$ Area of Garden (including path)

$= (24+2) \times (14+2) = 26 \times 16 \text{ m}^2 = 416 \text{ m}^2$.

Now, Area of Path = Area of garden(inculding path) – Area of Garden

$= 416 - 336 = 80 \text{ m}^2$.

Now, Area of Marbles $= 20 \times 20 = 400 \text{ cm}^2$

$\therefore$ Marbles required $= \frac{\text{Area of Path}}{\text{Area of Marbles}}$

$= \frac{80,0000}{400} = 2000$

60. (c) Volume of rain that is to be collected

in a pool $= 2 \times 1 \times 10^{10} \times \frac{1}{2}$

$= 10^{10} \text{ cm}^3 = 10^4 \text{ meter}^3$

Volume of Pool = L × B × h

$10^4 = 100 \times 10 \times h$

$h = \frac{10^4}{100 \times 10} = 10$ m.

61. (a) Let the rise in water level = x m

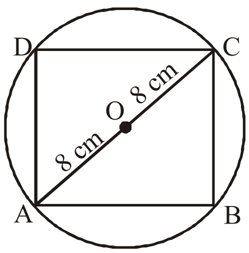
Now, volume of pool = $40 \times 90 \times x = 3600x$

When 150 men take a dip, then displacement of water = 8m^3

$\therefore \frac{3600x}{150} = 8 \Rightarrow \frac{900}{150}x = 2 \Rightarrow x = 0.33$m

$\Rightarrow x = 33.33$ cm

62. (c)



Diagonal of square = Diameter of circle

$\sqrt{2} \times$ side of square = 16 cm

Squaring on both sides

$$\left(\sqrt{2} \times \text{sides of square}\right)^2 = 16^2$$

$$\Rightarrow \quad (\text{side of square})^2 = \frac{16 \times 16}{2}$$

$\Rightarrow$ Area of square = 128 sq. cm

63. (d) The area of circle is 9π cm^2.

64. (b) Diagonal of a square (d) = $\sqrt{2} \times$ side of square (a).

$$d = \sqrt{2}a \Rightarrow a = \frac{d}{\sqrt{2}}$$

Area of square $\Rightarrow a^2 = \dfrac{d^2}{2}$

Now, diagonal gests doubled

$$a = \frac{(2d)}{\sqrt{2}}$$

Area of square $= \left(\dfrac{2d}{\sqrt{2}}\right)^2 = 4\left(\dfrac{d^2}{2}\right)$

$\dfrac{d^2}{2}$ is area of square

Therefore, Area will be four temes.

65. (a) Curved surface area of cylinder = $2\pi rh$

$$= 2 \times \frac{22}{7} \times 21 \times 90 = 11880 \text{ sq.cm}$$

67. (a) $C_1 = 2C_2$

$\pi r_1 l_1 = 2\pi r_2 l_2$

also, $l_2 = 2l_1$

$\pi r_1 l_1 = 2 \times 2_6\, \pi r_2 l_1$

$$\frac{r_1}{r_2} = \frac{4}{1}$$

68. (b) Let r be the radius of circle.

$\pi r^2 = 154$ cm^2

$$r^2 = \frac{154}{22} \times 7 = 49$$

r = 7 cm

length of wire = circumference of circle

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

Now, Perimeter of equilateral triangle = 44 cm

$$\text{side} = \frac{44}{3} \text{ cm}$$

Area of equilateral triangle $= \dfrac{\sqrt{3}}{4} \times \left(\dfrac{44}{3}\right)^2$

$$= \frac{484\sqrt{3}}{9} = 91.42 \text{ cm}^2$$

Area of equilateral triangle is nearly equal to 90.14 cm^2

Hence, option (b) is correct.

69. (d) Total surface area of cone = $\pi r(l + r)$

$$S = \frac{22}{7} \times 3 \times \left(\sqrt{3^2 + 4^2} + 3\right)$$

$$= \frac{22}{7} \times 3 \times 8 = \frac{528}{7}$$

S = 75.4 sq.cm

70. (d) Maximum number of boxes $= \dfrac{800 \times 700 \times 600 \text{ cm}^3}{8 \times 7 \times 6 \text{ cm}^3}$

$= 1000000$

71. (c) $\pi r_1^2 h_1 = \pi r_2^2 h_2$

$$\frac{r_1}{r_2} = \sqrt{\frac{h_2}{h_1}} = \sqrt{\frac{2}{1}}$$

$$r_1 : r_2 = \sqrt{2} : 1$$

72. (c) $2\pi r = 22$ cm

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

Height, h = 12 cm

Volume of cylinder $= \dfrac{22}{7} \times \dfrac{7}{2} \times \dfrac{7}{2} \times 12 = 462 \text{ cm}^3$

73. (a) Radius of cylinder = Radius of sphere = R

Height of cylinder = 2 R

Volume of cylinder = $\pi R^2 \times (2R) = 2\pi R^3$