MATHEMATICS

Class-VIII

Topic-15

MENSURATION

INDEX		
S. No.	**Topic**	**Page No.**
1.	Theory	1 – 18
2.	Exercise-1	19 – 23
3.	Exercise-2	24 – 25
4.	Exercise-3	25 – 27
5.	Answer Key	28 – 29

CH-15

MENSURATION

TERMINOLOGIES

Area, perimeter, total surface area, volume/capacity, solid figures, cuboid, cube, cylinder, base, height, lateral surface area, curved surface area, slant height, rhombus, triangle, cone, sphere, polygon, hemisphere, trapezium.

INTRODUCTION

In previous classes, we have already studied the methods to find the perimeter, area of different plane figures such as rectangle, square triangle etc. In this chapter we will learn to find the areas of trapezium, rhombus and other quadrilaterals. We will also learn to find the surface areas and volumes of solid figures such as cube, cylinder.

15.1 PLANE FIGURES

(a) Triangle

Let us review the formulas of area learned so far :

(i) Area of a rectangle = length × breadth

(ii) Area of a square = side × side or $(\text{side})^2$

(iii) Area of a triangle = $\frac{1}{2}$ × base × height

We have some other formulae for areas of some particular triangles.

Area of an equilateral triangle = $\frac{\sqrt{3}}{4}(\text{side})^2$

Area of an isosceles triangle = $\frac{1}{2}\text{ base}\sqrt{(\text{equal side})^2 - \frac{1}{4}(\text{base})^2}$

Area of right angle triangle = $\frac{1}{2}$ × (product of two side other than hypotenuse)

(iv) Area of parallelogram = side × corresponding altitude

(v) Area of a circle = πr^2, where r is the radius of the circle

Illustration 15.1

The length and breadth of a rectangular field are in the ratio 3 : 2. If the area of the field is 3456 m^2, find the cost of fencing the field at Rs 3.50 per metre.

Sol. Let the length and breadth of the rectangular field be 3x and 2x metres respectively. Then,

Area of the rectangular field = $(3x \times 2x) m^2 = 6x^2 \, m^2$.

Also, area of the rectangular field = 3456 m^2

$$6x^2 = 3456 \quad \Rightarrow \quad x^2 = \frac{3456}{6} \quad \Rightarrow \quad x^2 = 576 \quad \Rightarrow \quad x = \sqrt{576} = 24$$

Length = (3 × 24) m = 72 m, breadth = (2 × 24) m = 48 m

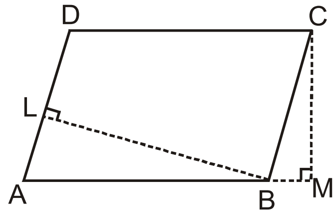
Perimeter of the field = 2 (length + breadth) = [2(72 + 48)]m = 240 m

Rate of fencing = Rs 3.50 per metre

Cost of fencing = Rs (240 × 3.50) = Rs 840.

Illustration 15.2

In figure, ABCD is a parallelogram, CM ⊥ AB and BL ⊥ AD. If AB = 16 cm, AD = 12 cm and CM = 10cm, find BL.



Sol. We have , base AB = 16 cm and altitude CM = 10 cm.

Area of parallelogram ABCD = Base × Altitude

= (16 × 10) cm^2 = 160 cm^2 ...(i)

Now, taking AD as the base, we have

Area of parallelogram ABCD = Base × Altitude

= (12 × BL) cm^2 ...(ii)

From (i) and (ii), we have

12 × BL = 160

BL = $\frac{160}{12}$ = 13.33 cm

Illustration 15.3

The area of a triangle is equal to that of a square whose each side measures 60 metres. Find the side of triangle whose corresponding altitude is 90 metres.

Sol. We have,

∴ Area of the square = (60 × 60) m^2 = 3600 m^2

Area of the square = 3600 m^2

Altitude of the triangle = 90 m

∴ Side of triangle $= \frac{2 \times \text{Area of square}}{\text{Corresponding altitude}} = \left(\frac{2 \times 3600}{90}\right)$ m = 80 m.

Illustration 15.4

The base of an isosceles triangle is 12 cm and its perimeter is 32 cm. Find its area.

Sol. We have, base = 12 cm and perimeter = 32 cm.

Let the length of each of the two equal sides be b cm. Then,

Perimeter = 32 cm

⇒ 2b + 12 = 32

⇒ 2b = 32 – 12

⇒ 2b = 20

⇒ b = 10

Thus, we have

Base = 12 cm and equal side = 10 cm.

Area of the given triangle

$= \frac{1}{2} \times \text{Base} \times \sqrt{(\text{Equal side})^2 - \frac{1}{4} \times (\text{Base})^2}$

$= \frac{1}{2} \times 12 \sqrt{(10)^2 - \frac{1}{4} \times (12)^2}$ cm^2

$= 6 \times \sqrt{100 - 36}$ cm^2

$= 6 \times \sqrt{64}$

= 6 × 8 cm^2 = 48 cm^2

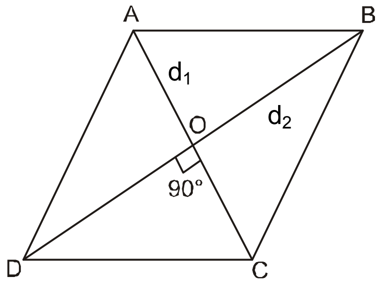
(b) Rhombus

We know that rhombus is also a parallelogram having all sides equal therefore formula of area of a || gm can also be used for area of a rhombus. i.e

Area of a rhombus = base × corresponding altitude.

Also we know that in rhombus both diagonals bisect each other at right angle, therefore we can determine another formula for area of rhombus in terms of its diagonals.

If both diagonals of a rhombus are $\mathbf{d_1}$ and $\mathbf{d_2}$, then according to **figure.**



$AC = d_1$

$BD = d_2$

Then $OA = \frac{d_1}{2}$

$OB = \frac{d_2}{2}$

Area of rhombus

$= 4 \times$ Area of ΔOAB

$= 4 \times \frac{1}{2}\left(\frac{d_1}{2}\right)\left(\frac{d_2}{2}\right)$

$= 4 \times \frac{1}{8} d_1d_2$

$= \frac{1}{2} d_1d_2$

Area of rhombus $= \frac{1}{2} d_1d_2$

If length of side of a rhombus ABCD is 'a' then in ΔOAB by pythagoras theorem we have :

$$a = \sqrt{\left(\frac{d_1}{2}\right)^2 + \left(\frac{d_2}{2}\right)^2}$$

Illustration 15.5

The area of a rhombus is 72 cm². If its perimeter is 32cm, find its altitude.

Sol. We have, perimeter of the rhombus = 32 cm

4 (side) = 32 cm [∵ Perimeter = 4 (side)]

⇒ Side = $\frac{32}{4}$ cm = 8 cm

Now, area of the rhombus = 72 cm²

⇒ (Side × Altitude) = 72

⇒ 8 × Altitude = 72

⇒ Altitude = $\frac{72}{8}$ cm = 9 cm.

Illustration 15.6

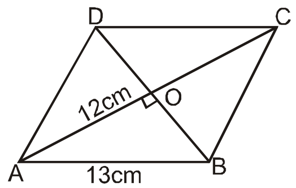
Find the area of a rhombus having each side equal to 13 cm and one of whose diagonals is 24 cm.

Sol. Let ABCD be the given rhombus whose diagonal intersects at O. Then,

AB = 13 cm and AC = 24 cm

Since, the diagonal of a rhombus bisect each other at right angles. Therefore ΔAOB is right triangle, right angled at O such that OA = $\frac{1}{2}$ AC = 12 cm and AB = 13 cm.

∴ By pythagoras theorem, we have



$AB^2 = OA^2 + OB^2$

$13^2 = 12^2 + OB^2$

$OB^2 = 13^2 - 12^2$

$OB^2 = 169 - 144 = 25$

$OB^2 = 5^2$

OB = 5 cm.

BD = 2 × OB = 2 × 5 cm = 10 cm.

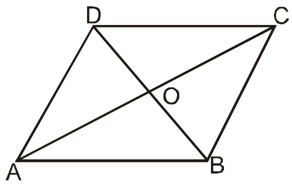
Hence, area of rhombus ABCD = $\left(\frac{1}{2} \times AC \times BD\right) = \left(\frac{1}{2} \times 24 \times 10\right) cm^2 = 120\ cm^2$

Illustration 15.7

If the area of a rhombus be 48 cm² and one of its diagonal is 12 cm, find its altitude.

Sol. Let ABCD be a rhombus of area 48 cm² and diagonal BD = 12 cm.

Now, Area = 48 cm²



$\Rightarrow \quad \frac{1}{2} \times AC \times BD = 48$

$\Rightarrow \quad \frac{1}{2} \times AC \times 12 = 48$

$\Rightarrow \quad 6 \times AC = 48$

$\Rightarrow \quad AC = \frac{48}{6}\ cm = 8\ cm$

Since, the diagonal of a rhombus bisect each other at right angles.

$OA = \frac{1}{2} AC = 4\ cm,\ OB = \frac{1}{2} BD = 6\ cm.$

Also, $AB^2 = OA^2 + OB^2$ [Using pythagoras theorem]

$\Rightarrow \quad AB^2 = 4^2 + 6^2$

$\Rightarrow \quad AB^2 = 16 + 36 \quad \Rightarrow \quad AB = \sqrt{52}$

Since a rhombus is a parallelogram also,

Therefore, Area of rhombus = AB Altitude

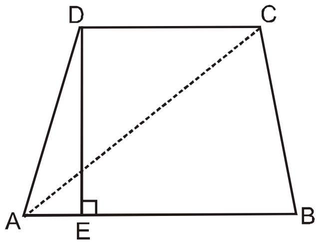
$\Rightarrow \quad 48 = \sqrt{52}$ Altitude $\Rightarrow$ Altitude = $\frac{48}{\sqrt{52}}$ cm .

(c) Trapezium

A trapezium is a quadrilateral whose two opposite sides are parallel. In trapezium each of two parallel sides is called a base of the trapezium and the distance between the two parallel sides is called the height or altitude of the trapezium.

Let h be the height of the trapezium ABCD then DE = h and join AC, then, clearly AC divides the trapezium into two triangles ABC & ACD.

Then area of trapezium ABCD = area of ΔABC + area of ΔACD



$= \frac{1}{2} \times AB \times h + \frac{1}{2} \times DC \times h = \frac{1}{2}(AB + CD) \times h$

$= \frac{1}{2}$ (sum of parallel sides) height

$= \frac{1}{2}$ (sum of parallel sides) (distance between parallel sides)

Illustration 15.8

The area of a trapezium is 34 cm^2 and the length of one of the parallel sides is 10 cm and its height is 4 cm. Find the length of the other parallel side.

Sol. Let the length of side be a cm.

$\therefore \quad \frac{1}{2}(a + 10) \times 4 = 34 \quad \Rightarrow \quad 2a + 20 = 34$

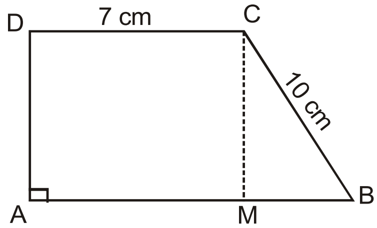
$2a = 34 - 20 \quad \Rightarrow \quad 2a = 14$

$\therefore \quad a = 7$ cm.

Hence, length of the other parallel side is 7 cm.

Illustration 15.9

In figure ABCD is a quadrilateral in which AB || DC, DC = 7cm, AB = 13 cm, CB = 10 cm and DA ⊥ AB. Find the area of the quadrilateral.



Sol. Let CM ⊥ AB

$\therefore \quad MB = AB - AM = AB - DC = 13 - 7$ or 6 cm

Now in right ΔCMB

$CM^2 = CB^2 - MB^2 = 10^2 - 6^2 = 100 - 36 = 64$

$\therefore \quad CM = \sqrt{64}$ or 8 cm

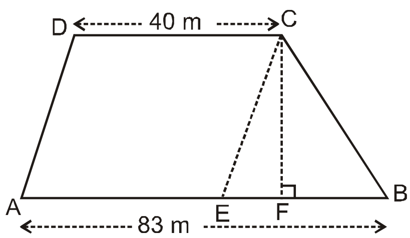
Since, AB || DC

∴ ABCD is a trapezium.

Area of ABCD $= \frac{1}{2}(AB + DC) \times CM = \frac{1}{2}(13 + 7) \times 8\ cm^2 = 80\ cm^2$

Illustration 15.10

A field ABCD is in the form of a trapezium in which AB II CD, AB = 83 m and CD = 40 m. A triangular flower bed EBC is cut in such a way that the shape of the remaining field becomes a parallelogram. If the area of the entire field 2337 m^2, find the area of (a) flower bed (b) remaining field.



Sol. From C draw CE II AD and CF ⊥ AB.

Now AECD is a parallelogram :

EB = AB – AE = 83 – 40 = 43 m.

Area of trapazium ABCD = 2337 m^2

$\therefore \quad \frac{1}{2}(83 + 40) \times CF = 2337$

$CF = \frac{2337 \times 2}{123}$ m = 38 m

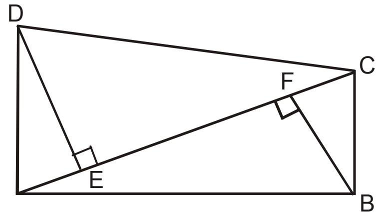
(a) Area of $\Delta EBC = \frac{1}{2} \times EB \times CF = \frac{1}{2} \times 43 \times 38\ m^2 = 817\ m^2$.

$\therefore$ Area of flower bed = $817\ m^2$

(b) Area of remaining field = $2337\ m^2 - 817\ m^2 = 1520\ m^2$.

(d) Quadrilateral

We make use of the formula for the area of a triangle to find area of a quadrilateral. In the given figure, AC is the diagonal of the quadrilateral ABCD, DEAC and BFAC. DE and BF are called the offsets of the quadrilateral.
By joining A to C, the quadrilateral is divided into two triangles ABC and ACD.



$\therefore$ Area of quadrilatral ABCD = area of ΔABC + area of ΔACD = $\frac{1}{2}$ AC x BF + $\frac{1}{2}$ AC x DE

$$= \frac{1}{2} AC \times (BF + DE)$$

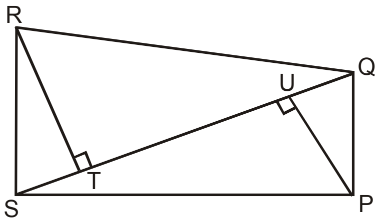
Hence, Area of a quadrilateral

$$= \frac{1}{2} \times \text{diagonal} \times \text{sum of the offsets}$$

Illustration 15.11

Find the area of the quadrilateral PQRS, whose diagonal QS = 19.5 cm and the offsets on it are 5.4 cm and 10.6 cm.

Sol.



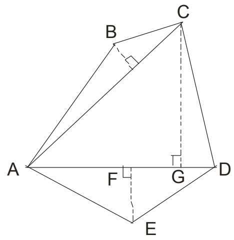
Diagonal QS = 19.5 cm
Offsets = 5.4 cm and 10.6 cm

$\therefore$ Area of quadrilateral PQRS = $\frac{1}{2}$ (sum of offsets) $\times$ diagonal

$$= \frac{1}{2} (5.4 + 10.6) \times 19.5 \text{ sq cm} = \frac{1}{2} \times 16 \times 19.5 \text{ sq cm} = 156 \text{ sq cm}.$$

(e) Polygon

We split a quadrilateral into triangles and find its area. Similar method can be used to find the area of a polygon. Observe the following for a pentagon :
By constructing two diagonal AC and AD the pentagon is divided into three parts. So, area of ABCDE = area of ΔABC + area of ΔACD + area of ΔAED.



By constructing one diagonal AD and two perpendicular BF and CG on it, pentagon ABCDE is divided into four parts. So, area of ABCDE = area of ΔAFB + area of trapezium BFGC + area of right angled ΔCGD + area ΔAED.

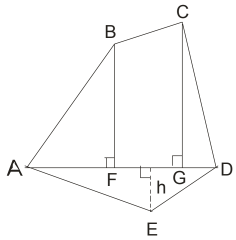
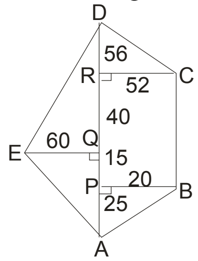


Illustration 15.12

In the given figure, the dimensions are given in meters. Find the area of this field.



Sol. Area of $\Delta APB = \frac{1}{2}$ AP x PB

$= \frac{1}{2} \times 25 \times 20 \text{ m}^2$

$= 250 \text{ m}^2$ ... (i)

Area of $\Delta AQE = \frac{1}{2}$ AQ x EQ

$= \frac{1}{2} \times 40 \times 60 \text{ m}^2 = 1200 \text{ m}^2$ .... (ii)

Area of $\Delta EQD = \frac{1}{2}$ QD × EQ

$= \frac{1}{2} \times 96 \times 60 \text{ m}^2$

$= 2880 \text{ m}^2$ ... (iii)

Area of trapezium PBCR $= \frac{1}{2}$ (PB + RC) x PR

$= \frac{1}{2} (20 + 52) \times 55 \text{ m}^2$

$= 1980 \text{ m}^2$ ... (iv)

Area of $\Delta RCD = \frac{1}{2}$ RD x RC

$= \frac{1}{2} \times 56 \times 52 \text{ m}^2$

$= 1456 \text{ m}^2$ . .. (v)

Adding (i) to (v), we get

Area of polygon ABCDE = (250 + 1200 + 2880 + 1980 + 1456) m^2 = 7766 m^2.

Ask yourself

1. Find the number of 20 cm × 15 cm bricks required to have a 45 m × 20 m lane. Find the cost of the bricks at the rate of Rs. 900 per thousand.

2. A square lawn, each side measuring 24 m has a 2 m wide path around and outside three sides only. Find the area of the path.

3. The area of a trapezium is 800 cm^2. If one of its parallel sides is 30 cm and height is 20 cm, then find the other parallel side.

4. The diagonals of a rhombus are 9 cm and 14 cm. Find its area.

Answers

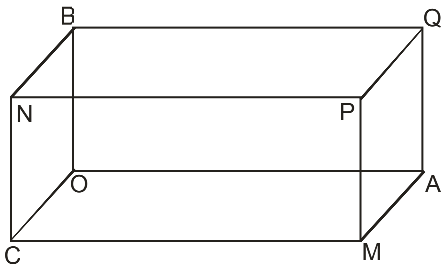
1. Rs. 27000 **2.** 152 m^2 **3.** 50 cm **4.** 63 cm^2

15.2 SOLID FIGURES

You already know that the geometrical figures which have only two dimensions are called the plane figures. A figure which have three dimensions as length, breadth and height is not a plane figure and we can not draw such figures on black board exactly. These three dimensional figures are called solids. For example Cube, cuboid, cylinder, cone, sphere etc. are some three dimensional figures. In this section we will learn how we determine the surface area of such solids.

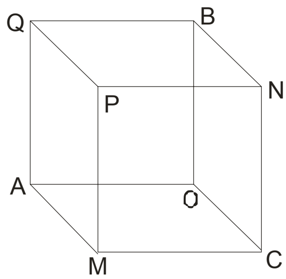
(a) Definitions

(i) Cuboid : A solid bounded by six rectangular plane regions is called a cuboid. [**Figure** below]

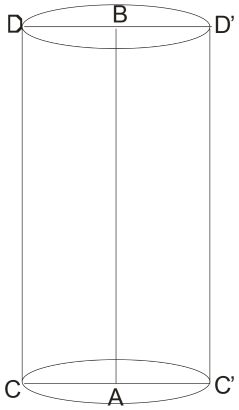


A cuboid has six faces OAQB, CMPN, OAMC , BQPN, PQAM and OCNB, eight vertices O, P, Q, M, N, A, B and C, twelve edges : OA, BQ, NP, CM, PM, CN, OB, AQ, BN, PQ, MA and OC and four diagonals OP, CQ, BM and AN.

(ii) Cube : A cuboid whose length, breadth and height are all equal is called a cube. [**Figure** below].



(iii) Right circular cylinder : A solid generated by the revolution of a rectangle about one of its side is called a right circular cylinder. [**Figure**]

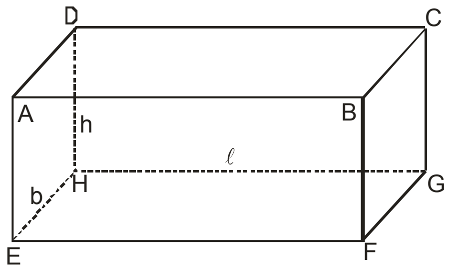


Let ABDC is a rectangle, keeping AB fixed we rotate CD around AB then we get a right circular cylinder. Here AB is called axis of cylinder and CD is called generator of cylinder, length of CD is called height and AC = AC' is called radius of base of a cylinder.

(b) Surface area of cube, cuboid and cylinder

(i) Surface area of a cuboid : In earlier section, we have learned about a cuboid and a cube. As we have seen that the surface of a cuboid consists of six rectangular faces. So, the surface area of a cuboid is equal to the sum of the areas of its six rectangular faces. In this section, we shall derive the formula for the surface area of a cuboid.

Consider a cuboid whose length is ℓ cm, breadth **b** cm and height **h** cm as shown in **Figure.**



Area of face ABCD = Area of face EFGH = $(\ell \times b)$ cm^2

Area of face AEHD = Area of face BFGC = $(b \times h)$ cm^2

Area of face ABFE = Area of faceDHGC = $(\ell \times h)$cm^2

Total surface area of the cuboid

= Sum of the areas of all its six faces

$= 2(\ell \times b) + 2(b \times h) + 2(\ell \times h)$ cm^2

$= 2(\ell \times b + b \times h + \ell \times h)$ cm^2

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

= 2 (length × breadth + breadth × height + length × height) cm^2

For the calculation of surface area of a cuboid, the length, breadth and height must be expressed in the same units.

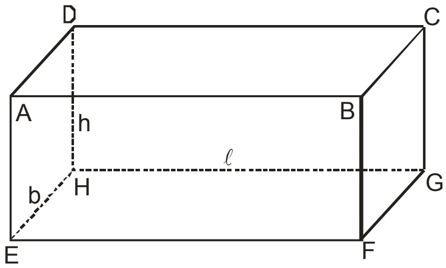
(ii) Surface area of a cube : Since all the faces of a cube are squares of the same size i.e. for a cube we have $\ell = b = h$. Thus, if ℓ cm is the length of the edge of a cube, then

Surface area of the cube $= 2(\ell \times \ell + \ell \times \ell + \ell \times \ell)$

$2 \times 3\ell^2 = 6\ell^2 = 6\,(\text{Edge})^2$

(iii) Lateral surface area of a cuboid and a cube : If out of the six faces of a cuboid, we only find the sum of the areas of four faces leaving the bottom and top faces. This sum is called the lateral surface area of the cuboid.

Consider a cuboid of length ℓ, breadth **b** and height **h** as shown in **figure.**



Lateral surface of the cuboid,

= Area of face AEHD + Area of face BFGC

+ Area of face ABFE + Area of face DHGC

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

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

= 2 (Length + breadth) × Height

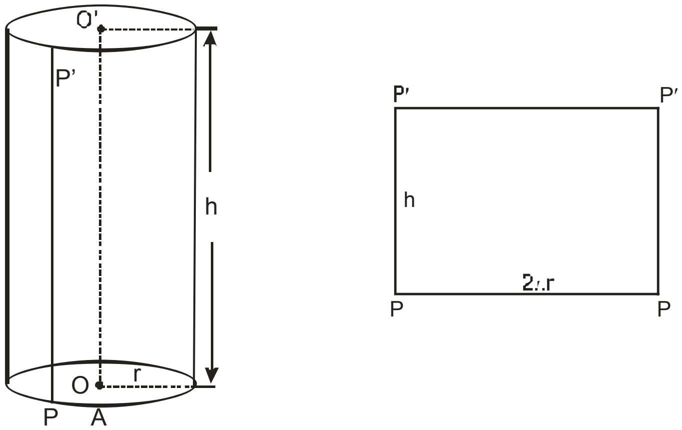
= perimeter of the base × Height

Lateral surface area of the cube

$= 2 (\ell \times \ell + \ell \times \ell)$

$= 2 (\ell^2 + \ell^2) = 4\ell^2 = 4 (\text{Edge})^2$

(iv) Surface area of a right circular cylinder : Consider a right circular cylinder of radius **r** and height **h** as shown in **figure** .



Each of the bases is a circle of radius **r**. Therefore, length of each circular edge is **2πr**.

Now, take a rectangular strip of paper of width **h**. Mark points P and P' on the two circular bases such that PP' is parallel to the axis OO'. Place the edge of the strip of paper along PP' and hold it fast. Now, wrap the strip around the cylinder, till you reach PP' again. Now, cut off the strip along PP'. Remove the piece of the strip so cut off and spread it on a plane surface. You will find that the strip is a rectangle of length **2πr** (equal to the length of the circular edge) and breadth **h**.

∴ Area of the lateral surface of the cylinder

= Area of the rectangular strip of paper

= Area of a rectangular strip of length $2\pi r$ and breadth h

$= 2\pi r \times h$ square units

$= 2\pi rh$ square units.

Thus, for a cylinder of radius r and height h, we have,
Lateral (curved) surface area = $2\pi rh$ sq. units
Each base surface area = πr^2 sq. units
Total surface area = $(2\pi rh + 2\pi r^2)$ sq. units = $2\pi r(h + r)$ sq. units

Illustration 15.13

Find the side of a cube whose surface area is 600 cm^2.

Sol. Suface area of a cube = 6 $(side)^2$

$\therefore$ 6 $(side)^2$ = 600

$(Side)^2 = \frac{600}{6} = 100 = (10)^2$ Side = 10 cm

Hence, side of the cube = 10 cm.

Illustration 15.14

A suitcase which measures 80 cm x 48 cm x 24 cm is to be covered with tarpaulin cloth. How many metres of tarpaulin of width 96 cm is required to cover 100 such suitcases.

Sol. Length of the suitcase = 80 cm
Breadth of the suitcase = 48 cm
Height of the suitcase = 24 cm
Surface area of the suitcase = 2(lb + lh + bh)
= $2(80 \times 48 + 80 \times 24 + 48 \times 24)$ cm^2
= $2(3840 + 1920 + 1152)$ cm^2
= 13824 cm^2
$\therefore$ Area of the cloth required = 13824 cm^2
Breadth of the cloth = 96 cm
Length of the cloth = $(13824 \div 96)$ = 144 cm.
$\therefore$ Cloth required to cover 100 suitcases = (144 x 100) cm = 144 m.

Illustration 15.15

Daniel is painting the walls and ceiling of a cuboidal hall with length, breadth and height 15 m, 10 m and 7 m respectively. From each can of paint 100 m^2 of area is painted. How many cans of paint will be required to paint the room ? Find the cost of paint if each can costs Rs 238.

Sol. Length of the room = 15 m
Breadth of the room = 10 m
Height of the room = 7m
Area of 4 walls
= 2 (length + breadth) x height
= 2 (15 + 10) x 7 m^2 = 350 m^2
Area of ceiling = length x breadth = 15 x 10 = 150 m^2
Total area to be painted = (350 + 150) m^2 = 500 m^2

No. of cans required = $\frac{500}{100} = 5$

Cost of 1 can = Rs 238
Cost of 5 cans = Rs 238 x 5 = Rs 1190.

Illustration 15.16

Hameed has built a cubical water tank with lid for his house, with each outer edge 1.5 m long. He gets the outer surface of the tank excluding the base, covered with square tiles of side 25 cm. Find how much he would spend for the tiles, if the cost of the tiles is Rs. 360 per dozen.

Sol. Since hameed is getting the five outer faces of the tank covered with tiles, he would need to know the surface area of the tank, to decide the number of tiles required.

Edge of the cubical tank = 1.5 m = 150 cm (= a)

So, Surface area of the tank = 5 × 150 × 150 cm^2

Area of each square tile = side × side = 25 × 25 cm^2

So, the number of tiles required $= \frac{\text{surface area of the tank}}{\text{area of each tile}} = \frac{5 \times 150 \times 150}{25 \times 25} = 180$

Cost of 1 dozen tiles, i.e., cost of 12 tiles = Rs. 360

Therefore, cost of one tile = Rs. $\frac{360}{12}$ = Rs. 30

So, the cost of 180 tiles = 180 × Rs. 30 = Rs. 5400

Illustration 15.17

The diameter of a garden roller is 1.4m and it is 2 m long. How much area will it cover in 5 revolutions ?

(Use π = 22/7)

Sol. Clearly, Area covered = Curved surface × No. of rev.

Here, r = $\frac{1.4}{2}$ m = 0.7 m and h = 2 m.

Curved surface = $2\pi rh$ m^2 [as per the question Garden roller is in shape of a cylinder]

$= 2 \times \frac{22}{7} \times 0.7 \times 2 = 8.8$ m^2

Hence, area covered = Curved surface × No. of revolutions = (8.8 × 5) m^2 = 44 m^2.

Illustration 15.18

It is required to make a closed cylindrical tank of height 1m and base diameter 140 cm from a metal sheet. How many square metres of the metal sheet are required for the same ?

Sol. Here, diameter = 140 cm

Radius r = $\frac{140}{2}$ cm = 70 cm = $\frac{70}{100}$ m = $\frac{7}{10}$ m.

Height h = 1 m

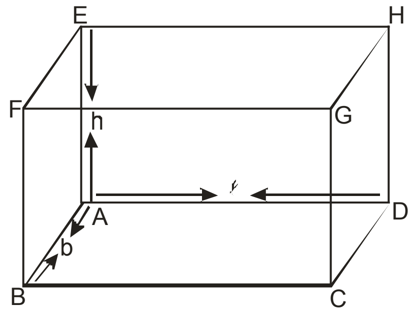
Total surface area of the tank = $2\pi r(h + r) = 2 \times \frac{22}{7} \times \frac{7}{10} \times \frac{17}{10} = 7.48$ m^2

(c) Volumes of solid figures

Now you are familiar with solid figures and their surface areas. These figure lie in space, i.e., in three dimensions. These figures can not lie entirely on a two dimensional plane. As these figures lie in space so they cover a part of space, that part of space is called volume of that solid figure. The volume of a solid is the amount of space enclosed by its bounding surfaces. The unit of volume is cubic centimeter or cubic metre. The basic formula for **volume** is **area of base × height.** In this section we will study how we determine the volume of some solid figures like cube, cuboid, cylinder, cone, sphere etc.

(i) Volume of cuboid : Let there be a cuboid of length ℓ, breadth **b** and height **h** as in **fig.**.

The area of the rectangular base ABCD of the cuboid is ($\ell \times b$).



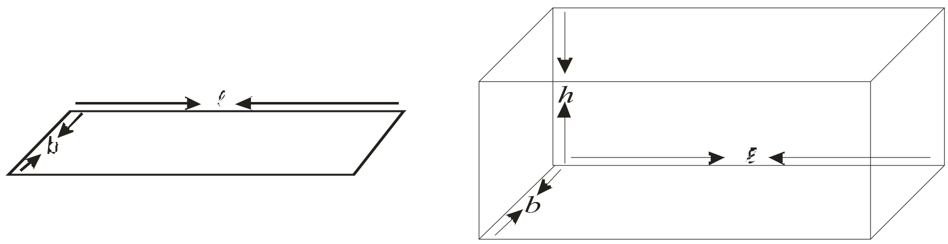
If we take rectangular sheets congruent to the base ABCD of the cuboid and the sheets are put one over the other as shown in **fig.**. Then, the height to which the sheets are stacked to form the cuboid is **h**.

$\therefore$ Measure of the space occupied by the cuboid

= Area of a rectangular sheet $\times$ h = ($\ell \times$ b) h = ℓ b h

Hence, Volume of the cuboid = ℓ b h = Length $\times$ Breadth $\times$ Height

Also, Volume of the cuboid = Area of the base $\times$ Height



NOTE :

(i) While finding the volume of a cuboid, its length, breadth and height must be expressed in the same units.

(ii) From the above formula, we obtain

$$\text{Length} = \frac{\text{Volume}}{\text{Breadth} \times \text{Height}} \quad \text{i.e} \quad \ell = \frac{V}{b \times h}$$

$$\text{Breadth} = \frac{\text{Volume}}{\text{Length} \times \text{Height}} \quad \text{i.e} \quad b = \frac{V}{\ell \times h}$$

$$\text{Height} = \frac{\text{Volume}}{\text{Length} \times \text{Breadth}} \quad \text{i.e} \quad h = \frac{V}{\ell \times b}.$$

(ii) **Volume of a cube :** We know that a cube is special type of a cuboid whose length, breadth and height are all equal.

So, the volume V of cube of edge ℓ is given by

$V = \ell \times \ell \times \ell = \ell^3 = (\text{Edge})^3$

(iii) **Volume of a cylinder :** Let us take circular sheets of radius r and stack them up vertically as shown in figure .To form a right circular cylinder of height **h**. Then,

Volume of the cylinder

= Measure of the space occupied by the cylinder

= The area of each circular sheet $\times$ height = $\pi r^2 h$

Thus, Volume of right circular cylinder

= Area of the base $\times$ Height = $\pi r^2 h$

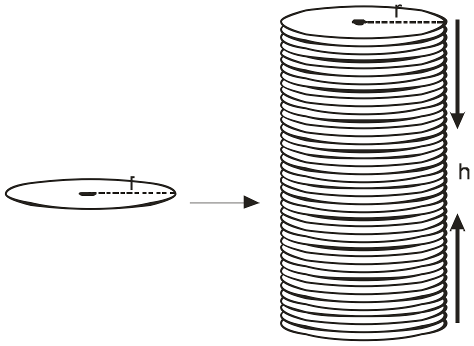


Illustration 15.19

Find the number of bricks, each measuring 25 cm × 12.5 cm × 7.5 cm required to construct a wall 6 m long, 5m high and 0.5 m thick, while the cement and sand mixture occupies 1/20 of the volume of the wall.

Sol. We have

Volume of the wall = $(6 \times 5 \times 0.5)m^3 = 15\ m^3$

Volume occupied by the mixture

$$= \frac{1}{20} \times \text{ Volume of the wall } = \left(\frac{1}{20} \times 15\right)\ m^3 = 0.75\ m^3$$

Volume occupied by the bricks = $(15 - 0.75)\ m^3 = 14.25\ m^3$

Volume of each brick $= \left(\frac{25}{100} \times \frac{12.5}{100} \times \frac{7.5}{100}\right) m^3 = \left(\frac{3}{1280}\right)\ m^3$

So, required number of bricks

$$= \frac{\text{Volume occupied by the bricks}}{\text{Volume of each brick}} = \frac{14.25}{3/1280} = 14.25 \times \frac{1280}{3} = \frac{1425}{100} \times \frac{1280}{3} = 6080 \text{ bricks.}$$

Illustration 15.20

A cube of 9 cm edge is immersed completely in a rectangular vessel containing water. If the dimensions of the base are 15 cm and 12 cm. Find the rise in water level in the vessel.

Sol. We have

Edge of the given cube = 9 cm.

$\therefore$ Volume of the cube = $(9)^3\ cm^3 = 729\ cm^3$

If the cube is immersed in the vessel, then the water level rises. Let the rise in water level be x cm.

Clearly,

Volume of the cube = Volume of the water replaced by it.

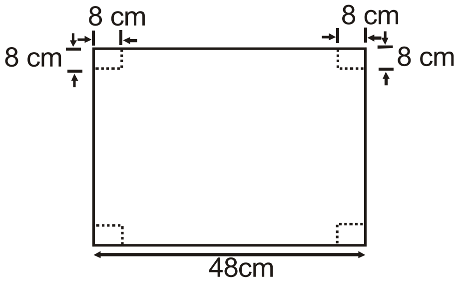
Volume of the cube = Volume of a cuboid of dimension15cm × 12 cm × x cm

$$729 = 15 \times 12 \times x \Rightarrow x = \frac{729}{15 \times 12}\ cm \quad \Rightarrow \quad x = \frac{81}{20}\ cm = 4.05\ cm.$$

Illustration 15.21

A metallic sheet is of the rectangular shape with dimension 48 cm × 36 cm. From each one of the corners, a square of 8 cm is cut off. An open box is made of the remaining sheet. Find the volume of the box.

Sol. In order to make an open box, a square of side 8 cm is cut off from each of the four corners and the flaps are folded up.



Thus, the box will have the following dimensions :
Length = (48 – 8 – 8) cm = 32 cm,
Breadth = (36 – 8 – 8) cm = 20 cm,
Height = 8 cm

$\therefore$ Volume of the box formed = $(32 \times 20 \times 8)\ cm^3 = 5120\ cm^3$

Illustration 15.22

A rectangular tank is 225 m by 162 m at the base. With what speed must water flow into it through an aperture 60 cm by 45 cm that the level may be raised 20 cm in 5 hours ?

Sol. Since the level of water raised by 20 cm in 5 hours. Therefore,

Volume of the water flowed in the tank in 5 hours $= \left(225 \times 162 \times \frac{20}{100}\right) m^2$

$\Rightarrow$ Volume of the water flowed in the tank in one hour

$$= \frac{1}{5}\left(225 \times 162 \times \frac{20}{100}\right) m^3 = 1458\ m^3 \qquad ...(i)$$

Area of the cross section of aperture

$$= \left(\frac{60}{100} \times \frac{45}{100}\right) m^2 = \frac{27}{100}\ m^3$$

Let the speed of the water be x metres per hour. Then,
Volume of the water flowed in the tank in one hour

= (Area of cross section of aperture) × (Speed in metre per hour)

$$= \left(\frac{27}{100} \times x\right) \qquad ...(ii)$$

From (i) and (ii), we have,

$$\frac{27}{100} \times x = 1458 \quad \Rightarrow \quad x = \frac{1458 \times 100}{27}\ m/hr \quad \Rightarrow \quad x = 5400\ m/hr.$$

Illustration 15.23

A well is dug 16 m deep. Its radius is 1.75 m. The earth dug out is spread evenly on a rectangular platform which is 11 m x 4 m. Find the height of the platform raised.

Sol. Radius of the well = 1.75 m $= \frac{7}{4}$ m

Depth of the well = 16 m

Volume of earth dug out = $\frac{22}{7} \times \frac{7}{4} \times \frac{7}{4} \times 16 m^3 = 154\ m^3$

Now area of the base of the platform = 11m x 4 m = 44 m^2

$\therefore$ Height of the platform raised = $\frac{154}{44}$ m $= \frac{7}{2}$ or $3\frac{1}{2}$ m.

Illustration 15.24

The rainfall recorded on 21 July was 10 cm. The rain water that fell on a roof 70 m long and 44 m wide was collected in a cylindrical tank of radius 14 m. Find :

(a) volume of rain water fell on the roof

(b) rise of water level in the tank due to rain water.

Sol. **(a)** Volume of rain water fell on the roof $= 70 \times 44 \times \frac{10}{100}$ m^3 = 308 m^3

(b) Volume of rain water collected in tank = 308 m^3

Radius of the base of the tank = 14 m

Height of water raised $= \frac{\text{Volume}}{\pi r^2} = \frac{308 \times 7}{22 \times 14 \times 14}$ m $= \frac{1}{2}$ m = 0.5 m

Illustration 15.25

The capacity of a closed cylindrical pipe of height 1 metre is 15.4 litres. How many square metres of metal sheet would be needed to make it ?

Sol. Volume of the cylinder = Capacity of the cylinder = 15.4 litres = 15400 cm^3

Height of the cylinder = 1 metre = 100 cm

$\pi r^2 h = 15400 \quad \Rightarrow \quad \frac{22}{7} \times r^2 \times 100 = 15400$

$r^2 = \frac{15400 \times 7}{22 \times 100} = 49 \quad \Rightarrow \quad r = \sqrt{49} = 7 \quad \therefore \quad$ Radius = 7 cm

Total surface area of the cylinder

$= 2\pi rh + 2\pi r^2 = 2\pi r(h + r) = 2 \times \frac{22}{7} \times 7\,(100 + 7)$ cm^2

$= 2 \times \frac{22}{7} \times 7 \times 107 = 4708$ cm^2 $= \frac{4708}{10000}$ m^2 = 0.4708 m^2

Ask yourself

1. A hall is 20 m long, 12 m wide and 7 m high. Its ceiling and four walls are to be plastered. Find the area to be plastered.

2. Find the curved surface area and total surface area of a right circular cylinder whose height is 20 cm and radius of base is 3.5 cm. $\left(\pi = \frac{22}{7}\right)$.

3. Find the height of a cylinder whose radius is 14 m and total surface area is 1932 m^2.

4. Two cubes each of side 10 cm are placed together. Find the volume of the cuboid so obtained.

5. The volume of a room is 300 m^3. If the length is 10 m and the breadth is 5 m, what is its height?

6. The radius of a right circular cylinder is 28 cm, its height is 50 cm. Find the volume of the cylinder.

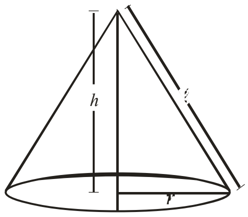
Answers

1. 688 m^2 **2.** 440 cm^2 ,517 cm^2 **3.** 7.95 m **4.** 2000 cm^3

5. 6m **6.** 123200 cm^3

Add your knowledge

(1) Cone :



(i) C.S.A. = $\pi r\ell$

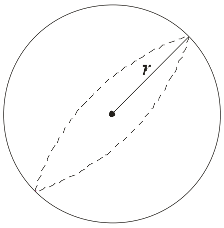
(ii) T.S.A. = C.S.A. + base area = $\pi r\ell + \pi r^2 = \pi r(\ell + r)$

(iii) Volume = $\frac{1}{3}\pi r^2 h$ Where, h = height

r = radius of base

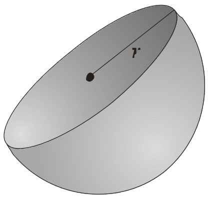
ℓ = slant height

(2) Sphere :



T.S.A. = S.A. = $4\pi r^2$ Volume = $\frac{4}{3}\pi r^3$

(3) Hemisphere :



C.S.A. = $2\pi r^2$

T.S.A. = C.S.A. + base area

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

$= 3\pi r^2$

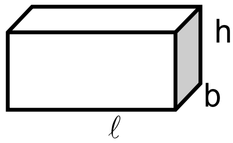
Volume = $\frac{2}{3}\pi r^3$

Concept Map

VOULME AND SURFACE AREA

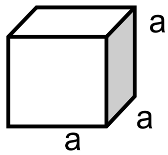
↓

SOLID FIGURES



Cuboid
L.S.A. = $2(\ell + b)h$
T.S.A. = $2(\ell b + bh + h\ell)$
V = ℓbh

Cube
L.S.A. = $4a^2$
T.S.A. = $6a^2$
V = a^3



Summary

1. Area of a parallelogram = Base × Altitude (height) or A = b × h.
2. Area of a triangle = $\frac{1}{2}$ Base × Altitude (height) or A = $\frac{1}{2}$ b × h.
3. Area of a trapezium = $\frac{1}{2}$ (Sum of bases) × Altitude (height) or A = $\frac{1}{2}(b_1 + b_1) \times h$.
4. Circumference of a circle = 2π × (radius) or c = $2\pi r$.
5. Circumference of a circle = π × (diamter) or c = πd.
6. Area of a circle = π × (radius)^2 or A = πr^2.
7. Lateral or curved surface area of a right circular cylinder = 2π rh.
8. Total surface area of a right circular cylinder = $2\pi rh + 2\pi r^2 = 2\pi r(h + r)$.
9. $1\ l = 10^3\ cm^3$, $1\ ml = 1\ cm^3$.
10. Volume of a right circular cylinder :
    V = (Area of the base) × (Height) = $\pi r^2 h$.

Exercise-1

SECTION -A (FIXED RESPONSE TYPE)

MULTIPLE CHOICE QUESTIONS

1. Find the area is sq. cm of an isosceles triangle whose base is 16 cm and each equal side is 9 cm :

(A) $800\sqrt{17}$ (B) $24\sqrt{3}$ (C) $81\sqrt{16}$ (D) $8\sqrt{17}$

2. The area of a rhombus is 119 cm^2 and its perimeter is 56 cm. Find its altitude.

(A) 8 cm (B) 8.5 cm (C) 9 cm (D) 9.5 cm

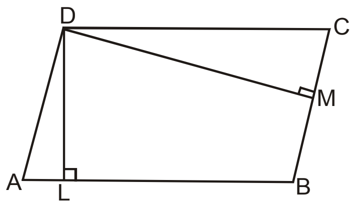
3. The area of a rhombus is 24 cm^2 and one of its diagonals is 8 cm. Its perimeter is :

(A) 20 cm (B) 24 cm (C) 40 cm (D) 4 cm

4. A field in the shape of a rhombus has the distances between pairs of opposite vertices as 14 m and 48 m. What is the cost of fencing the field at Rs. 20 per metre :

(A) Rs. 1800 (B) Rs. 1900 (C) Rs. 2000 (D) None of these

5. In **figure**, ABCD is a parallelogram, DL $\perp$ AB and DM $\perp$ BC. If AB = 18 cm, BC = 12 cm and DM = 9.3 cm, find DL.



(A) 6.2 m (B) 6.4 m (C) 6.6 m (D) 6.8 m

6. The adjacent sides of a parallelogram are 10 m and 8 m. If the distance between the longer sides is 4 m, find the distance between the shorter sides.

(A) 2 m (B) 3 m (C) 4 m (D) 5m

7. The area of a trapezium is 440 sq cm. The lengths of the parallel sides are respectively 30 cm and 14 cm. Find the distance between them.

(A) 20 cm (B) 5 cm (C)14 cm (D) 10 cm

8. The area of a trapezium is 28 cm^2 and one of its parallel sides is 6 cm., If the distance between the parallel sides is 4 cm, then the other parallel side is :

(A) 4 cm (B) 7 cm (C) 8 cm (D) 6 cm

9. An orchard (trapezium) has the parallel sides of lengths 33 m and 12 m. The distance between them is 24 m. How many fruit trees can be in the orchard, if each tree occupies 30 sq.m. of area :

(A) 17 (B) 18 (C) 19 (D) 20

10. The perimeters of two squares are 748 cm and 336 cm. Find the perimeter of a square whose area is equal to the sum of the areas of these two squares :

(A) 810 cm (B) 815 cm (C) 820 cm (D) 825 cm

11. The edge of cube is 20 cm. How many small cubes of 5 cm edge can be formed from this cube ?

(A) 4 (B) 32 (C) 64 (D) 100

12. How many cubes of side 15 cm can be fitted into a box which measure 1.5m × 90cm × 75cm?
(A) 120 (B) 300 (C) 140 (D) 100

13. The dimensions of a hall are 40 m, 25 m and 20m. If each person requires 200 cubic metres. Then the number of persons who can be accommodated in the hall are :
(A) 120 (B) 150 (C) 140 (D) 100

14. The percentage increase in the surface area of a cube, when each side is increased to $\frac{3}{2}$ times the original length is :
(A) 225 (B) 200 (C) 175 (D) 125

15. The radius of the cylinder whose lateral surface area is 704 cm^2 and height 8 cm is :
(A) 6 cm (B) 4 cm (C) 8 cm (D) 14 cm

16. Vertical and horizontal cross sections of a right circular cylinder are always respectively.
(A) rectangle, square (B) rectangle, circle (C) square, circle (D) rectangle, ellipse

17. The volume of a cylinder is 3850 cubic cm. Find the height if the radius is 7 cm.
(A) 25 cm (B) 27 cm (C) 30 cm (D) 32 cm

18. Two cylinders of same volume have their heights in the ratio 1 : 3, find the ratio of their radii.
(A) $\sqrt{3}$: 1 (B) $\sqrt{2}$: 1 (C) $\sqrt{5}$: 2 (D) 2 : $\sqrt{5}$

19. If V and C stand respectively for volume and curved surface area of a cylinder with base radius r, then :
(A) VC = π (B) 2V = Cr (C) 2C = Vr (D) 2r = VC

20. The radius of a cylinder is doubled but its lateral surface area is unchanged. Then its height must be :
(A) Doubled (B) Halved (C) Tripled (D) Constant

FILL IN THE BLANKS

1. 2.5 hectare = _____________ m^2

2. 1 Sq. m = _____________ cm^2

3. Perimeter of an isosceles right triangle of equal sides a cm each is ______________

4. Area of an equilateral triangle with perimeter 6a is ___________

5. Perimeter of an equilateral triangle whose area is $4\sqrt{3}$ cm^2 is ____________

6. Base of triangle = $\frac{2 \times \text{area}}{}$

7. Diagonal of a square of side 2a is ___________.

8. The perimeter of a square is $144\sqrt{2}$ cm then Its area is __________.

9. Diagonal of a square of perimeter (4a + 20) cm is ___________.

10. Diagonal of a rhombus are (x + y) and (x – y) the area of the rhombus is ___________.

TRUE / FALSE

1. Area of a rectangle = Product of Adjacent sides

2. The area of an equilateral triangle with side 2a cm is $\frac{\sqrt{3}}{2}a^2\ cm^2$

3. The area of a sector with sector angle 60° is $\frac{1}{5}$th of the area of circle.

4. Area of an isosceles right triangle with hypotenuse $\sqrt{2}$ a is $\frac{1}{2}a^2$.

5. Base of a triangle = $\frac{2 \times \text{Area}}{\text{height}}$

MATCH THE COLUMN

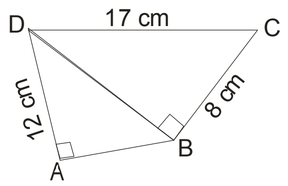
Column – I		Column – II	
(A)	l and b remaining the same, h of a cuboid is doubled	(p)	volume become one-eighth
(B)	l, b and h of a cuboid is tripled	(q)	volume become 4 times
(C)	edge 'a' of a cube halved	(r)	volume become two times
(D)	edge 'a' of a cube one-fourth	(s)	surface area become 9 times
(E)	r and h of a cylinder becomes one third	(t)	surface area be comes one-ninth
(F)	r remaining the same, h of a cylinder sixteen	(u)	surface area be comes one becomes four times

SECTION -B (FREE RESPONSE TYPE)

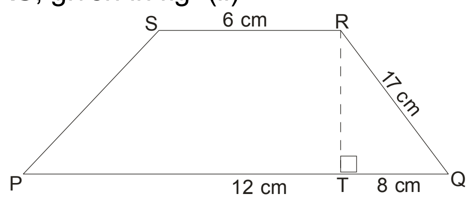
VERY SHORT ANSWER TYPE

1. Find the area of a rhombus, the lengths of whose diagonals are 16 cm and 24 cm respectively.

2. **(i)** Calculate the area of quadrilateral. ABCD, given in fig. (i)
(ii) Calculate the area of trapezium. PQRS, given in fig. (ii).

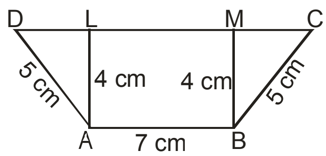


(i)



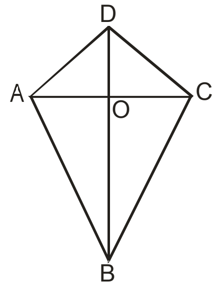
(ii)

3. In figure, ABCD is a trapezium in which AB || DC; AB = 7 cm; AD = BC = 5 cm and the distance between AB and DC is 4 cm.

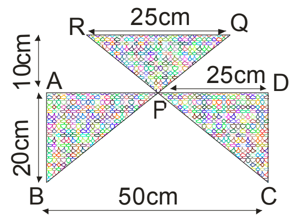


Find the length of DC and hence, find the area of trapezium ABCD.

4. Calculate the area of the quadrilateral ABCD as shown in figure, given that BD = 42 cm, AC = 28 cm, OD = 12 cm and ACBD.



5. Find the area of the shaded figure, where ∠BAP = 90º & ∠CDP = 90º.



6. The area of a triangle, whose base and the corresponding altitude are 15 cm and 7 cm, is equal to a right triangle whose one of the sides containing the right angle is 10.5 cm. Find the other side of this triangle.

7. The area of a trapezium is 384 cm^2. Its parallel sides are in the ratio 3 : 5 and the perpendicular distance between them is 12 cm. Find the length of each of the parallel sides.

8. A rectangular sheet of paper 44 cm × 18 cm is rolled along its length and cylinder is formed. Find the radius of the cylinder.

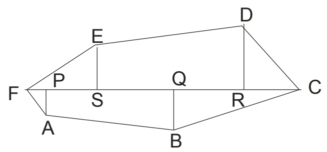
SHORT ANSWER TYPE

9. The area of a trapezium is 720 cm^2. The ratio of the parallel sides is 2 : 1. If the distance between the parallel sides is 20 cm, find their lengths.

10. The parallel sides of a trapezium are 65 cm and 49 cm and each of the non-parallel sides is 10 cm. Find the area of the trapezium.

11. The area of an isosceles trapezium is 168 sq metres. If the lengths of the parallel sides are 36 m and 20 m respectively, find the lengths of the non-parallel sides.

12. Find the area of the field ABCDEF shown in figure AP, BQ, DR and ES are perpendiculars to FC.



FC = 100 m, FP = 20 m, FS = 35 m, FQ = 55 m, FR = 80 m, AP = 30 m, BQ = 54 m, DR = 35 m and ES = 15 m.

13. A closed tank 12 m long, 9 m wide and 4 m deep is to be made. Determine the cost of iron sheet used at the rate of Rs 5 per metre, sheet being 2 m wide.

14. A cylindrical pillar is 50 cm in diameter and 3.5 m in height. Find the cost of white washing the curved surface of the pillar at the rate of Rs 12.50 per m^2.

15. Find the volume of a cylinder, if radius of its base and height are 7 cm and 15 cm respectively.

16. The circumference of the base of a cylinder is 132 cm and its height 25 cm, find the volume.

17. A cylindrical vessel open at the top has a base diameter 21 cm and height 14 cm. Find the cost of tin plating its inner part at the rate of Rs. 5 per 100 cm^2.

18. The dimensions of a room are 9 × 8 × 6.5 metres. It has three windows of 1.5 m × 1 m and one door of 2 m × 1.5 m. What will be the cost of white washing the walls and painting the windows and doors, if the rate of white washing is Rs 5 per m^2 and the rate of painting is Rs. 12 per m^2?

LONG ANSWER TYPE

19. Water flows into a tank at the rate of 2.5 litres per second. Calculate the time would take to fill a tank with a rectangular base 75 cm by 100 cm to a height of 64 cm.

20. Water flows from a tank with a rectangular base measuring 80 cm by 70 cm into a tank with a square base of side 60 cm. If the water in the first tank is 45 cm deep, how deep will it be in the second tank ?

21. A pit 3 m x 2.4 m x 90 cm is dug. The earth dug out was evenly spread 12 m high on a 4 m wide platform. Find the length of the platform.

22. An open box is made of a thin cardboard (negligible thickness of cardboard). It is 8 cm long, 6 cm wide and 5 cm high. It is without a lid. Find the total surface area of the box.

23. Three cubes, each having an edge 4 cm, are joined together. Find the surface area of the cuboid thus formed. Is this surface area equal to the sum of the surface areas of the three separate cubes ?

24. The paint in a certain container is sufficient to paint 8.5 m^2 surface. How many containers of paint will be required to paint the walls of a hall room which is 12 m long, 5 m wide and 4.25 m high? Find the cost of paint if each container costs Rs 350.

25. The area of 4 walls of a room is 57.4 m^2. If the room is 5 m long and 3.2 m wide, find the height of the room.

26. A cube of metal whose each edge is 4 cm is melted to form a cylindrical wire of radius $\frac{1}{11}$ cm. Find how many centimetre of wire will be obtained.

27. The radius of a roller is 49 cm and its length is 125 cm. How much area of a playground will be levelled in 400 revolutions moving once over the ground?

Exercise-2

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

MULTIPLE CHOICE QUESTIONS

1. The area of a rhombus is 72 cm^2. If one of the diagonals is 18 cm long, find the length of the other diagonal.
(A) 15 (B) 12 (C) 8 (D) 16

2. The area of the trapezium is 105 cm^2 and its height is 7 cm. If one of the parallel sides is longer than the other by 6 cm, find the two parallel sides.
(A) 12,18 (B) 12,16 (C) 14,18 (D) 14,16

3. The base of a solid cylinder of height 10 cm has radius 7 cm. Its total surface area is :
(A) 176 cm^2 (B) 514 cm^2 (C) 154 cm^2 (D) 748 cm^2

4. It is required to make a closed cylindrical tank of height 1 m and base diameter 140 cm from a metal sheet. How many square metres of the metal sheet are required for the same ?
(A) 7.6 m^2 (B) 5.4 m^2 (C) 6.8 m^2 (D) 7.48 m^2

5. Find the number of bricks, each measuring 25 cm × 12.5 cm × 7.5 cm required to construct a wall 6 m long, 5m high and 0.5 m thick, while the cement and sand mixture occupies 1/20 of the volume of the wall.
(A) 6000 (B) 6080 (C) 6180 (D) 6200

6. A carpenter builds a hollow wooden box using wood that is 1 cm thick. How much wood does he use in building a box whose shape is a cube with exterior dimensions of 5 cm on each side ?
(A) 61 cm^3 (B) 64 cm^3 (C) 98 cm^3 (D) 125 cm^3

7. The cost of white washing the four walls of a room is Rs. 25. The cost of white-washing a room twice in length, breadth and height will be :
(A) Rs. 50 (B) Rs. 75 (C) Rs. 100 (D) Rs. 200

8. The ratio of the height of a circular cylinder is to the diameter of its base is 1 : 2. Then the ratio of the areas of its surface to the sum of the areas of its two ends is :
(A) 1 : 1 (B) 1 : 2 (C) 2 : 1 (D) 1 : 3

9. Savitri had to make a model of a cylindrical kaleidoscope for her science project. She wanted to use chart paper to make the curved surface of the kaleidoscope. What would be the area of chart paper required by her, if she wanted to make a kaleidoscope of length 25 cm with a 3.5 cm radius ? You may take $\pi = \frac{22}{7}$
(A) 540 cm^2 (B) 520 cm^2 (C) 550 cm^2 (D) 560 cm^2

10. If the area of three adjacent faces of a cuboid is a, b and c. Then find its volume.
(A) abc (B) $\sqrt{abc}$ (C) $a^2 b^2 c^2$ (D) a + b + c

SECTION -B (TECHIE STUFF)

11. The radius and height of a cone are in the ratio 4 : 3. The area of the base is 154 cm^2. Find the area of the curved surface.
(A) 192.5 cm^2 (B) 195 cm^2 (C) 190.5 cm^2 (D) 185.5 cm^2

12. A hemispherical dome of a building needs to be painted. If circumference of the base of the dome is 44 m, find the cost of painting it, given the cost of painting is Rs 2 per 100 cm^2.
(A) Rs 62600 (B) Rs 63000 (C) Rs 61000 (D) Rs 61600

13. The surface area of a sphere of radius 5 cm is five times the area of the curved surface of a cone of radius 4 cm. Find the height of the cone.
(A) 3 cm (B) 2 cm (C) 4 cm (D) 5 cm

14. Three cubes with sides in the ratio 3 : 4 : 5 are melted to form a single cube whose diagonal is $12\sqrt{3}$ cm. The sides of the cubes are :
(A) 3 cm, 4 cm, 5 cm (B) 6 cm, 8 cm, 10 cm
(C) 9 cm, 12 cm, 15 cm (D) None of these

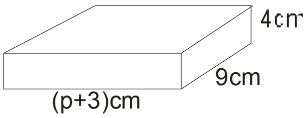
15. A right circular cone has for its base a circle having the same radius as a given sphere. The volume of the cone is one-half that of the sphere. The ratio of the altitude of the cone to the radius of its base is :
(A) $\frac{1}{1}$ (B) $\frac{1}{2}$ (C) $\frac{2}{1}$ (D) $\frac{2}{3}$

Exercise-3

(PREVIOUS YEAR EXAMINATION QUESTIONS)

1. The area of a circle that is inscribed in a right triangle with sides of length 8 m, 15 m and 17 m is **[NSTSE - 2009]**
(A) 9π m^2 (B) $11\frac{1}{9}\pi m^2$ (C) $14\pi m^2$ (D) 10π m^2

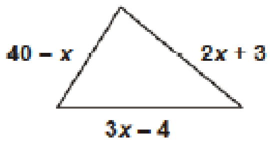
2. The figure shows a cuboid with a volume of 180 cm^3, find p **[NSTSE - 2009]**



(A) 2 (B) 18 (C) 36 (D) 72

3. The radius of the cylinder whose lateral surface area is 704 cm^2 and height 8 cm is ________ **[IMO - 2010]**
(A) 6 cm (B) 4 cm (C) 8 cm (D) 14 cm

4. Which of the following expressions represents the distance around the triangle? **[IMO - 2010]**



(A) 5x + 39 (B) 4x - 37 (C) 4x + 39 (D) 6x + 47

5. What are the lengths of the sides of a triangle that has a perimeter of 24 centimeters? **[IMO - 2010]**

(A) 6cm, 6cm, 12cm (B) 7cm, 7cm, 10 cm
(C) 3cm, 8cm, 13cm (D) 4cm, 5cm, 15cm

6. Two flower beds in a park are similar rectangles of same width. The longest side of the large flower bed is 24 cm long, and the longest side of the small flower bed is 8 cm. If L is the area of the large flower bed and S is the area of the small flower bed, which equation is true? **[IMO - 2010]**

(A) S = L - 16 (B) S = L + 18 (C) $S = \frac{1}{9}L$ (D) $S = \frac{1}{3}L$

7. What would be the cost of laying carpet on a floor which has length and breadth in the respective ratio of 32 :21 and perimeter 212 feet, if the cost per square foot of laying carpet is Rs.2.5? **[IMO - 2011]**

(A) Rs.6,720 (B) Rs.5,420 (C) Rs.7,390 (D) None of these

8. The total area of a circle and a rectangle is equal to 1166 sq. cm. The diameter of the circle is 28 cm What is the sum of the circumference of the circle and the perimeter of the rectangle if the length of the rectangle is 25 cm? **[IMO - 2011]**

(A) 186 cm (B) 182 cm (C) 184 cm (D) 132 cm

9. A path of uniform width runs all around the inside of a rectangular field 116 metres by 68 metres and occupies 720 square metres. Find the width of the path. **[IMO - 2011]**

(A) 1 metre (B) 1.5 metres (C) 2 metres (D) 4 metres

10. The curved surface area of a cylindrical pillar is 264 m^2 and its volume is 924 m^3. The ratio of its diameter to its height is **[Aryabhatta - 2012]**

(A) 3 : 7 (B) 7 : 3 (C) 6 : 7 (D) 7 : 6

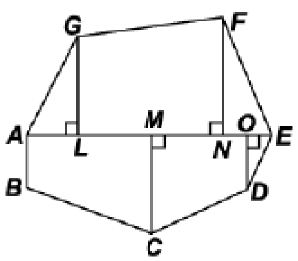
11. Diagonal of a cube is $\sqrt{6}$ cm. Then its lateral surface area is **[Aryabhatta - 2012]**

(A) $6\sqrt{6}$ cm^2 (B) 36 cm^2 (C) 12 cm^2 (D) 8 cm^2

12. If the height of a cone is halved and its radius is doubled, then its volume is increased by :

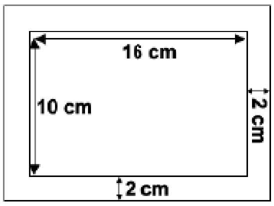
(A) 100% (B) 200% (C) 300% (D) 400%

13. Find the area of the field ABCDEFGA in which AL = 30 m, AM = 70 m, AN = 90 m, AO = 110 m, AE = 135 m, AB = 36 m, LG = 40 m, NF = 42 m, MC = 54 m, and OD = 46 m. **[IMO - 2012]**



(A) 9010 m^2 (B) 8000 m^2 (C) 8670 m^2 (D) 9730 m^2

14. A rectangular picture 16 cm long and 10 cm wide. It has a 2 cm border around it as shown in the figure. Calculate the area of the border, giving your answer in square millimetres. **[IMO - 2012]**



(A) 1200 mm^2 (B) 120 mm^2 (C) 12000 mm^2 (D) 120000 mm^2

15. The length of longest pole that can be placed on the floor of a room is 10 m and the length of the longest pole that can be placed in the room is $10\sqrt{2}$ m. The height of the room is. **[IMO - 2012]**

(A) 6 m (B) 7.5 m (C) 8 m (D) 10 m

16. The volume of a wall, 5 times as high as it is broad and 8 times as long as it is high, is 12.8 m^3. The breadth of the wall is **[IMO - 2012]**

(A) 30 cm (B) 40 cm (C) 22.5 cm, (D) 25 cm

17. A swimming pool is 25 m long, 15 m broad and 5 m deep. Find the cost of cementing its floor and the walls at the rate of Rs.10 per sq. metre. **[IMO - 2012]**

(A) Rs.3840 (B) Rs.7750 (C) Rs.6960 (D) None of these

18. A rectangular tank 25 cm long and 20 cm wide contains water to a depth of 5 cm. A metal cube of side 10 cm is placed in the tank so that one face of the cube rests on the bottom of the tank. Find how many litres of water must be poured into the tank so as to just cover the cube? **[IMO - 2012]**

(A) 1 L (B) 1.5 L (C) .5 L (D) 2.5 L

19. A square sheet of paper is converted into a cylinder by rolling it along its length. The ratio of the base radius to the side of the square is **[Aryabhatta - 2013]**

(A) $1 : \pi$ (B) $1 : 2\pi$ (C) $2\pi : 1$ (D) $\pi : 1$

20. A rectangular tank has a capacity of 24 litre. If its length is twice its breadth and its height is $\left(\frac{3}{4}\right)^{th}$ its length, find its length. **[NSTSE - 2013]**

(A) 25 cm (B) 30 cm (C) 40 cm (D) 45 cm

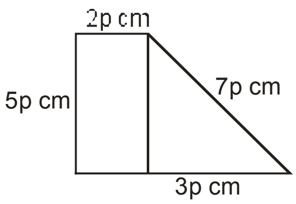
21. A wooden cuboid is 24 cm by 30 cm by 36 cm. Cubes of equal sides are cut from all its corners. The volume of the remaining block is 20088 cm^3. What is the length of the edge of each cube cut off from the cuboid ? **[NSTSE - 2014]**

(A) 6 cm (B) 9 cm (C) 1 cm (D) 7 cm

22. Each edge of a cube is increased by 50%. The percent of increase in the surface area of the cube is

(A) 50 (B) 125 (C) 150 (D) 300

23. If the perimeter of the figure given is 57 cm, find the perimeter of the triangle in the figure **[NSTSE - 2014]**



(A) 30 cm (B) 45 cm (C) 39 cm (D) 3 cm

Answer Key

Exercise-1

SECTION -A (FIXED RESPONSE TYPE)

MULTIPLE CHOICE QUESTIONS

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	D	B	A	C	A	D	A	C	B	C	C	B	D	D	D	B	A	A	B	B

FILL IN THE BLANKS

1. 25000
2. 10^4 cm²
3. $2a + \sqrt{2}\,a$
4. $\sqrt{3}\,a^2$
5. 12 cm
6. altitude
7. $2\sqrt{2}\,a$
8. 2592 cm^2
9. $(a + 5)\sqrt{2}$ cm
10. $\frac{x^2 - y^2}{2}$

TRUE / FALSE

1. True
2. False
3. False
4. True
5. True

MATCH THE COLUMN

1. (A) – r, (B) – s, (C) – p, (D) – u , (E) – t, (F) – q

SECTION -B (FREE RESPONSE TYPE)

VERY SHORT ANSWER TYPE

1. 192 cm^2
2. **(i)** 114 cm^2 **(ii)** 195 cm^2
3. DC = 13 cm, Area = 40 cm^2
4. 588 cm^2
5. 625 m^2
6. 10 cm
7. 24cm, 40 cm
8. 7 cm

SHORT ANSWER TYPE

9. 48 cm, 24cm
10. 342cm^2
11. 10 cm each
12. 4722.5 m^2
13. Rs 960
14. Rs. 68.75
15. 2310 cm^3
16. 34650 cm^3
17. Rs. 63.53
18. Rs. 1157.5

LONG ANSWER TYPE

19. 3 min.12 sec.
20. 70 cm
21. 13.5 cm
22. 188 cm^2
23. 224 cm^2,No
24. 17, Rs. 5950
25. 3.5 m
26. 2464 cm
27. 1540 m^2

Exercise-2

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

MULTIPLE CHOICE QUESTIONS

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

Exercise-3

SECTION -A (PREVIOUS YEAR EXAMINATION QUESTIONS)

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